Ministry of Economy and Poverty Reduction
of the Republic of Uzbekistan

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SUSTAINABLE CONSUMPTION AND PRODUCTION ACTION PLAN

REPUBLIC OF UZBEKISTAN

ABRIDGED VERSION

Acknowledgement

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LIST OF ACRONYMS

AQM	Air Quality Management
AQP	Air Quality Pollutants
BAT	Best Available Techniques
BAT-AEL	BAT-Associated Emission Level/s
BAT-AEPL	BAT-Associated Environmental Performance Level/s
Blue Hydrogen	'Blue Hydrogen' - gas produced by the steam reformation of methane (natural gas), the CO_2 (carbon dioxide) by product of this process being separated from the hydrogen and either put to beneficial use or immobilised using CCS technology.
Bt	Bacterium *Bacillus thuringiensis* (Bt) - it produces a chemical harmful to a small fraction of insects, most notably the larvae of moths and butterflies, beetles, and flies. The responsible gene is used to produce genetically modified cotton plants.
CCS	Carbon Capture and Storage
CE	Circular Economy
CH_4	Methane
CHP	Combined Heat and Power
CIS	Commonwealth of (Newly) Independent States
CLRTAP	Convention on Long Range Transport of Air Pollutants
CMS	Chemicals Management System
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2-eq	Carbon Dioxide Equivalent of a gas concerning its Global Warming Potential (GWP) relative to that of carbon dioxide.
COD	Chemical Oxygen Demand – a measure (mg oxygen / litre) of the oxidisable strength of a wastewater or other water stream
DEFRA	UK Government Ministry: Department for Environment, Food and Rural Affairs
EC	European Commission
EE	Energy Efficiency
EEBPP	Formerly the Energy Efficiency Best Practice Programme of the United Kingdom
EGD	European Green Deal
ELP	End of Life Product or Products
EMS	Environmental Management System e.g. one certified as compliant with ISO14001
EN	European Standards (European Norm) - technical standards drafted and maintained by CEN (European Committee for Standardization) and others
EPA	Environmental Protection Agency of the USA
EPCA	Enhanced Partnership and Cooperation Agreement between Uzbekistan and the EU
EPR	Extended Producer Responsibility
ETS	Emissions Trading System
ETSU	Formerly the Energy Technology Support Unit of the United Kingdom
EU	European Union
FOLU	Forestry and Other Land Use
GDP	Gross Domestic Product
GE	Green Economy
GHG	Greenhouse Gas

GM	Genetically Modified
Green Hydrogen	'Green Hydrogen' is hydrogen produced by the electrolysis of water using electricity generated from renewable energy sources.
H_2O_2	Hydrogen Peroxide
Ha	Hectare
HSE	Health, Safety and Environment
INCD	Intended Nationally Determined Contribution to reducing GHG emissions under the Paris Agreement
IPCC	Intergovernmental Panel for Climate Change
IPM	Integrated Pest Management
ISO	International Organization for Standards
LCA	Lifecycle Assessment
MEDPR	Ministry of Economic Development and Poverty Reduction
MHCS	Ministry of Housing and Communal Services
MHSSE	Ministry of Higher and Secondary Special Education
MoA	Ministry of Agriculture
MoC	Ministry of Construction
MoE	Ministry of Energy
MoT	Ministry of Transport
MPE	Ministry of Public Education
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
MWR	Ministry of Water Resources
MWth	MegaWatt Thermal
NaOH	Sodium Hydroxide also known as Caustic Soda
NAP	National Action Plan/s
NAPCP	National Air Pollution Control Programme
NGO	Non-governmental Organisation
NMVOC	Non-Methane Volatile Organic Carbon Compound/s
N_2O	Nitrous oxide
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
PCA	Partnership and Cooperation Agreement between Uzbekistan and the EU – see EPCA
PM	Airborne Particulate Matter. PM_{10} is the concentration in air of all PM whose aero-dynamic diameter is equal to or less than 10µm. Hence it includes the finer PM fraction, $PM_{2.5}$, whose aerodynamic diameter is equal to or less than 2.5µm.
PRC	Peoples' Republic of China
R&D	Research and Development
RES	Renewable Energy Source
SCEE	State Committee of Ecology and Environmental Protection
SCAP	Sustainable Clothing Action Plan
SCP	Sustainable Consumption and Production
SDG	Sustainable Development Goal
SO_2	Sulphur Dioxide

STRUGE	Strategy for the Transition of the Republic of Uzbekistan to a Green Economy, 2019-2030
TA	Technical Assistance
TI	Tracking Indicator and Indicators
TI	Tracking Indicator
TPP	Thermal Power Plant
UK	United Kingdom
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
USA	United States of America
VAT	Value Added Tax
WCP	Whole Chain Plans, e.g. for food waste reduction
WEEE	Waste Electric and Electronic Equipment
WHO	World Health Organization
WRAP	Waste & Resources Action Programme
WWTP	Waste water Treatment Plant

1. SUSTAINABLE CONSUMPTION AND PRODUCTION (SCP)

1.1 The Three Cornerstones of SCP

The concept of sustainable consumption and production (SCP) has evolved and been defined in a number of ways.[1] For instance, the Oslo Symposium in 1994 defined SCP as:

> *"The use of services and related products which respond to basic needs and bring a better quality of life while minimising the use of natural resources and toxic materials as well as the emission of waste and pollutants over the life cycle of the service or product so as not to jeopardise the needs of future generations".*

Whilst, more recently, UNEP in 2011 defined SCP more simply as:

> *"A holistic approach to minimising the negative environmental impacts from consumption and production systems while promoting quality of life for all".*

Regardless of SCP's definition, four underlying SCP principles apply:

1. Improving the quality of life without increasing environmental degradation and without compromising the resource needs of future generations.
2. Decoupling economic growth from environmental degradation by:
   - Reducing material/energy intensity of current economic activities and reducing emissions and waste from extraction, production, consumption and disposal;
   - Promoting a shift of consumption patterns towards groups of goods and services with lower energy and material intensity without compromising quality of life;
3. Applying life-cycle thinking which considers the impacts from all life-cycle stages of the production and consumption process; and
4. Guarding against the re-bound effect, where efficiency gains are cancelled out by resulting increases in consumption.

Three fundamental concepts may be extracted from the above definitions and principles: **resource efficiency, substitution,** and **circularity**. Drawing on these concepts, SCP may be seen as a delivery agent for a national Green Economy (GE) – see Figure 1.

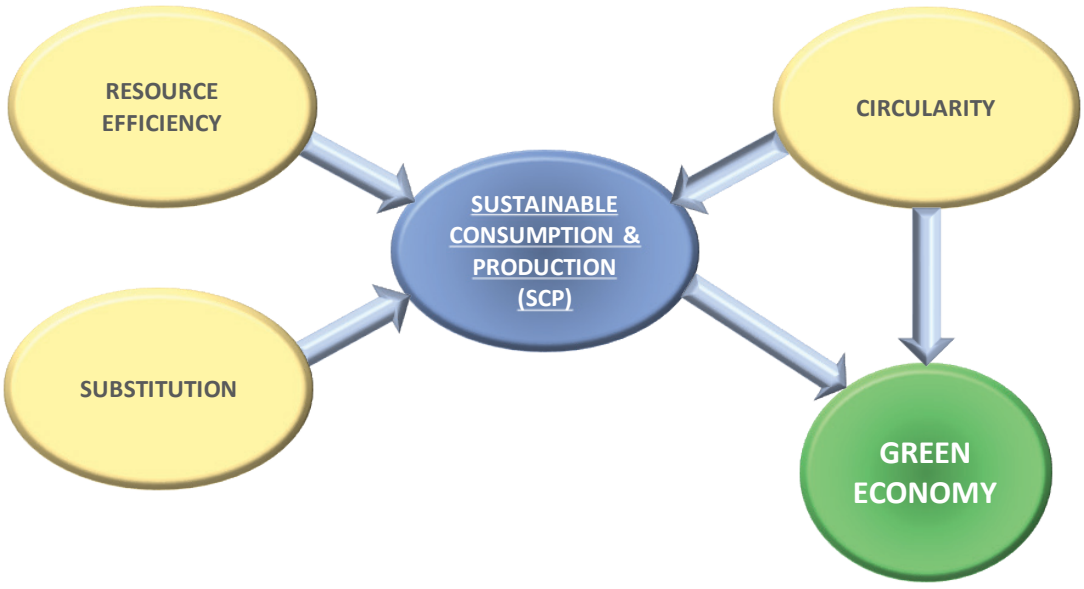


Figure 1 SCP, together with Circularity, contributes to delivering a Green Economy

1 Oslo Symposium, 1994: https://enb.iisd.org/topics/sustainable-consumption-production. And UNEP, 2011: https://www.unep.org/explore-topics/resource-efficiency/what-we-do/sustainable-consumption-and-production-policies

Understanding each of these concepts helps us develop our appreciation and recognition of the systematic, deep-seated changes in behaviour and practice that SCP strives to achieve. It represents a profound shift away from 'Business as Usual'. A further feature of SCP is that it recognizes and places an emphasis on the role not only of producers but of consumers which include Government, institutions, members of the public, and businesses. Each of the three concepts are described below whilst Section 1.2 introduces the roles of Government, Producers and Consumers.

Resource Efficiency (Use Less): reduce the consumption of energy, water and materials in production; and design, buy and use products whose use is less resource-intensive, e.g.:

- Increase the energy efficiency of buildings by improving their insulation;
- Adopt water saving techniques to reduce the net freshwater consumption of agricultural and industrial production;
- Optimise product design and production operations so that less resources are consumed in making and using consumer products;
- Consumers to purchase resource efficient products (incentivised by e.g. eco-labelling and communication messaging);

Substitution (Use Better): use harmless or less harmful resources to produce goods and services, e.g.:

- Produce, buy, and use paints that contain less or are free of organic solvents;
- Generate electricity using renewable energy sources instead of fossil fuels;

Circularity ("From Cradle to Cradle"): in a minimalist sense, this involves resource saving by recycling or reusing a waste stream or product. A deeper interpretation, as exemplified by the Circular Economy approach being adopted by the EU, represents a strategic transformation from a linear to a more sustainable economy that decouples economic growth and resource use (Section 1.3). It thus affects product design, production, end-of-life product management and consumer behaviour and is inclusive of wastes recycling (solid, liquid, gaseous), by e.g.:

- Recovery and recycling of waste streams (solid, liquid and gaseous) at production sites and from consumers, and, where this is not possible, in off-site facilities;
- Designing products for low resource consumption while in use, and for durability, repairability, and ease of end-of-life disassembly, i.e. 'circularity';
- Applying a value-chain approach in key sectors, including measures to reduce all forms of waste systematically, reusing or recycling those that do arise. And adopting necessary systems and infrastructure to enable the recovery and reuse / recycling of constituent components and materials from products that have reached their end-of-life.

1.2 Roles of Government, Producers and Consumers in SCP

The three main stakeholder groups noted in the foregoing section are introduced below.

Government

In addition to setting appropriate goals and policies, the Government has the responsibility to ensure that those policies are implemented effectively and that the outcomes of implementation are recorded and fed back into the policy review process. And it has the primary responsibility, through its agencies, to monitor and inspect entities in the productive, supply and waste management sectors to enforce legislative requirements.

As prime mover in the policy decision to adopt SCP as a key part of its green agenda, **Government has also to ensure there exists a sustained enabling environment**. Key elements of an enabling environment for SCP include the following:

- Applicable policy documents are clear and unambiguous and that the policy requirements are enforceable;

- That SCP tools and associated information are made available for the productive and supply sectors to use,
- That entities in the productive and supply sectors have the capacity to apply SCP tools and, where their capacity is limited, receive capacity building and advisory support;
- That those entities in the sectors of the economy lying within identified national key value-added chains – see Section 1.5 - undertake coordinated SCP action in pursuit of a circular economy agenda;
- That the policy goals, the policies themselves, and the practical steps - including the use of SCP tools – that help to identify and implement measures are communicated effectively to the productive and supply sectors;
- Similarly, that policy and what that implies for consumers – households and others – is communicated effectively to consumers;
- That consumers are motivated to buy green products and producers and suppliers are motivated to supply them;
- That Government ministries and departments purchase goods and services in accord with the Government's Green Economy agenda, consistent with SCP principles and concepts;
- That financial resources are available to catalyse the above, and that economically disadvantaged members of society are not treated unfairly.

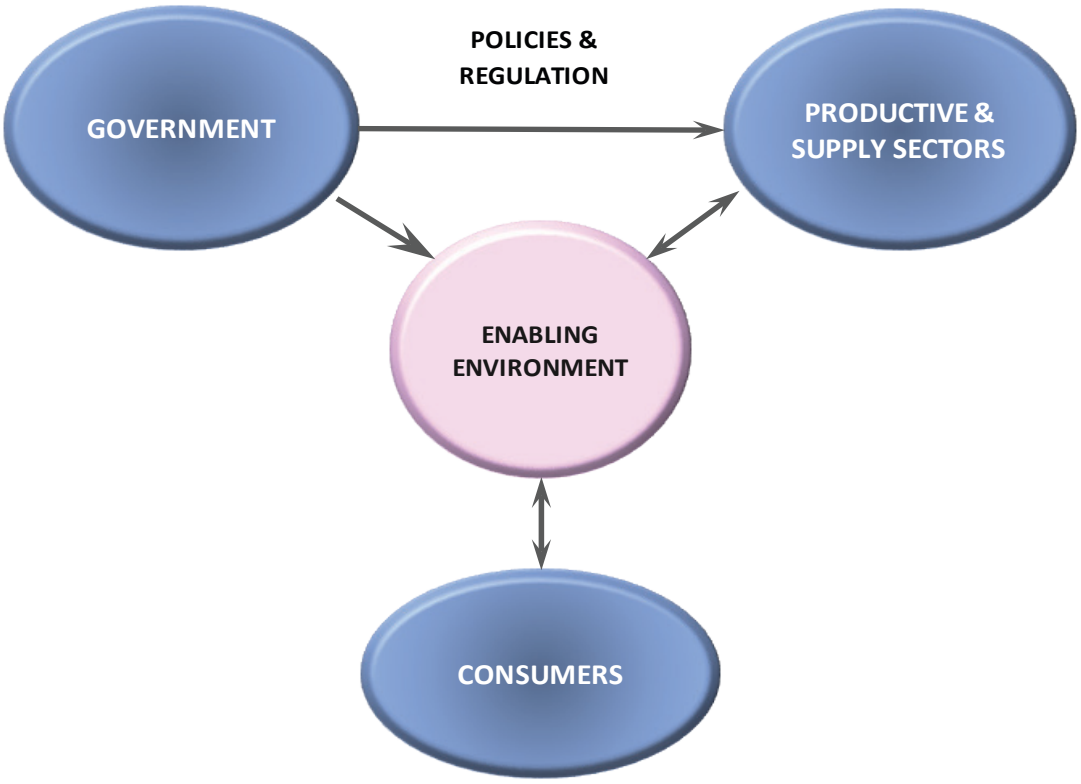


Figure 2 Schematic illustration of a need for an enabling environment to interface with Government, productive and supply sectors, and consumers

Producers and Suppliers

It is the responsibility of producers and suppliers to apply appropriate SCP tools to identify, and then implement, the specific measures that will contribute to achieving the national Green Economy vision. Regarding entities in key value-added chains, especially – see below - this includes taking coordinated action to respond to the national Green Economy agenda.

As purchasers of intermediate goods and services they also play a role as consumers.

Consumers

Consumers can lie in the private, business and Government sectors. Their roles include:

- Responding positively to communications regarding the green agenda;
- Buying and boosting the demand for green products, communicating their desires to suppliers;
- Using products responsibly, avoiding waste where possible, and avoiding excessive use of water and energy etc;
- Complying responsibly with requirements to, for instance, separate solid wastes at source before their collection, and disposing of defined end-of-life products in accord with regulatory requirements and making use of available facilities.

1.3 How Linear and Circular Economies Differ

Creating a greener economy requires the transformation of the consuming and productive sectors of the economy – primary, secondary and tertiary – shifting from a predominantly linear model to one that is more circular. What distinguishes these two models? The differences are illustrated schematically in Figure 3 and elaborated below.

Linear Economy

Put simply, a linear economy is one in which little or no emphasis is placed on minimising resource consumption, and material recycling, energy and water efficiency measures are not practised. *In extremis*, a linear economy may be characterised as "***Take-Make-Use-Dispose***". At present, despite the energy substitution, resource efficiency, recycling, and (solid, liquid and gaseous) wastes management measures that have been adopted, the Republic of Uzbekistan's economy bears an uncomfortably close resemblance to the linear model.

Circular Economy

In contrast, as indicated in Figures 3 and 4, a circular economy involves substantial feedback loops, in which efforts are made at the design and subsequent stages to eliminate or, if this is not possible, to minimize waste generation throughout a product's life-cycle – starting with its production, through to its use and at the end of its useful life. It involves all sectors of the economy, for instance:

- **Primary sectors**: agriculture, forestry, fisheries, water abstraction, mining for coal and ores, quarrying for stone, oil and gas extraction;
- **Secondary sectors**: processing of primary raw materials and foodstuffs, treatment of freshwater for the purpose of supply, oil and gas refining and petrochemicals production, energy transformation processes including the generation of electricity and heat from the combustion of fossil fuels, and coke production, and the manufacture and production of all manner of goods and packaging materials for sale;
- **Tertiary sectors**: distribution and supply of goods and services, public transport, municipal sewerage and wastewater treatment services, municipal solid waste management facilities, retail outlets, health and educational services offices, and the supply of all manner of services including government at national and lower-level tiers;
- **Consumers**: government and institutions, households, hospitality, private transport, all sectoral users of goods and services irrespective of their being produced in-country or imported, and all external users of goods and services exported from Uzbekistan.

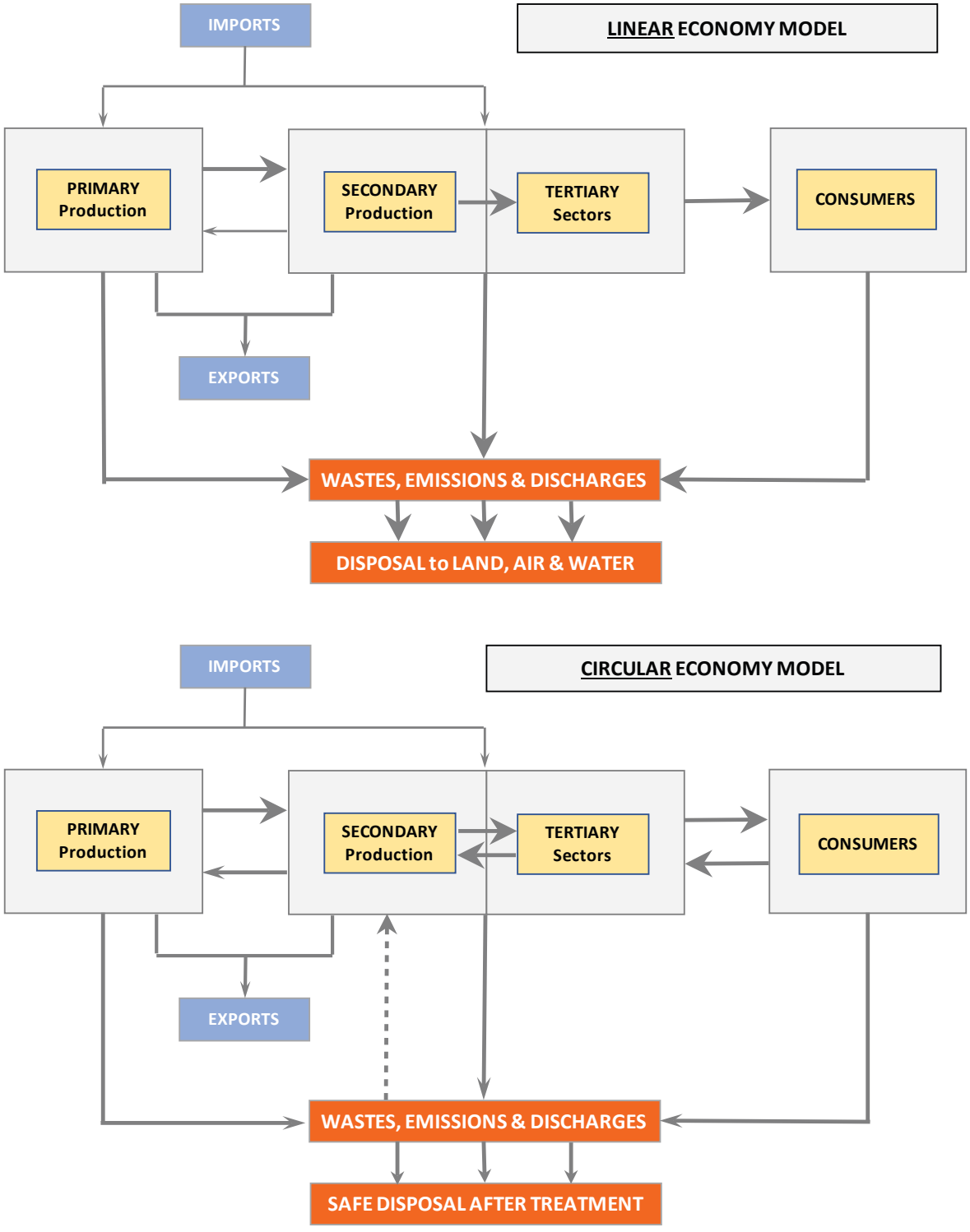


Figure 3 Simplified, schematic illustration of the differences between linear and circular economies

A circular economy (CE) is one which successfully ***decouples economic growth from resource consumption and Greenhouse Gas (GHG) emissions*** and achieves or approaches a state of ***sustainability***: it is the antithesis of the linear "Take-Make-Use-Dispose" model and ***applies the Waste Management Hierarchy*** in full – a key concept within the EU's Green Deal – see below and in Annex B. ***Adoption of SCP concepts and tools is key to delivering a CE.*** Qualitatively, ***SCP tools may be applied in policy areas that include***:

- Reducing national energy demand through applying energy efficiency policies and measures in all sectors;
- Minimising GHG emissions through using renewable energy resources (RES) to the full, thereby eliminating or reducing the need to extract and burn fossil fuels. Improved ambient air quality and public health is a co-benefit;

- Gasifying an energy system, since the combustion of natural gas instead of coal releases less GHG, though it does not eliminate them. Hence this policy should be seen as representing an intermediate stage of development towards a CE;
- Minimising freshwater demand within river basins and catchments through applying water efficiency policies and measures in all sectors including industry, energy, institutions, offices and households – but especially in agriculture. Co-benefits include the safeguarding of water resources, freshwater and wetland habitats, and biodiversity;
- Adapting agricultural practices to minimize, where elimination is not feasible, the use of inorganic nitrogenous and phosphate fertilizers, pesticides and other chemicals; to minimize emissions to air from arable cultivation, animal manures management, and crop residues management; and to minimize, reuse or recycle agricultural solid wastes;
- Minimising all food wastes downstream of agricultural production and, where feasible, their recovery and recycling. This concerns all segments of the agri-food production, distribution, shops, hospitality, institutional and household sectors – and includes treating food wastes and municipal wastewater sludge solids in such a manner as to enable their use as organic fertilizer in agriculture;
- Designing all material products and packaging through applying the sustainable production approach, embodying the 'Circularity' principle introduced in section 1.1. And motivating consumers to base their product purchasing and disposal decisions on those principles – catalysed in part through communication measures. Special provisions may be needed to deal with the management of end-of-life products that have been imported and are not manufactured to a significant extent within Uzbekistan.

Figure 4 shows an alternative visualisation of a Circular Economy, commonly referred to as a 'Butterfly Diagram', developed by the Ellen MacArthur Foundation.[2] It portrays the flow of materials in an economy as two main cycles: one biological (renewables, left-hand side of the diagram), and one technical (finite materials, right-hand side of the diagram):

> *"In a circular economy, we eliminate waste and pollution, circulate products and materials, and regenerate nature. The circular economy system diagram (butterfly diagram) illustrates the continuous flow of materials in the economy. In the biological cycle, the nutrients from biodegradable materials are returned to the Earth, through processes like composting or anaerobic digestion. This allows the land to regenerate so the cycle can continue. In the technical cycle, products are kept in circulation in the economy through reuse, repair, remanufacture and recycling. In this way, materials are kept in use and never become waste."*

Biological and material resource leakage occurs when 'goods' – intermediate and final products – are produced and consumed. Leakage takes the form of miscellaneous solid waste, emissions to air, and wastewater discharges. Viewed from a sustainable use of resources perspective, the closer the subsidiary cycles or 'loops' (keeping resources in circulation) are to the points of leakage, the better.

2 https://ellenmacarthurfoundation.org/circular-economy-diagram

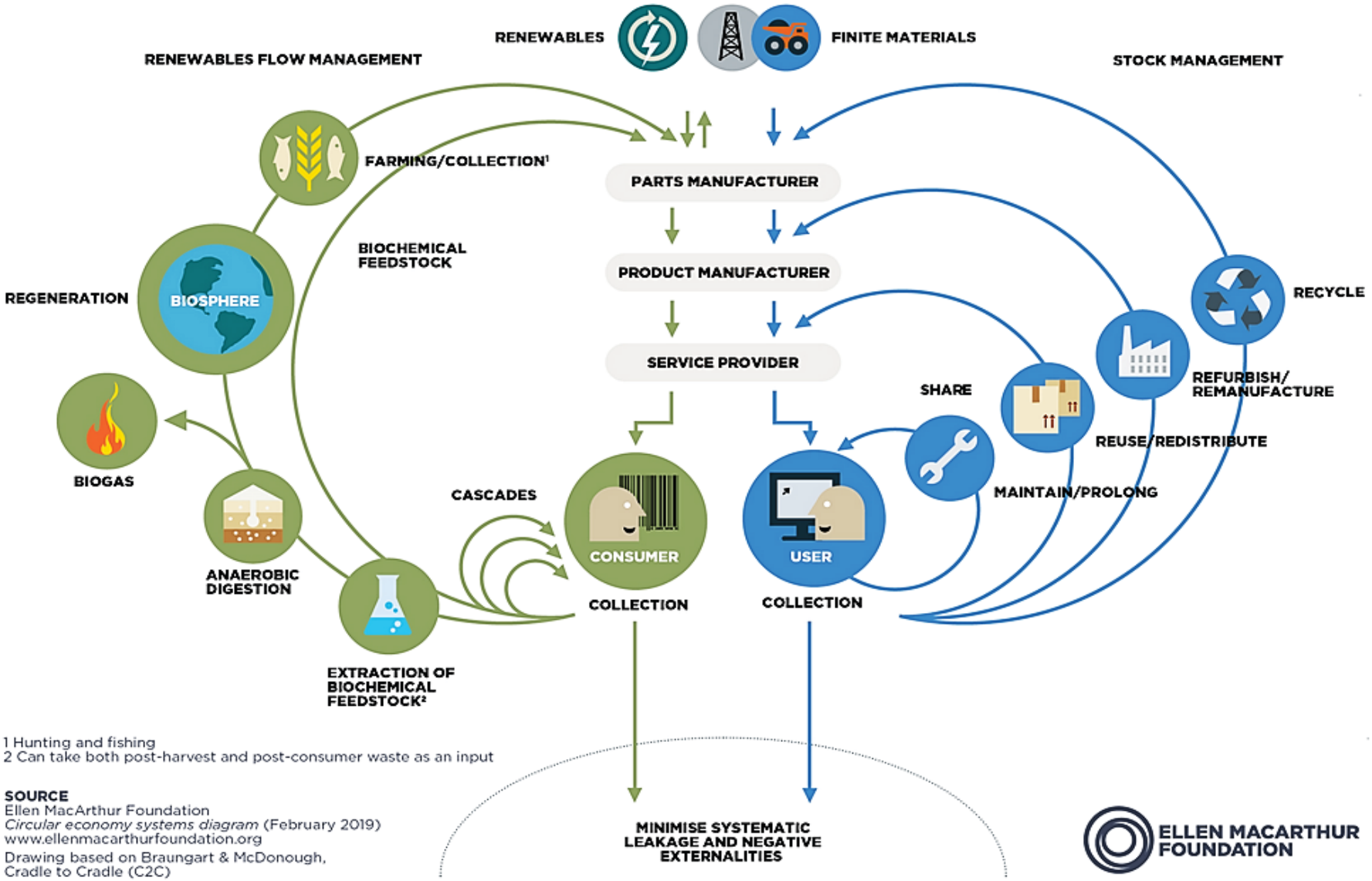


Figure 4 Butterfly Diagram' Visualisation of a Circular Economy

Waste Management Hierarchy

The waste hierarchy lays down a priority order of, in principle, the best overall environmental and sustainable options in waste management. In a circular economy, every effort is made to adopt options that lie at the pyramid's pinnacle. In reality, departures from applying the hierarchy in practice may be justified for specific waste streams on the grounds of technical feasibility and economic viability.

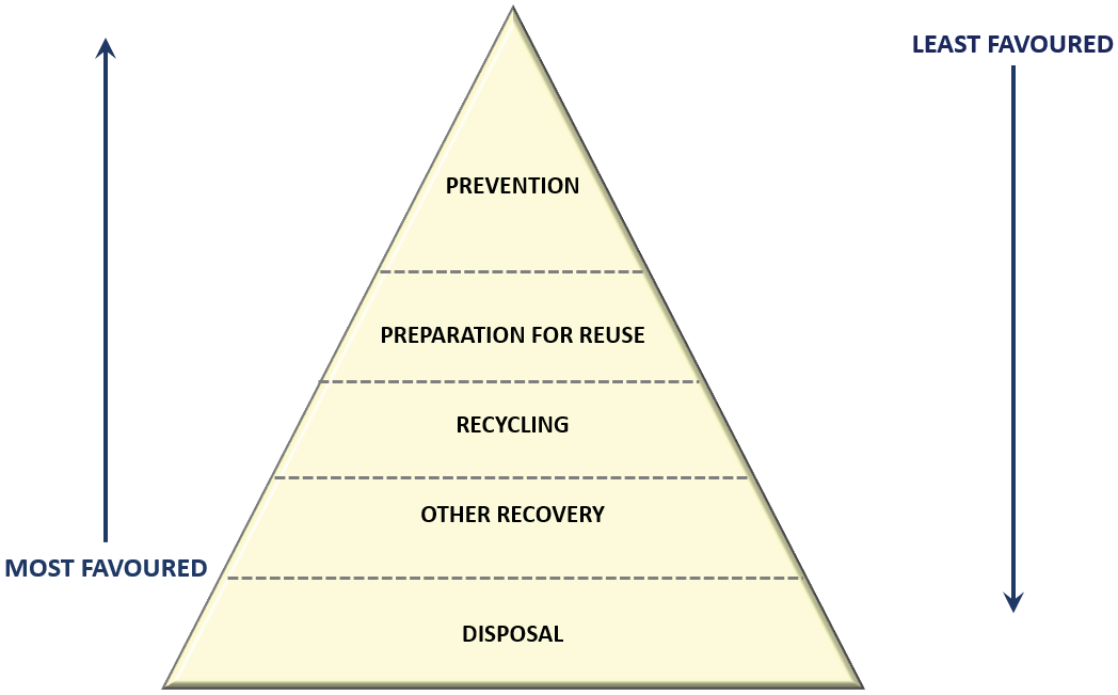


Figure 5 Waste Management Hierarchy

Figure 5 represents the waste management hierarchy as defined in Articles 3 and 4 of the EC Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives, whereby. "*The following waste hierarchy shall apply as a priority order in waste prevention and management legislation and policy:*

a. *Prevention:* measures taken before a substance, material or product has become waste, that reduce:
   - the quantity of waste, including through the re-use of products or the extension of the life span of products;
   - the adverse impacts of the generated waste on the environment and human health; or
   - the content of harmful substances in materials and products;

b. *Preparing for re-use:* 'preparing' means checking, cleaning, repairing or recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing; 're-use' means any operation by which products or components that are not waste are used again for the same purpose for which they were conceived;

c. *Recycling:* means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations;

d. *Other Recovery, e.g. energy recovery:* means any operation, the principal result of which is that waste serves a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste prepared to fulfil that function, in the plant or in the wider economy. Annex II of the Directive sets out a non-exhaustive list of recovery operations; and

e. *Disposal*: means any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy. Annex I of Directive 2008/98/EC sets out a non-exhaustive list of disposal operations.

1.4 Environmental Goals, Policies and Indicators

Goals and Policies

In moving towards a Green Economy there must be a vision as to what this means in substance. This vision may be expressed as achieving a number of environmental, economic and social goals. They will be nationally specific. A **major role of SCP and of SCP tools is their application to help identify measures whose implementation may help meet Green Economy goals**. Table 1 provides an Illustrative set of potentially relevant environmental goals – based on but not necessarily the same as those of the EU's Green Deal, see Annex B. In addition, it provides a set of policies whose implementation could contribute to achieving one or more goals.

Table 1 Illustrative Green Economy Goals and Potentially Appropriate Policies

Example Goal	Examples of Contributing Policies
The link between national economic growth and resource consumption / waste generation is broken	Broaden the national Green Economy Strategy to embrace the EU's 'Sustainable Product Policy Framework', a major component of the EU's CE Action Plan (CEAP), to include: • Promotion and coordination of activity in national 'Key Product Value Chains' • Introducing 'Sustainable Consumption and Production' concept and 'Sustainability Principles' into the GEC • Applying Sustainability Principles to regulated economic activities • Placing 'Extended Producer Responsibility' requirements on producers and importers of defined categories of goods • Prohibiting, form a defined future date, the placement on the market of energy-related and other consumer products that lie within the scope of the current / strengthened Ecodesign Directive and Ecolabel scheme • Setting a mandatory requirement that public sector bodies adopt minimum 'Green Public Procurement' criteria • Introducing CE practices in BAT reference documents.
	Broaden the national Green Economy Strategy to embrace the 'Less Waste, More Value' component of the EU's CEAP, to include: • Creating a well-functioning market for secondary raw materials, including the export of high-grade recovered / recycled materials to product-producing countries • Mandatory separation at-source and collection of household and other municipal solid wastes, in support of such markets • Strengthening the provisions for managing end-of-life vehicles, electronic equipment, and batteries • Strengthening the provisions for the prevention and minimisation of packaging wastes, including setting waste reduction targets for selected streams • Commitment to explore pricing and financial instruments as a means to change the patterns of waste generation and disposal, with the aim of minimising disposal quantities.
	Broaden the national Green Economy Strategy to embrace the principles of the 'Farm to Fork' strategy for reducing food waste in the Agriculture-Agrifoods-Consumption Value Chain.
	Establish an appropriate set of stage-based Target Indicators to track progress, and systems to collect the necessary data, its analysis, reporting and timebound review.

Example Goal	Examples of Contributing Policies
The link between national economic growth and GHG emissions is broken, Net-Zero emissions to be achieved by 2050/2060	Broaden the national Green Economy Strategy to embrace the EU's 'European Green Deal' (EGD) proposals concerning Net-Zero emissions, to include: • Ratification of the protocols to the UNECE Convention on Long-Range Transport of Air Pollutants (CLRTAP), requiring progressive reductions in national emissions • Requiring that biennial national GHG emission projections to 2050/2060 are prepared and published • Setting national targets for energy efficiency improvements in key sectors, and publicise progress in achieving these targets • Setting national targets for renewable energy use as a share of the total energy consumption, and publicise progress in achieving these targets • Committing to gasification to replace coal as the source of energy for electricity generation and residential heating, whilst recognising that this is only an interim policy measure • Committing to explore pricing and financial instruments as a means to change the patterns and intensity of energy use in order that less GHG emissions are generated.
	Establish an appropriate set of staged Target Indicators to track progress, and systems to collect the necessary data, its analysis, reporting and timebound review.
Urban ambient air quality to satisfy World Health Organization (WHO) recommended limit values by 2050	Broaden the national Green Economy Strategy to embrace an unambiguous commitment to achieve non-toxic ambient air quality and to reduce the emissions of air quality pollutants (AQPs) accordingly, to include: • Ratification of the protocols to the UNECE Convention on Long-Range Transport of Air Pollutants (CLRTAP), requiring progressive reductions in national AQP emissions • Committing to the preparation of a National Air Pollution Control Plan (NAPCP) in line with the EU Directive (EU) 2016/2284 and to a cycle of periodic review and updating (every four years) • Set ambitious national targets for renewable energy use as a share of the total energy consumption, and publicise progress in achieving these targets • Prohibiting, from a defined future date, the placement on the market of energy-related and other consumer products that lie within the scope of the current / strengthened Ecodesign Directive and Ecolabel scheme • Prohibiting the import of pre-EURO 4 diesel-powered road vehicles from a defined date (restricting imports prior to that).
	Establish an appropriate set of staged Target Indicators to track progress, and systems to collect the necessary data, its analysis, reporting and timebound review.
The water demands of the general public and of the nation's productive sectors are met whilst freshwater abstraction rates are minimised, surface and groundwater resources are used sustainably, freshwater and wetland habitats are conserved, and biodiversity is safeguarded	Introduce specific policy commitments into the National Green Economy Strategy, to include: • Setting sustainable, quantitative limits on the maximum annual volumes of freshwater abstracted from each defined water basin • Development of a national strategy to develop, adapt and introduce water conservation and water efficiency techniques in major water using sectors – principally agriculture – and implement the strategy, tailored if appropriate, in each water basin • Committing to explore pricing and financial instruments as a means to reduce nett freshwater demand as a component of this national and basin strategies.
	Establish an appropriate set of staged Target Indicators to track progress, and systems to collect the necessary data, its analysis, reporting and timebound review.

Policy Implementation Indicators

Implementation of policy measures to achieve national goals is always challenging – both in terms of implementation being timely and being applied to the full technical extent envisaged in policy. Financial and institutional capacity constraints often apply, whilst unforeseen regulatory ambiguities and enforcement weaknesses can also be an issue. To assist the high-level monitoring of implementation progress, it is always useful to adopt a robust, targeted set of indicators whose values may be determined using basic statistical data that are, or could be, collated nationally. Data collection should be conducted in a strategic manner as it requires resources, and maximum use should always be made of existing data collection systems.

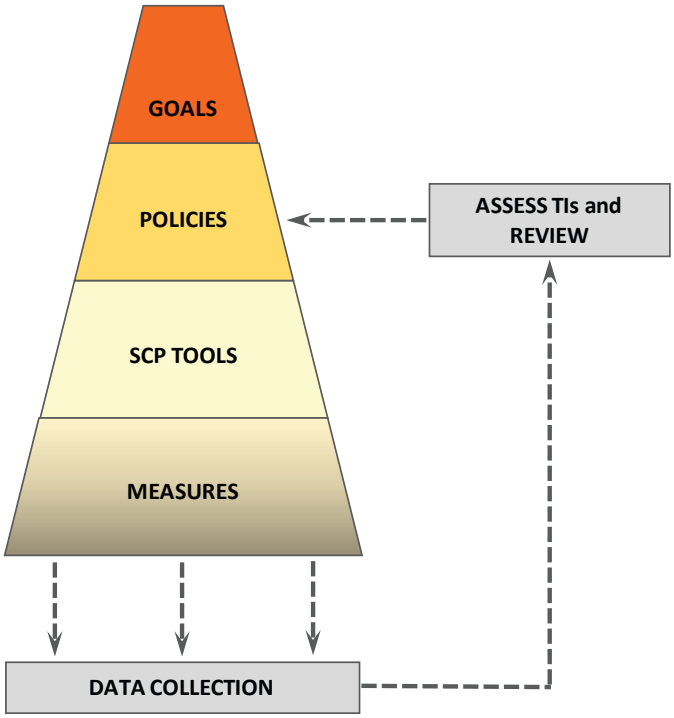


Figure 6 Hierarchy of goals, policies, tools and measures, and monitoring outcomes via Tracking Indicators

The use of TIs can help Government and other stakeholders track progress in the achievement of policy goals. Interim, time-bound targets for the tracking indicators (TIs) enable Government to review overall progress at stages and, where laggard progress is evident, and to step in to instigate remedial actions that might include policy adjustments. Figure 6 illustrates the hierarchal concept whilst Table 2 provides a non-comprehensive example. Setting goals drives policy development and SCP tools aid the identification of appropriate measures. The effects of implemented measures are determined through monitoring and data analysis, and the results of reviewing progress on meeting the TIs feedbacks into policy revision (if needed).

Establishing an appropriate set of national-specific Tracking Indicators (TIs) – which may also help assess the degree and extent of SCP tools and measures use – depends on the precise nature of the national goals.

Table 2 Illustration of the hierarchal relationship between a goal and subsidiary policies, SCP tools, and measures

Example	GOAL: Net Zero GHG Emissions by 2060		
Policies	Stop biodegradable waste from being disposed of to landfill sites	Decarbonise the energy supply	Minimise GHG emissions from the agriculture value chain
Tools	Inventories of waste arisings and fishbone analysis ; Guidance and awareness raising activities targeting households and other stakeholders; *et al.*	GHG emissions inventory and projections policy to tool; Benchmarking (external and internal) of energy use in processes & operations; Energy efficiency audits; *et al*	Life cycle analysis of emissions from the value chain; Walk-through audits & fishbone analysis at food processing plants; Awareness raising and guidance activity targeting specific stakeholders; *et al*
Measures	Separate wastes at source and separate collection; Instal and operate anaerobic digestion and composting plants to process biowastes; Put the processed biowaste to beneficial use; *et al*.	All energy efficiency measures; Incentivise the generation of renewable energy and its use; Production of 'green' hydrogen from gas; Carbon Capture and Storage technology; *et al.*	Adopt best practices to match fertiliser use to crop type and nutrient needs; Anaerobic digestion of animal manures, with energy recovery; Changes in consumption behaviour that minimises food waste *et al.*

The application of SCP Tools and implementation of measures to deliver policy goals involves many stakeholders, each group having distinctive roles – see Section 1.2. But all stakeholder groups act also as consumers – the consumer category is not limited to households. Available SCP Tools are many and diverse, falling broadly into two groups – policy focused and application focused. Annex A provides a glossary of the SCP Tools that have been proven useful elsewhere. The full, unabridged version of the present document indicates the range of tools applicable to activities in the value chains and cross-sectoral areas but, for concision, are omitted here. For illustration, Table 3 presents a sample of those applicable in the agricultural and agri-product value chain.

1.5 Key Value-Added Chains

Key value-added chains are those which offer multiple opportunities to apply SCP in adopting a Circular Economy approach and are significant for the national economy. Three are explored in Chapter 3, respectively agriculture, textiles, and energy.

SCP actions apply to each stage of production in a value chain. Wherever appropriate and possible, stakeholders should undertake action – coordinated where necessary - to maximise the application of the three SCP cornerstones. Such actions increase resource efficiency, minimise resource consumption and waste, and reduce environmental harm.

Table 3 Example to show some of the SCP Tools and Measures that may be Applied in a Product's Life Cycle: Agriculture - Considering only Crop and Animal Product Chains

Cornerstone	Sub-branch	Primary Production	Processing	Wholesale & Retail	Consumption	End of Life Management
Resource Efficiency	Crops	Apply good practice guidance regarding: Water-efficient crop watering techniques; Timing N&P fertiliser application - to improve efficiency of use & reduce consumption.	Baseline assessment including walk-through audit. Set improvement targets & monitor performance using benchmarking tools. Champions to drive the identification of measures and their implementation.	As for processing - to reduce resource inputs, food waste	Communication to alert consumers to the effects of food waste. Apply good practice and change habits to reduce food waste in households and hospitality sector.	Separate food waste at source for collection and treatment & utilisation as biogas, fertiliser, and compost.
	Animals	Optimise feeding regimes of non-range animals to minimise N emissions in urine and faeces.	As above	As for processing to reduce waste and resource inputs	As above	As above
Substitution	Crops	Grow crop varieties that need less water. Substitute treated bio-wastes for inorganic fertiliser. Substitute less for hazardous pesticides.	Use renewable energy as a substitute for fossil fuel derived energy where possible.	As for processing. Substitute compostable for plastic packaging.	Communication to alert consumers of the benefits of adopting a more vegetarian diet & eating less meat.	As above
	Animals	Minimise antibiotic use.	As above.	As above.	As above	As above.
Circularity	Crops	Apply good practice guidance regarding the management of crop residues, including their incorporation in soil.	Apply life cycle analysis and cleaner design to minimise food waste and packaging waste.	As for processing.	Communication of the need to minimise food waste and to separate it at source for separate disposal & collection.	Apply treated sewage sludge and animal manures to land, as partial replacements for inorganic fertilisers.
	Animals	Rear animals according to organic farming principles.	As above and to minimise leather waste.	As for processing	As above.	-

2. RATIONALE FOR THE SCOPE OF THE ACTION PLAN

2.1 Underlying Principles

Eight principles underlie the rationale for the scope of the SCP action plan:

1) First is to align its duration to that of the Concept for Transition to a Green Economy (STRUGE, 2019-2030), and the commitment to meet Sustainable Development Goal SDG12 and other SDG Goals, i.e. to the year 2030. STRUGE and the SDG commitments are key drivers for a green and circular economy in Uzbekistan. Hence it makes sense to align a first SCP Action Plan with them in terms of timescale.

2) STRUGE preparation wasn't able to fully embrace the SCP philosophy, hence it is recommended that SCP be introduced into a STRUGE Action Plan as a contributory means of STRUGE delivery. This action is included in the SCP Action Plan.

3) Third, the mainstreaming of SCP philosophy into practice requires the existence of an enabling environment, which can be considered as a framework of interrelated elements, each of which act to promote, support and enable SCP implementation. Six elements are identified in this Action Plan: a consistent legislative and regulatory framework, institutional capacity and capability, operational infrastructure, sustainable finance, a culture of compliance, and efficient and supportive markets / outlets. Their relative significance depends on the characteristics of the sector in which SCP is to be mainstreamed.

4) Whilst the legislative and regulatory framework has undergone significant development over time, always there is scope for improvement and refinement. Policy areas where further Government consideration and action might support the promotion and uptake of SCP are identified in the Action Plan. They derive from a consideration of the potential constraints on SCP adoption in the identified value chains and cross-sectoral themes.

5) Fifth, much of the application of SCP in practice depends on stakeholders and actors taking voluntary action – whether national and regional government branches, households, institutions, farmers, miners, and enterprises in many industrial, energy and service sectors. It is recognised, therefore that actors need first to be *motivated and have practical tools and guidance tailored to their specific needs*. A mechanism to stimulate actors to take voluntary SCP action and provide appropriate tools and guidance, therefore, should be regarded as an essential element of an SCP action plan. Its implementation contributing significantly to strengthening the institutional capacity and capability within an enabling environment: its role is complementary to but distinct to that of legislation and regulation.

   To aid the Government to determine an appropriate mechanism and its institutional 'home', the underlying principles for such a mechanism are provided in Chapter 6.

6) Whilst the scope for SCP action is significant in most economic sectors, an attempt to stimulate strong SCP action in all sectors at the same time will likely fail owing to an initially limited capability and an overstretching of capacity. Therefore, the national SCP Action Plan adopts a *strategic focus*, concentrating initially on key sectoral value chains and significant cross-sectoral themes that have the Government's attention. Effort may then be built-up over time, phased in so as to allow capability and capacity to develop and be strengthened sustainably. Securing appropriate international Technical Assistance as a first step would help the swift development of capability and capacity.

7) *Key value chains* for SCP action are selected based on several factors: (i) their identification in STRUGE, (ii) their significance in the national economy as measured by GDP, (iii) the extent of their reach in the primary through to the tertiary branches of the economy, (iv) the significance of their relative consumption and / or overconsumption of major resources, and (v) their significant release of

emissions to air, wastewater and pollutants to water, and / or solid wastes. With these criteria in mind, three sectoral value chains are included in the Action Plan:

- *Agriculture and Agri-Products*: essential to food security and the livelihoods of poorer members of society; responsible for about 80% of national freshwater demand, and significant GHG emissions from both crop-growing and animal rearing; a user of herbicides and pesticides, hazardous chemicals that can be harmful to human health; the value chain involving a long and complex supply chain starting with primary production, through a myriad of food and beverage processing operations, food storage, distribution and supply to consumers via many retail outlets, and consumption in households, institutions and multiple hospitality venues – all stages collectively generating huge amounts of food waste, which is mostly disposed of to land, and significant amounts of packaging waste.
- *Textiles*: a value chain that is economically significant and an important vehicle for developing national manufacturing capacity, exports, employment, and poverty relief. Raw cotton, wool and silk production may be viewed as part of the primary agricultural sector, but the secondary production of textiles (yarn and fabric) involve significant energy, water and chemicals consumption.
- *Energy (Oil, Gas, Coal) – Mining, Refining, Energy Transformation, and Large-Scale Combustion*: a value chain that is the principal source of both national wealth and GHG emissions – both carbon dioxide and methane. And, through the combustion of prepared coal, refined natural gas, and petroleum fuels in various settings along the value chain, a significant primary source of the ambient air pollutants ($PM_{2.5}$, NOx, SO_2, NMVOCs) that may contribute to poor air quality in cities and urban areas.

8) Even where a specific value chain is a major contributor to significant resource use, ecological and human health issues, the role played by activities in diverse other sectors may also be substantial. Resolving issues such as freshwater resource availability, material and energy resources recovery from solid wastes, GHG emissions reduction in response to climate change, and ambient air quality, requires a *cross-sectoral approach* also, in which can SCP play a big role. The above four cross-sectoral themes are included in the SCP Action Plan, in line with the Green Economy Concept and national SDG commitments. It also reflects some of the EU Green Deal's priorities.

2.2 SCP Action Plan – Abridged Version: Signposting and Correlation with Full Version

Table 4 correlates the unabridged version with the abridged version of the SCP Action Plan document, which comprises:

Chapter 1 introduces SCP, its relationship to higher-level environmental and other policies and goals, and to many of the SCP tools and measures that can help identify practical measures for improving resource efficiency, reducing waste, substituting more benign resources for those that are potentially harmful, and for the reuse and recycling of end-of-life products. A major consideration in applying SCP is the mapping of sectoral 'value chains', which comprise all the stages in production, product use (consumption) and the management and disposal of products that have reached the end of their useful life.

Chapter 2 provides a principled rationale for the scope of the national SCP Action Plan, and identifies the three value chains and four cross-sectoral areas for action.

Chapter 3 addresses three strategic value chains: agriculture and agri-products, textiles, and energy. It summarises the scope of each value chain, resolving it into major stages and subsidiary steps. The major resource consumption, waste and emission issues (for air, water, soil) and the scope for using SCP to improve resource efficiency and reduce ecological impacts, are summarised for each stage of the value chains.

Chapter 4 starts with a consideration of the overlaps that may occur between value-chain and cross-sectoral action. It then introduces the scope for SCP action in four cross-sectoral areas: (i) water saving and efficiency; (ii) recovering resources – materials and energy – from municipal solid waste (MSW); (iii) Climate Change – mitigating GHG emissions through energy efficiency and using renewable energy; and (iv) ambient air quality.

Chapter 5 introduces the elements of an SCP enabling environment that is applicable for action in all value chains and cross-sectoral areas. The relative significance of these elements in action plan varies, depending on value-chain and cross-sectoral characteristics, but all are relevant, especially in the cross-sectoral area of resources recovery from MSW. Hence the concept is developed through its application to this area.

Chapter 6 introduces the need for a mechanism to promote and stimulate SCP uptake in priority areas. As much SCP action is voluntary, attitudinal and behavioural change is critical to its widespread uptake. A promotional mechanism is needed, therefore, that has the stimulation of behavioural change as a major goal. The chapter identifies the underlying principles for such a mechanism. Some international experience illustrating how such a mechanism may evolve over time, as experience is gained, is summarised in an accompanying Annex (Annex B).

Chapter 7 presents the SCP Action Plan to 2030, derived from the analysis presented in Chapters 4 to 6 and the reviews of national and EU policy presented in the unabridged version.

Annex A: provides a Glossary of SCP Tools, measures and terminology;

Annex B illustrates the evolution of SCP Support Mechanisms in an OECD country and identifies indicative Terms of Reference and a staff complement for a potential option.

Annex C identifies the United Nations' Sustainable Development Goals (SDGs) relevant to SCP implementation, important drivers for Green Economy policy implementation.

Annex D notes the infrastructure needed in two scenarios for recovering resources from municipal solid wastes.

Table 4 Correlation of the Long and Abridged Versions of the SCP Action Plan

Unabridged Version Content	Transferred to Abridged Version as
Chap. 1: Sustainable Consumption and Production	
Sect. 1.1 to 1.5: Cornerstones of SCP; Roles of Government, Producers and Consumers; How Linear and Circular Economies Differ; Environmental Goals, Policies and Indicators; Key Value-Added Chains.	**Chap. 1**.
Sect. 1.6 Glossary of SCP Tools, Measures and Terminology	**Annex A**
Chap. 2: Rationale for the Scope of the Action Plan	**Chap. 2**.
Sect. 2.1 and 2.2: Underlying Principles and Signposting	Signposting recast, reflecting the grouping of three value chains into one chapter.
Sect. 2.3 Structural Composition of the Economy	Omitted
Chap. 3: SCP in the Agriculture Value Chain	**Chap. 3**: abridged as Section 3.2.
Chap. 4: SCP in the Textiles Value Chain	**Chap. 3**: abridged as Section 3.3.
Chap. 5: SCP in the Energy Value Chain	**Chap. 3**: abridged as Section 3.4.
Chap. 6: SCP in four Cross-Sectors - Water Efficiency and Saving – Resource Recovery from MSW – Climate Change Mitigation – Ambient Air Quality	**Chap. 4**: an abridged version.
Chap. 7: An Enabling Environment for SCP Uptake	**Chap. 5**.
Chap. 8: A Mechanism to Help Stimulate SCP Uptake	**Chap. 6**.
Chap. 9: SCP Action Plan: 2022-2030	**Chap. 7**.
Annex A: National Policies, Regulations and International Commitments Relevant to the Republic of Uzbekistan's Concept for Transitioning to a Green Economy	Omitted
Annex B: Comparative Analysis of Priorities – the EU's Circular Economy Action Plan and the Republic of Uzbekistan's Concept for Transitioning to a Green Economy	Omitted
Annex C: UN Sustainable Development Goals Relevant to SCP	**Annex C**
Annex D: International Experience of SCP Support Mechanisms & Illustrative ToR	**Annex B**
Annex E: Textiles Industry – Development Strategy, 2017-2020	Omitted
Annex F: Interim BAT Conclusions for the Textiles Industry	Omitted
Annex G: Reformation of the Gas and Oil Industry of Uzbekistan	Omitted
Annex H: Infrastructure Needs for Recovering Resources from MSW	**Annex D**

3. SCP IN SECTORAL VALUE CHAINS

3.1 Analysing a Value Chain

Value chains comprise several stages and multiple steps within each. Four main stages may be involved: (i) primary production; (ii) secondary processing and production; (iii) tertiary or services sector; and (iv) consumption. Resources are used in each step, and various wastes, liquid and gaseous emissions are generated. In a green and circular economy, actions are taken at each step to:

- Minimise resource consumption, waste arisings and emissions;
- Substitute less harmful substances for potentially harmful resources, where possible; and
- Recover resources, treat solid and liquid wastes, and utilise treated wastes where possible.

The preparation of simple block diagrams, each representing a significant stage or step in a value chain can help to identify the potential for applying resource efficiency, substitution and circularity approaches to minimise resource consumption. Example block diagrams are shown in section 3.2, adopting the following colour-coding:

Key to Applicable SCP Tools and Measures

Resource efficiency	R
Substitution	S
Circularity	C

An appreciation of the undesirable environmental issues posed by the wastes and emissions from each stage or step, and how they may be better managed, is also needed. This appreciation aids communication with stakeholders, informing them of the reasons why action is necessary. Environmental issues arising in each stage or step also are also noted in the block diagrams.

3.2 Agriculture and Agri-Products Value Chain

Scope of the Value Chain

The agriculture and agri-products value chain is comprehensive and links to all four cross-sectoral themes covered in the Action Plan: water saving and efficiency, recovery of resources from solid wastes, GHG emissions and air quality. Figure 7 illustrates its range and complexity and its many discrete steps. The cultivation of cotton, raw wool and silk may be regarded as primary agricultural activity, but is considered separately in Section 3.3 regarding the textiles value chain. Fishing is not shown since the activity's significance is local rather than national. Nor is forestry, though the principles outlined in the described value chain apply to both. Broadly speaking, each step in the value chain can be considered to lie in one or other of the following economic stages:

- **Primary production sector**: cereals, vegetables, fruit, milk, eggs, wool, meat and animal hides;
- **Secondary processing and production sector**: including cereal milling, bakeries, multiple food processing operations, dairies, meat processing, brewing, wine making etc, the tanning of animal hides to produce leather, and the manufacture of shoes and other leather products;
- **Tertiary or services sector**: covering the storage of raw and part-finished goods, their distribution, and the sale of finished goods through retail outlets ranging from large supermarkets in urban areas down to small shops in villages and towns;
- **Consumption**: of foodstuffs in domestic households, institutional canteens (work-place, educational, prison eating halls etc), and in the hospitality sector – hotels, restaurants, cafés etc; and the wearing of shoes and other products made from leather.

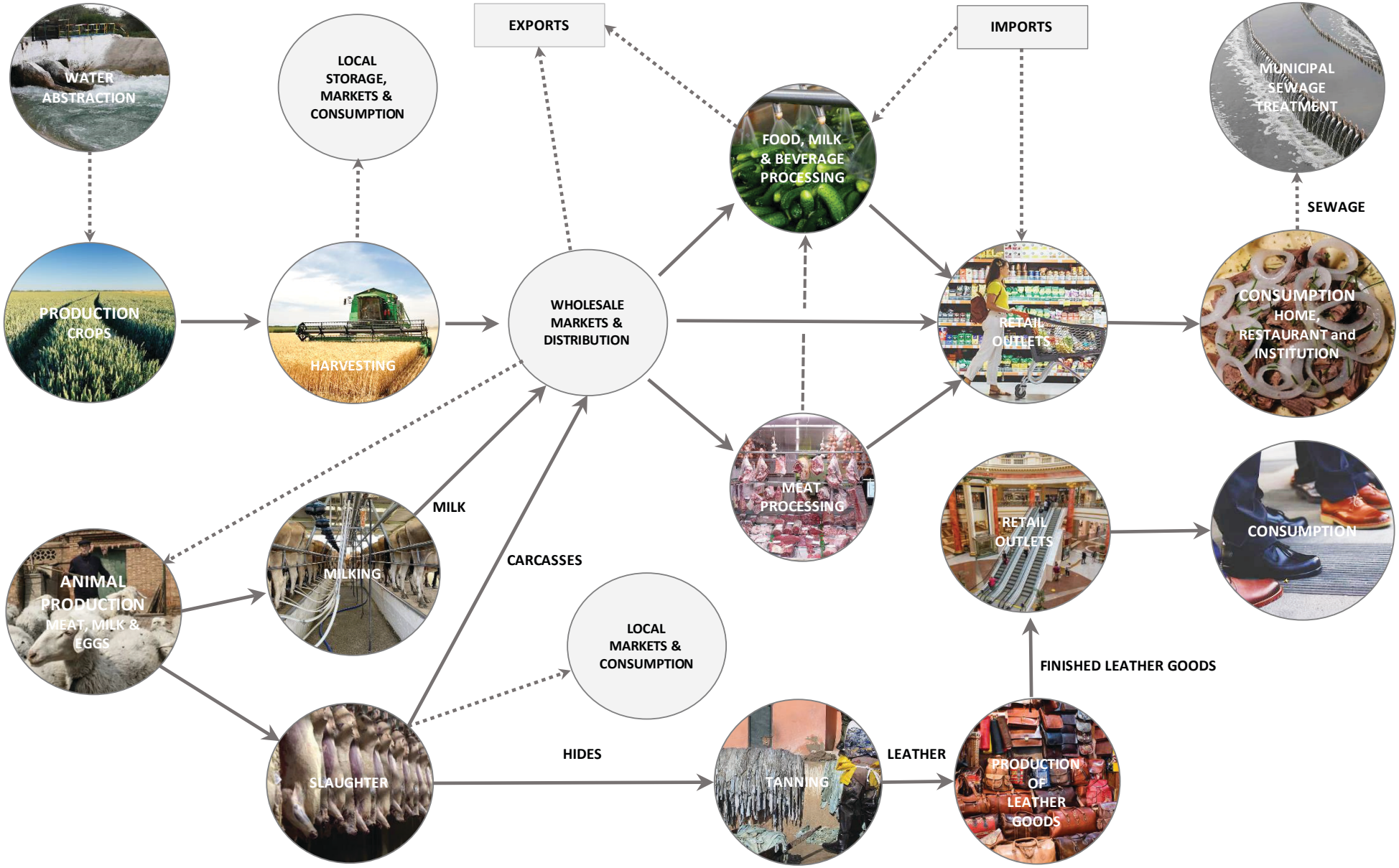


Figure 7 Mapping of the Product Chains for Agriculture, Agriculturally-Derived Products, and Consumption

Primary Production – Resource Inputs and Issues

Agricultural primary production may be broken down into three steps: (i) crop production, (ii) animal rearing, and (iii) slaughterhouses.[3]

Crop Production

Crops include all cereals, vegetables and fruits whether grown for human or animal consumption. The block diagram shown in Figure 8 identifies major resource inputs; the applicability of resource efficiency (R), substitution (S), and circularity (C) approaches to minimise resource consumption; and significant wastes and emissions of concern.

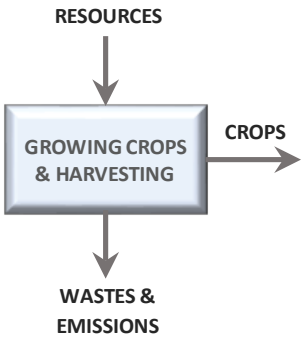
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
CROP PRODUCTION					
	Water	R		C	Crop spoilage – food waste
	Fertilisers – N and P	R	S	C	Crop residues
	Pesticides and herbicides	R	S	C	Emissions to air
	Seeds		S	C	Discharge to surface water & groundwater

Figure 8 Resource Inputs and Wastes Arising from Primary Production (Crops), and the Applicable Types of SCP Action

Note: the contents of the rows in the 'Resource Inputs' and 'Wastes and Emissions' columns of Figure 9 are independent of each other.

In addition to the seeds and plants that form the basis of crop production, major resource inputs and their effects may be identified as follows:

- *Freshwater*: its abstraction may exert negative impacts on river basins and their dependent ecosystems. Agriculture, primarily crop production, accounts for up to about 80% of the national freshwater demand. Given that the effects of climate change may include elevated temperatures and reduced rainfall, the sustainability of surface water resources is a major issue that the agriculture sector must face.
- *Inorganic nitrogenous and phosphate fertilisers*: though their use may be key to high agricultural productivity, their production incurs a significant carbon footprint. Also, the application of nitrogenous fertilisers to land causes ammonia and nitrogen oxide emissions to air – contributing to air pollution and GHG emissions, respectively - and, potentially, the leaching of nitrates into soils and surface waters. Whilst the injudicious application of phosphates to land may cause phosphates to leach into surface waters. Nitrate and phosphate leaching may cause surface water pollution.
- *Synthetic chemical pesticides and herbicides*: are hazardous substances by definition and commonly used in modern agriculture (i) to protect growing crops from depredation and infestation by pests, and (ii) to suppress the growth of unwanted plants (weeds) that may compete for the light, water and nutrients needed by crops. Their indiscriminate and excessive use can contaminate products, however, e.g. if applied to the surfaces of growing fruit and vegetables, posing health risks to consumers. Their adsorption onto soil particles, subsequently carried by surface water run-off to rivers and streams, may result in spreading the chemicals further afield.

3 Fisheries and forestry may also be considered aspects of agriculture, broadly defined, though they are not included specifically in the SCP Action Plan.

Additionally, solid wastes are generated:

- *Post-harvest crop residues*: these should be managed in an ecologically sound manner, though for farmers used to open-field burning this may pose a challenge;
- *Crop wastage*: 'on the farm' and in local storage facilities is additional to the significant post-harvest food wastage occurring across the length of the agricultural food chain.[4] The degradation of untreated food waste disposed of on land may contribute to methane emissions, and will attract vermin.

Animal rearing

Cattle, horses, pigs, goats, sheep, camels, chickens and other fowl are raised to provide meat and other foodstuffs. Some are housed for at least part of their lives whilst others range more or less freely prior to their being gathered in for shearing or slaughter. Milk, eggs and wool are harvested from live animals whilst slaughtered animals provide meat, hides, skins, feathers and other animal by-products. The comments below concern the consumption of resources and the wastes and emissions generated when animals are housed, whether full-time or for part of the time – see Figure 9.

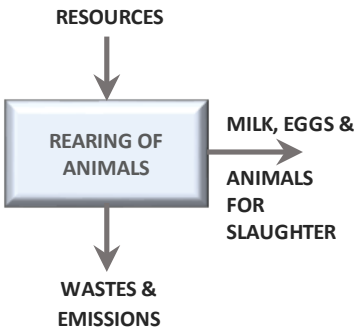
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
(HOUSED) ANIMAL REARING					
	Food – including additives	R	S	C	Manure – faeces & urine, bedding
	Water – drinking, cleaning	R			Emissions to air – ammonia, methane
	Bedding	R	S	C	Wastewater
	Energy – ventilation, heat	R			

Figure 9 Resource Inputs and Wastes Arising from Primary Production (Animals), and the Applicable Types of SCP Action

Major resource inputs and their effects include:

- *Feedstuffs and additives*: a major issue is the emission of ammonia from animal excreta (urine and faeces). Up to 90% of national ammonia emissions to air are generated by the agricultural sector, of which about two-thirds can result from animal rearing. Management of the nitrogen cycle therefore is one of the central features of modern, sustainable agriculture. Animals fed an overly protein-rich diet convert less of the feed protein into meat and, consequently, generate higher ammonia emissions. Hence, the animal feeding regime adopted is a significant aspect of farm management that should be considered.[5] A further consideration is the use of food additives such as antibiotics.

  Emissions of the potent GHG, methane, by ruminant animals such as sheep, cattle and horses – whether housed or free ranging – is an inescapable consequence of animal rearing, though some studies suggest that emission volumes depend on animal diet to an extent.

  The rearing of housed animals inevitably generates manure, comprising faecal material, urine, and soiled bedding.[6] The improper management of animal manures has several potentially adverse effects, including the transmission of pathogenic organisms; high emissions of ammonia and methane to air; surface water pollution arising from their storage near to surface freshwater bodies; groundwater pollution caused by the storage of manure in unlined ponds or lagoons; and severe odour nuisance

4 According to an estimate made in 2011 by the UN's Food and Agriculture Organization, about a third of all food produced globally is lost as food waste: https://www.fao.org/food-loss-and-food-waste/flw-data. A more refined estimate prepared in 2016 suggests the average food loss from post-harvest up to but excluding food retailing is 13.8% globally but 20.7% in central and southern Asia.

5 The UNECE Framework Code (of 2014) for Good Agricultural Practice for Reducing Ammonia Emissions. Available at: https://unece.org/environment-policy/publications/framework-code-good-agricultural-practice-reducing-ammonia.

6 The excreta (faeces and urine) of free-ranging animals falls onto land where it degrades naturally through a combination of aerobic and anaerobic processes, becoming incorporated into the soil.

if operations are conducted close to inhabited areas. Manures need to be collected, treated and disposed of safely, therefore, in order to prevent and reduce their adverse environmental effects and to recover useful energy and nutrients.

- *Water for cleaning*: The cleaning of animal housing with water generates wastewater containing faecal matter and urine not directed into manure slurry pits, likewise soiled bedding, and contaminants washed from soiled floors and walls. As with manure, its improper management may give rise to several adverse impacts.
- *Energy*: used for ventilation, heating and lighting – a source of GHG emissions.

Methane and ammonia are the *principal emissions to air* of concern from housed agricultural animals: the first a powerful GHG and the second an air quality pollutant. Emissions arise from ventilation air exhausted from housing, and from the operations involved in manure and wastewater management.

Slaughterhouses

Whether housed or allowed to range freely, most farm animals raised by humans are destined for slaughter, whether in small-scale local operations or industrial-scale abattoirs. Whilst animal carcasses passing inspection for disease form the main product, significant *by-products* of animal slaughter include offal (organs selected for human consumption or pet food), blood (as the basis for certain foodstuffs), untreated hides and skins, feathers, and other animal parts bones, feet, hooves etc) that either can be eaten or used to make non-food products.

The comments below relate mainly to the consumption of resources and the generation of wastes and emissions in industrial-scale facilities:

- *Freshwater*: In addition to the provision of drinking water to animals held in pens or stockyards, slaughterhouses consume freshwater in washing down surfaces and cleaning of carcasses and animal parts (such as the intestinal tract);
- *Energy*: required for space heating, hot water and steam-cleaning, stunning of animals prior to slaughter, and chilling of the skinned carcasses and by-products prior to transport.
- *Significant waste streams* comprise:
  - All parts of the slaughtered animals that are not regarded as products or by-products. These body parts should be considered a potential bio-hazard;
  - Animal excreta (faeces and urine) generated in the holding pens (lairage), in the slaughtering process, and produced in the post-slaughter cleaning of intestinal tracts;
  - Wastewater from the cleaning of slaughterhouse surfaces.

Primary Production – Opportunities to Apply SCP

Crop Production

An SCP approach offers farmers and institutions many options to reduce resources consumption, waste, emissions, and their impacts. Regarding the issues raised above, SCP may involve:

- *Freshwater demand*: freshwater should be used with utmost efficiency, focusing on the production of crops yielding high economic added value whilst ensuring national food security and national commitments to sustaining biodiversity. SCP opportunities regarding *resource efficiency* include:
  - *Water efficient irrigation*: maintenance of irrigation distribution systems (channels etc) to minimise leakage and evaporation losses; adoption of water-efficient crop watering techniques;
  - *Crop selection*: adopting good practice guidance on the choice of crop and crop varieties grown, selecting crops requiring less water, with the twin goals of reducing water demand and increasing the added value of crops produced per hectare; innovation to develop and plant seeds that have been gene-edited (for example) to tolerate low levels of water availability or consume less water (an example of applying cleaner design for *resource efficiency*);

- *Timing and rate of water application*: adopting good practice guidance on the optimum timing and rate of crop watering to affect plant water uptake. Two aspects to consider: (i) soil preparation prior to seed sowing, and (ii) watering of growing crops;
- *Communication and outreach activity*: effective communication of good water use practices to the land-owning and farming communities; provision of advice on these practices and emerging techniques; and access to technical support for those who need it.

Complementary policies to incentivise and steer farmers to adopt tools and measures to reduce the water-intensity of crop growing combine both 'carrot and stick' approaches:

- *'Carrots or incentives'*: (i) partial grants and subsidised loans for investing in water-efficient technologies, and (ii) additional tax relief for making such investments; and
- *'Sticks or penalties'*: (i) increasing the prices paid for water abstraction and use, the additional monies raised being used to invest in water efficiency measures and outreach programmes, and (ii) strictly enforced, mandatory, basin-specific limits on the annual quantity of water abstracted from surface and groundwater resources.

– *Inorganic fertiliser consumption (N & P)*: *Resource efficiency* and *substitution* principles apply. Chiefly, this involves the adoption of good practice guidance[7] regarding:
  - *Optimal timing and rates of application*: (i) prior to planting and (ii) during crop growth;
  - *Inorganic fertiliser selection*: different compounds release nutrients at different rates, affecting the extent of their effective assimilation by the crop. It may be noted that, for this reason, the use of ammonium carbonate is banned in the EU;
  - *Replacement by organic fertilisers*: this may involve the partial or total substitution of nitrogenous, treated biowaste for inorganic fertilisers. After suitable treatment, and subject to further safeguards, biowastes such as animal manures, sewage sludge, food and green wastes may be so used;[8]
  - *Organic farming*: seeks, amongst other things, to minimise or eliminate the use of chemicals, including inorganic fertilisers, producing crops and animal-based food 'naturally';
  - *Communication and outreach activity*: effective communication and outreach programmes to disseminate good practice and guidance.
– *Synthetic pesticide and herbicide use*: adhering to good practice guidance may (i) reduce the quantities of synthetic pesticides and herbicides used and the risks arising, and (ii) substitute naturally occurring substances where possible.
– *Crop wastage*: adopting good practice at harvesting and post-harvest (e.g. local storage) not only reduces food waste but increases net output, productivity and the effective efficiency of all resource inputs to crop production.[9] Development of national good practice guidelines on minimising crop wastage, as part of an overall strategy to minimise food waste throughout the value chain, is recommended. These may then be disseminated to the farming community via effective outreach mechanisms.
– *Post-harvest crop residues*: SCP options for dealing with these residues include:
  - Baling straw and other residues, transferring the compressed bales to engineered combustion plant equipped with energy recovery, ashes applied to land as fertiliser;
  - Incorporating the residues into soil by ploughing or other techniques, helping to sustain the humus and soil structure;
  - Composting, applying the composted residues to land as soil conditioner and fertiliser.

7 See, for example, The UNECE Framework Code (2014) for Good Agricultural Practice for Reducing Ammonia Emissions,

8 See, for example: WRAP (2016), 'Digest and Compost Use in Agriculture - Good practice guidance for agricultural contractors'. https://wrap.org.uk/resources/guide/compost-and-digestate-agriculture-good-practice-guide

9 See, for example: https://www.fao.org/3/x0039e/X0039E01.htm

Animal Rearing

Adopting an SCP approach in animal rearing involves, amongst other things: (i) adopting good practice to manage the nitrogen cycle in a holistic manner[10] (ii) minimising GHG emissions, and (iii) appropriate management of the wastewaters generated:

- *Managing the nitrogen cycle*: involves optimising the animals' feeding regime, the effective management of the manures and wastewaters generated, and the management of housing conditions:
  - *Feeding regime*: feed animals an optimised diet regarding protein content, eschewing a diet overly rich in proteins – thus maximising its conversion to animal protein and minimising the release of nitrogenous material in animal excreta;
  - *Manure management*: adopt good practice measures including:

    (i) collecting manure and soiled bedding swiftly, passing it to storage, preferably covered and vented to treatment to reduce ammonia emissions – allowing manure and bedding to stand uncollected encourages its decay and the uncontrolled release of ammonia emissions;

    (ii) treating manure and biodegradable bedding in heated anaerobic digestion plant equipped with biogas collection and a burner[11] to provide process heat and the treatment of ammonia and methane emissions by combustion;

    (iii) storing treated manures in ventilated tanks prior to disposal, passing the vented gases to the biogas burners;

    (iv) as a potential alternative to anaerobic digestion, composting manures (with other materials), ideally in covered, ventilated facilities equipped with emissions treatment;

    (iv) ensuring that , whether treated or not, any manures that are stored on open ground are stored in lined ponds or lagoons that minimise the risk of groundwater and surface water pollution; and

    (v) applying treated manures to arable land or pasture, thereby reducing the need to apply synthetic inorganic fertilisers. Preferably, manures should be applied using techniques that incorporate the applied treated manure into the soil (covering the deposited manure with soil), rather than by surface application;
  - *Wastewater management*: Wastewater generated in the cleaning of animal housing will be contaminated by animal excreta and bedding to a varying extent and should be treated accordingly:

    (i) Highly contaminated wastewater, e.g. the first flush from cleaning soiled floor and wall areas and drains, may be mixed and jointly treated with manure and soiled animal bedding as noted above;

    (ii) Less contaminated wastewater may be collected and passed to treatment in lined lagoons having a relatively long residence time, allowing sedimentation, natural degradation and oxidation processes to take place, prior to the discharge of treated effluent to surface water.[12]

Reducing GHG emissions: the main opportunity for adopting SCP here is the collection and treatment of manures and biodegradable bedding in heated anaerobic digestion plant equipped with biogas collection and a burner to combust methane, oxidising it to the less powerful GHG, carbon dioxide, thereby providing process heat.

10 See: The UNECE Framework Code (of 2014) for Good Agricultural Practice for Reducing Ammonia Emissions. Available at: https://unece.org/environment-policy/publications/framework-code-good-agricultural-practice-reducing-ammonia; WRAP (2016), 'Digest and Compost Use in Agriculture - Good practice guidance for agricultural contractors'. https://wrap.org.uk/resources/guide/compost-and-digestate-agriculture-good-practice-guide; and the BAT Reference Document and BAT Conclusions published by the European IPPC Bureau, which refers specifically to the intensive rearing of poultry and pigs, though many of the good practices that may be found there are applicable to rearing other animals – see: https://eippcb.jrc.ec.europa.eu/reference/intensive-rearing-poultry-or-pigs-0.

11 Ammonia emissions in the animal housing may be treated by supplying vented air to the biogas burners.

12 Where climatic factors prevent such operations, it may be necessary to develop alternative good practice approaches.

Slaughterhouses

Good practice for slaughterhouses and the production of animal by-products may be found in the appropriate BAT Reference Document: issued in 2005, currently undergoing revision, the 1st draft published in June 2021.[13] As part of good practice, SCP tools and measures should be used to ensure that water and energy are used efficiently, and that wastewater is captured effectively. All parts of the slaughtered animals that are not regarded as products or by-products, form a significant waste stream that should be managed in a hygienic and environmentally acceptable manner. Good practice should be adhered to, including the separation of solid and waterborne wastes. Waste streams generated in the slaughtering and post-slaughter processes that comprise animal excreta (faeces and urine), and wastewater from other cleaning operations, should be managed using good practice at least as stringent as that applied to farm-generated manures.

Secondary Production – Resource Inputs and Issues

Secondary production comprises (i) food and beverage processing – whether for human or animal consumption - and product packaging, (ii) the production of leather and leather goods, and (iii) the processing of raw wool, timber and miscellaneous other primary products. The summary below considers only the first and second of these categories.

Food and beverage processing and packaging

Food and beverage production – Figure 10 - involves a wide and diverse range of processes and activities, many of which are indicated below:

STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
PROCESSING AND PACKAGING OF FOODS AND BEVERAGES					
	Primary feedstocks: meat, fish, milk, cereals, vegetables, fruit, pulses, fungi etc.	R			Food wastes
	Other food ingredients and additives	R	S		Packaging wastes
	Packaging & other material	R	S	C	Other solid wastes
	Energy	R	S		Wastewater
	Water – process & cooling	R			Cooling water
	Chemicals	R	S		Emissions

Figure 10 Resource Inputs to and Wastes Arising from Food & Beverage Production, and the Applicable Types of SCP Action

- Bakeries – bread, pasta and pastries etc;
- Bottling of beverages, vegetables and fruits etc;
- Butchering – preparing meat for retail sale;
- Brewing – beer and other liquors produced by the fermentation of cereals, potatoes, etc;
- Canning of processed foodstuffs;
- Dairies – milk pasteurisation and sterilisation, production of dried milk powder, cheeses, cream, yoghurts, kefir and other fermented products;
- Distillation – of wines and other brewing liquors to make brandy, vodka and other high-strength liquors;
- Freezing and chilling of meat, vegetable, fruit and dairy products;
- Meat processing e.g. to make mince, sausages, pies etc;
- Milling of cereal grains;

13 https://eippcb.jrc.ec.europa.eu/reference/slaughterhouses-and-animals-products-industries

- Packaging (primary and secondary) of foods and beverages;
- Pet food production;
- Pickling of vegetables, fungi and fruits;
- Processing of raw and other food ingredients to make ready-meals, confectionary, etc;
- Storage of raw and processed foods, in bulk or small-scale;
- Transport of raw primary foodstuffs and intermediate products for processing;
- Vinification – fermentation of grapes (and fruit) to make wine.

Major resource inputs to food and beverage processing, and the wastes and emissions it generates, include:

- *Feedstock*: raw foodstuffs are resource inputs of high economic value yet their processing can result in significant wastage, generating miscellaneous food wastes. These may be generated as solid waste, whose improper disposal can attract vermin, with implications for health and hygiene, and contribute to GHG emissions. Or they may be waterborne, contributing to wastewater pollution loads: for instance, milk and intermediate product wastage at dairies constitutes the principal COD (Chemical Oxygen Demand) load of a dairy's wastewater.
- *Additives*: in the preparation of processed foods a range of chemical substances may be added to foodstuffs to enhance product taste, visual appearance (e.g. colour), stability and shelf-life. Examples include salt, sugar, curing and preservative agents such as nitrites in processed meat, and a range of synthetic colouring and favouring agents. In excess, however, all may have undesirable effects on human health. On the other hand, some chemicals may be added for health-enhancing reasons, e.g. Vitamin D added to butter-like spreads.
- *Packaging and packaging waste*: product packaging serves several purposes: protecting food from contamination, enabling its efficient transport and storage, serving as a medium for product advertising and the conveying of product information to the purchaser / consumer, and for consumer convenience. There are three types of packaging:[14]
  1) Primary packaging to contain a product - to prevent its contamination and spoilage - is usually essential and takes many forms: e.g. bottles (glass, plastic), jars, cans, cartons, tubes, plastic pouches or bags (e.g. to contain frozen foods), cardboard, and wrappers around individual portions.
  2) Secondary packaging, for ease of handling by distributors, retailers and consumers includes e.g. cardboard boxes containing primary packaged products; and shrink-wrapping to bind several cans, bottles or packets together.
  3) Tertiary packaging to reduce damage during transport and for the ease of distributors and retailers includes pallets to support boxes containing secondary-packaged products, and shrink-wrapping of such boxes to form a larger 'package', etc.

  In the absence of packaging minimisation and recycling, meeting these and other requirements results in a substantial consumption of packaging materials, water and energy - and the generation of substantial quantities of packaging wastes.
- *Energy*: most of the food and beverage processing operations indicated above involve the use of substantial quantities of energy - hot water, steam, electricity, fossil fuels. Its consumption contributes to manufacturers' production costs and, unless based on renewable energy sources, to national GHG emissions.
- *Water*: similarly, most food and beverage processing operations involve the use of substantial quantities of freshwater. Some may form an integral component of the product (e.g. in beer and non-alcoholic drinks); some may be used in production and cleaning operations, generating wastewater that may carry a high load of biodegradable matter (e.g. effluent from breweries, dairies, processed food manufacture); whilst some may be used as an indirect coolant, the spent coolant being relatively uncontaminated. Whilst freshwater consumption in processing is small relative to that of crop growing, it contributes to the pressures on water resources and is a cost to producers.
- *Chemicals in cleaning operations*: for product safety and hygiene reasons process plant used to process foods and beverages, and filling operations (bottling, canning) need to be clean. Cleaning operations may employ a range of chemical substances to maintain cleanliness and good hygiene, contributing to a plant's wastewater pollutant load.

14 See, for instance, the EU's Packaging and Packaging Waste Directive 94/62/EC as amended by (EU) 2018/852.

Leather and leather goods production

The production of leather involves the chemical stabilisation of raw animal hides and skins, a process known as tanning. Most of material resources consumed are hazardous - stabilising agents, solvents (releasing NMVOCs to air), and other chemicals. Figure 11 indicates the main resource categories in tanning and leather finishing, and the wastes and emissions generated. Most of the wastes and emissions are ecologically harmful and pose some risk to human health.

STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
TANNING OF ANIMAL HIDES					
	Hides and skins	R		C	Raw hides and skins – trimmings, hair, grease and spoilage
	Tanning chemicals	R	S	C	Tanned hides and skins – trimmings and spoilage
	Solvents and other chemicals	R	S		Chemical wastes, drums, sludge etc.
	Water	R			Wastewater
	Energy	R	S		Emissions to air

Figure 11 Resource Inputs to and Wastes Arising from the Tanning of Animal Hides and the Applicable Types of SCP Action

The production of leather goods such as shoes, clothing, furniture upholstery and others may be practised in small workshops, or at large-scale, employing many people. Whatever the scale, typical leather working operations include cutting to shape, stitching, gluing and trimming. Wastes of note include:

- Hide trimmings and spoilage, hair and grease - attracting vermin and flies, its improper management creating offensive pollution;
- Hazardous chemical wastes in spent drums and in tannery sludge;
- Emissions to air from the tanning process.

Secondary Production – Opportunities to Apply SCP

Food and beverage processing

Resource Efficiency and Substitution Opportunities

Most SCP opportunities in food and beverage processing lie in improving *Resource Efficiency* (a cornerstone principle), for which many SCP Tools are applicable - see Annex A. Their use can help minimise material waste, including food waste, and improve both energy efficiency and the efficiency of water use. Taking action on all such resources may be cost-effective, but from an economic and financial perspective, taking SCP action to reduce the wastage of primary feedstock material may be especially beneficial as this wastage represents lost product value. Such losses amplify the food and other resource wastage in preceding steps of the value chain.

Relatively simple monitoring can indicate the amount of product wastage at some production sites. For instance, monitoring the flowrate and chemical oxygen demand (COD) of a dairy's wastewater – mostly associated with milk and other product or by-product losses – can readily give an indication of 'lost' product value. In general though, SCP tools may be used at all production-sites to examine and identify means of improving the efficiency with which the resources noted in Figure 10 are used.

SCP possibilities to reduce food additives such as salt and sugar, and *substitute* healthier food additives for chemical taste and colour enhancers (a cornerstone principle) should also be considered, whether prompted by a marketing rationale or in response to consumer demand. Similarly the quantity and type of

cleaning substances used in processing and bottling operations, should be examined with a view to reducing consumption and chemical loads to wastewater.

Management of Food Wastes and Wastewater

Food wastes and wastewaters are generated at each stage of food and beverage processing and cleaning. Their generation should be minimised as noted above, for resource efficiency reasons, but is unlikely to be eliminated. The characteristics of the generated wastes are highly dependent on the nature of the feedstock and the operation, but most are biodegradable, hence amenable to biochemical treatment - whether anaerobic (in the absence of oxygen) or aerobic (in the presence of oxygen). Untreated, they may cause water pollution. In general, and where feasible, it is advisable that:

- Food waste streams are segregated according to whether they are solid, high-strength waterborne waste, or light-strength wastewater;
- Where (solid) food wastes are deemed unfit for human consumption, they may be considered as feedstock for pet-food production. Otherwise:
  - Solid and high-strength waterborne food waste – including animal fats and greases - may be treated in heated anaerobic digestion reactors, the generated biogas burnt to provide process heat and or to serve other beneficial purposes;
  - Aerobic treatment of solid food waste by composting is another possibility;
- Medium to low-strength waterborne food wastes may be treated aerobically in wastewater treatment plants – there are many designs;
- Unless there is a valid reason for doing so, spent cooling water should not be mixed with other waste / wastewater streams but discharged to surface water. Mixing with food wastewaters dilutes and thereby increases the volume of these streams to be processed - raising the costs of treatment.

Subject to sanitary and hygienic protocols being adhered to, and that appropriate safeguards are upheld, the food wastes so treated may be utilised in agriculture as a soil additive, providing humus and partially substituting for inorganic fertilisers (N and P).

Packaging and Packaging Waste

Food processors and distributors, and their suppliers of packaging, should pay attention to all aspects of packaging design and materials specification in order to:

- Apply cleaner design techniques (*circularity principle*) to reduce the quantity of primary, secondary and tertiary packaging materials to the minimum needed to meet functional requirements. This will reduce the resources consumed in their manufacture and the quantity of waste packaging arising at retail outlets and at consumer premises;
- Require that the producers and suppliers of packaging use recycled materials to as great an extent as practicable, and to at least the extent that Government may mandate;
- Wherever possible, avoid the use of composite materials (such as plasticised cardboard, e.g. Tetra Pak) that inhibit or prevent the recycling of packaging waste;
- Include signage on primary packaging to inform consumers as to whether the packaging waste may be recycled and, where this is so, to which waste stream it should be classified when separating at source. Allied to other measures, this will help final consumers to practice at-source waste separation, and enhance the recycling of household and similar wastes;
- Replace materials that are difficult to recover and recycle with materials that can be reused, recycled, or processed for incorporation into the environment.[15]

15 An example of the latter, in the retail sector, is the replacement of plastic bags for holding loose vegetables and fruit by compostable clear bags made from potato starch.

Leather and leather goods production

Given the hazardous nature of many of the chemicals used in the tanning process, appropriate levels of care need to be exercised in leather production. The European Commission's BAT Reference Document for the Tanning of Hides and Skins gives a comprehensive description of the many steps involved in the process[16], and of applicable BAT, but is over 270 pages long.[17] Published in 2007, the World Bank Group's Environmental, Health, and Safety Guidelines for Tanning and Leather Finishing provides an easier 21-page introductory description to leather production and a good practice summary.[18]

SCP tools to identify resource efficiency saving measures, such as may be found by reference to good practice documentation, will likely play the major role though substitution and circularity actions may be relevant also. Opportunities to substitute less hazardous tanning chemicals and leather finishing solvents should be sought and implemented where feasible.

The wastes and emissions from tanning and leather finishing operations are environmentally damaging unless treated appropriately. Adopting good practice guidance, therefore, is essential.

Whatever the scale at which final leather goods are produced, major objectives should be to minimise the tanned and finished leather wastage, and ensuring that glues and solvents are used responsibly so as not to prevent adverse health impacts amongst leather workers.

Tertiary Sectors – Resource Inputs and Issues

Storage and distribution

Foodstuffs may be stored between most stages of production, and its wastage can occur during storage and when transported. Causes include foodstuffs being eaten or spoiled by vermin; spoilage resulting from inappropriate handling and storage conditions – spillages, damp, etc; and he vulnerability of perishable foods to failures in transport logistics, resulting in delay and rot. Electricity is consumed in the storage and distribution of chilled and frozen foods.

Retail Outlets

Retail outlets range from local markets where products are sold by individuals on a semi-casual basis, through dedicated outlets such as bakery shops and retail butchers, small-scale local supermarkets that sell a limited range of goods, through to large supermarkets able to provide a comprehensive range of products and services - including the delivery of foodstuffs and other goods ordered over the internet. Figure 12 shows schematically the main resource inputs at retail outlets, and the wastes and emissions generated.

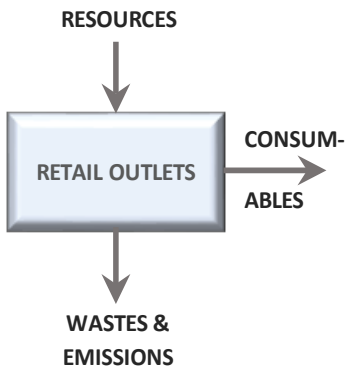
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
RETAIL OUTLETS					
	Foodstuffs etc.	R		C	Food wastes
	Packaging	R	S	C	Packaging wastes
	Energy – heating, chilling, freezing, lighting, etc.	R	S	C	Other solid wastes including used lamps & other equipment
	Water	R			Emissions to air – including refrigerants
	Transport (delivery to meet internet orders)	R	S	C	Wastewater

Figure 12 Resource Inputs to and Wastes Arising at Retail Outlets, and Applicable Types of SCP Action

16 See Figure 15 in the Full version of this SCP Action Plan.

17 JRC Reference Reports, European Commission, 'Best Available Techniques (BAT) Reference Document for the Tanning of Hides and Skins – p.13' (2013)

18 IFC, World Bank Group (April 2007). 'Environmental Safety and Health Guidelines for Tanning and Leather Finishing'.

Whilst appropriate good practice is applicable to all types and scales of retail outlet, the comments below are directed primarily at wastes and emissions arising at supermarkets and specialist shops:

- *Food and beverage waste*: results from retail product storage conditions, and how products are packaged, displayed and handled on site. It also is influenced by an outlet's policy and practice regarding product 'sell-by-date' and 'use-by-date'. The former lead to the withdrawal of products from sale, henceforth being regarded as waste. Whilst the latter may cause consumers to throw away foodstuffs that have exceeded their 'use-by-date', even if the food passes common-sense tests of being safe – e.g. smell and visual appearance.
- *Packaging and Packaging Waste*: retail outlets receive much secondary and tertiary packaging which, unless recycled, eventually enters the waste stream;
- *Energy*: chilling and freezer compartments, space heating, and lighting contribute to the energy consumption of retail premises and the indirect emission of GHGs. When considering the carbon footprint of a major food retailing entity, the energy consumption and GHG emissions of its product delivery fleet - supplying consumers directly (where ordering on-line is available) - should also be taken into consideration.

Tertiary Sectors - Opportunities to Apply SCP

Storage and distribution:

SCP tools such as baseline assessment, walk-through auditing and fishbone analysis are well-suited to identifying the sources and causes of food waste in these settings. Good practice should be adopted to minimise the wastes that arise, and to treat, use, and dispose of such wastes that do arise.[19] Once the root causes of waste have been identified, they can then be addressed locally through specific measures. Internal benchmarking may be usefully applied to stimulate, monitor and maintain improvements.

To ensure that energy is used efficiently, attention should be paid to thermal insulation of cold container and storage units, maintenance and operating conditions. The replacement of old, inefficient units with new ones having higher design efficiency should also be considered.

Retail Outlets

SCP opportunities in retail outlets include:

- *Food and beverage waste*: Good practice to prevent and minimise food waste should be adopted.[20] SCP tools such as baseline assessment, walk-through auditing and fishbone analysis are well-suited to identifying the sources and causes of food waste here. As in storage and distribution, this can lead to the identification and implementation of specific improvement measures, which internal benchmarking may stimulate, monitor and maintain. Good practice can include participation in food banks whereby tinned and otherwise unwanted but packaged food products (provided by customers or by the store) are made available to poorer members of the community.

  Ideally, food waste that does occur should be collected separately, transferred to processing centres for treatment by anaerobic digestion or composting, and applied to land as a partial substitute for synthetic inorganic fertilisers and source of humus.
- *Packaging and packaging waste*: large retail outlets such as major supermarket chains may act as wholesalers in many respects, enabling them to exert pressure on their suppliers to adopt good packaging practice. Wherever possible they should do so. They may be able to act in partnership – as members of a retail supply chain – to optimally reduce packaging and jointly agree target indicators.[21] Other areas where retail outlets may act to reduce packaging waste and increase the resource efficiency of the supply chain include:
  - Ensuring that all packaging waste generated on site is collected separately – to prevent and minimise its contamination - and that arrangements are put in place for its transfer to recycling entities. The latter include producers of cardboard who may pulp recovered carboard waste as a partial feedstock;

19 See, e.g., the resources made available by WRAP: https://wrap.org.uk/taking-action/food-drink/sectors/manufacturers-brands

20 See, for example, the resources made available by WRAP: https://wrap.org.uk/taking-action/food-drink/sectors/retailers

21 Retail outlets in EU member states are subject to the provisions of the EU's Packaging and Packaging Waste Directive 94/62/EC as amended by (EU) 2018/852.

- Stop providing customers with plastic carrier bags for bulk purchases, substituting (free) paper bags or paid-for durable bags made of natural materials;
- Substitute bags made from compostable cellulosic material for thin-film plastic bags used by customers buying several loose items (bread rolls, apples, etc). Reuse of such bags and their eventual disposal with green waste should be encouraged;
- Participate in glass bottle (deposit and) return schemes, enabling customers to return empty bottles, for bulk transfer from the retailer to bottling plants;
- Provide space on available land for customers to deposit segregated primary packaging waste – cardboard, glass bottles, tin cans, and plastic bottles – enabling its efficient collection and transfer to recycling entities.

– *Energy:* the use of resource efficiency tools to benchmark an outlet's energy consumption and identify the scope for improving its performance should be considered at each site, and certainly at major sites. Good practice should be adopted and, where feasible, renewable energy resources (such as heat pumps) considered for local substitution;

– *Other solid wastes*: should be collected separately from food wastes and clean packaging wastes. Ideally, components containing hazardous materials – e.g. fluorescent lighting tubes - should also be collected separately. Solid wastes having the characteristics of household waste may be managed similarly.

– *Other considerations*: food production that adopts organic farming techniques typically eschews the use of synthetic fertiliser, pesticide and herbicide chemicals – relying on 'more natural' methods. Retail outlets may help promote the production, sale and consumption of organic products through the provision of dedicated sales areas.

Final Consumption – Resource Inputs and Issues

Food and Beverages

Food and drinks are prepared, served and consumed in households, the hospitality sector (cafes, restaurants, hotels etc), industrial and commercial premises (offices, workers' restaurants, etc), and institutional settings (hospitals, universities, government buildings, etc). Figure 13 indicates the main resource inputs, and the wastes and emissions generated:

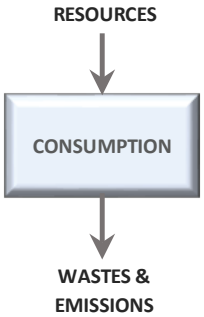
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
CONSUMPTION					
	Foodstuffs including beverages	R			Food wastes
	Energy – cooking, heating, chilling, freezing	R	S		Packaging wastes
	Appliances – cooking, chilling, freezing	R	S	C	Wastewater
	Water – cooking, cleaning	R			Emissions – direct & indirect

Figure 13 Resource Inputs to and Wastes Arising from Final Consumption, and the Applicable Types of SCP Action

– *Food Wastes*: arise from inappropriate storage conditions in the kitchen or larder; buying foodstuffs in excess of actual consumption; preparing an overabundance of food served at the table, resulting in food left-overs on the serving dish or dishes, and on individual plates.

Root causes include economic constraints inhibiting proper food storage, consumer patterns of food purchasing, overstocking of food supplies 'just in case', cultural factors including a tradition of generous hospitality, and consumers responding over-cautiously to 'best-use-by' date marking on food products;

- *Energy Consumption and Emissions*: the energy efficiency of appliances used for the cooking, chilling, and freezing of food will depend on their age, design and condition. In turn, this affects the emission of GHGs and air pollutants to air. Food preparation behaviour in the kitchen, whether in households or in hospitality and institutional settings, also plays a part;
- *Packaging Waste*: lies outside the immediate control of the consumer. In the absence of alternative means of disposal, consumers will dispose of such waste with other components of municipal solid waste;
- *Wastewater*: human excreta is the inevitable by-product of food and drink consumption, forming (where flush toilets are provided) a major constituent of the sewage discharge to municipal wastewater treatment plants (MWTP).

Leather Products

Unwanted leather products are usually handled with other MSW streams.

Final Consumption – Opportunities to Apply SCP

Food and Beverages

Opportunities to apply SCP in the consumption of food and beverages include:

- *Food Wastes*: much wastage results from consumer behaviour, though this may be moderated through a concerted effort to educate and communicate.
- *Energy Consumption and Emissions*: Good practice techniques should be adopted in all settings, but especially in hospitality outlets and institutions. And concerted communication efforts to raise awareness and provide practical guidance and examples may play a significant role. Use of the SCP tools identified in Annex A may help to improve resource efficiency in large-scale restaurants, while eco-labelling and eco-design systems will help guide all consumers to energy-efficient appliances. Large-scale restaurants in the hospitality and institutional settings may also consider the application of renewable energy sources – such as heat pumps, solar panels etc – as at least a partial substitute for fossil-fuel based energy, thereby reducing the emissions of GHGs and air quality pollutants.
- *Packaging Waste*: through their behaviour consumers can influence in several ways the quantity of packaging waste generated and the efficiency of its reuse and recycling. For instance:
  - If hygienic and possible, reuse plastic or other bags provided by retail outlets;
  - Choose to use biodegradable 'thin-film' bags if made available by retail outlets;
  - Avoid breakage of beverage bottles and return empty bottles if this option is offered by retail outlets;
  - Consumers to make known to retail outlets their desire that the options indicated above <u>are</u> made available;
  - Where there is provision for the collection of at-source separated waste – food, glass containers, clean tinned cans, plastics, cardboard etc - make the effort to ensure that wastes are segregated correctly and deposited in the appropriate containers.

  A concerted effort to raise consumer awareness, to educate, and communicate, will be required for the above and other opportunities to be realised in practice.
- *Wastewater*: additional to the emission of oxidation products to air, municipal wastewater treatment plants typically generate three outputs:
  - Grit and gross solids separated and screened out from the sewage prior to treatment. After washing, grit may be recovered and used in various ways. The associated gross solids should be treated and disposed of appropriately to landfill;
  - Effluent which, if given a high level of treatment and subject to sanitary safeguards being met, may be (re)used to aid the cultivation of agricultural crops;[22]
  - Sludge containing the solids arising from sewage treatment. After further treatment, and subject to rigorous sanitary and hygienic safeguards being met, it also may be utilised as a source of humus

22 Within the EU, this practice (though uncommon) is governed by Regulation (EU) 2020/741 of the European Parliament and of the Council of 25 May 2020 on minimum requirements for water reuse.

and nutrients (nitrogen and phosphorus) in agricultural crop production and on pasture.[23] Anaerobic treatment is one such treatment, producing biogas which may be used as a renewable source of energy. Alternative beneficial outlets for treated sewage sludge can include land reclamation, forestry, and as backfill material for MSW landfill sites.

Societal Diet and Consumer Choice

A further issue concerns the resource inefficiencies and associated wastes generation implicit in animal rearing for meat: producing foodstuffs for animals to consume and convert into animal protein for human consumption. A societal-wide change of diet away from a heavy reliance on meat would represent a major step forward in resource efficiency and reducing GHG emissions. Eating more cereal products, vegetables and fruit, and eating less meat and other protein-rich foods of animal origin may be culturally challenging. But it is an issue raised and debated in Europe and elsewhere, not only for reasons of GHG emissions mitigation but as a behavioural change toward a healthier lifestyle. It is a factor for medium to long-term consideration, at least, one that could be taken forward by a future programme of awareness and communication.

Consumers whose awareness and interest has been stimulated may also express to suppliers their collective demand for change and expanded choice, exerting influence in several areas. For instance, they may demand that:

- Organic foods are made more available in stores;
- Secondary packaging is minimised or eliminated, reducing the quantity that consumers have to dispose of;
- The variety and availability of raw and processed vegetarian foodstuffs at retail outlets is increased;
- Local facilities are provided for the storage of at-source separated wastes prior to regular and efficient collection.

Used Leather Goods

Potential opportunities for leather recovery and recycling, and the repurposing of recovered products (footwear etc) should be sought where possible. For instance, charities may be able to pass on discarded footwear to poorer members of local communities.

3.3 Textiles Value Chain

Scope and Size of the Textiles Value Chain

The textiles value chain is dominated by cotton, the major natural fibre produced, though silk, and wool from sheep, astrakhan, goats and camels is also produced. Figure 14 illustrates its scope. Of the synthetic fibre consumed in the textiles sector, whether alone or in combination with natural fibres, most is imported. Broadly speaking, the major stages in the value chain lie in the following economic categories:

- **Primary production**: production of natural fibres - cotton, wool, and silk. In many respects, the issues here are similar to those faced in the agricultural value chain.
- **Secondary production**: including synthetic fibres production, spinning natural and synthetic fibres to produce yarn, using the yarn to manufacture a wide range of textile fabrics and products (clothing, bedding, knitwear, carpets, etc).
- **Tertiary or Services**: comprising the sale of manufactured textile goods through retail outlets in Uzbekistan, ranging from large stores in cities down to small shops and markets in villages and towns. And the exporting of such products;
- **Consumption**: wearing of clothing, use of bedding, towelling, curtains, carpets etc, and their periodic washing and cleaning – whether in Uzbekistan or in export markets.

Resources are used throughout the value chain – water, chemicals and energy are of primary concern.[24] Likewise various wastes, liquid and gaseous emissions are generated throughout.

23 See, for example, DEFRA (May 2018), Guidance - Sewage sludge in Agriculture: Code of Practice, available at: https://www.gov.uk/government/publications/sewage-sludge-in-agriculture-code-of-practice/sewage-sludge-in-agriculture-code-of-practice-for-england-wales-and-northern-ireland. And Environment Agency (July 2020), Policy Paper - Environment Agency Strategy for Safe and Sustainable Sludge Use, available at: https://www.gov.uk/government/publications/environment-agency-strategy-for-safe-and-sustainable-sludge-use/environment-agency-strategy-for-safe-and-sustainable-sludge-use.

24 Shanti Radhakrishnan, 'Sustainable Cotton Cultivation', in Sustainable Fibres and Textiles, 2017. Extract accessible at: https://www.sciencedirect.com/topics/engineering/cotton-cultivation

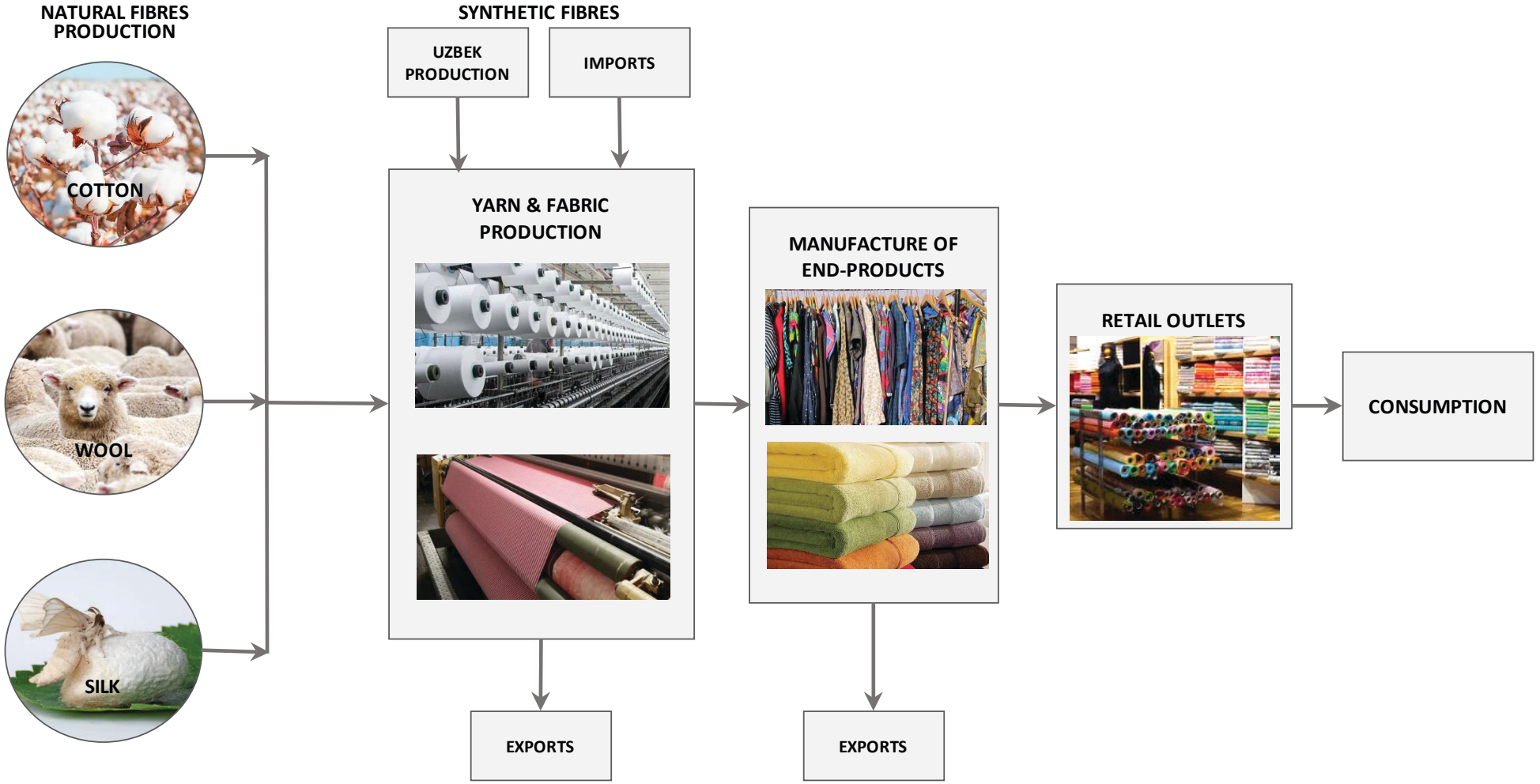


Figure 14 Schematic Illustration of the Textiles Value Chain

The sub-sections that follow summarise the major consumption of resources, the issues that arise from their consumption, and appropriate SCP action.

Primary Production – Resource Inputs and Issues

Natural Fibre – Raw Cotton

Cotton is an attractive crop for arid and semiarid regions provided that irrigation water is available. Uzbekistan's cotton industry has undergone significant reforms in recent years and major developments include:

- Cancelling the State-level planning of cotton production from 2020;
- Forming a system of market-oriented 'clusters', vertically integrated enterprises that are engaged in primary production, processing, logistics and the production of finished products. A structural transition that was initiated in 2016-17 and completed by 2021;
- In parallel Uzbekistan's raw cotton processing capacity has expanded substantially, the focus now lying on the production and export of finished goods with higher added value.

Figure 15 indicates the major resources used in the cultivation and production of raw cotton.

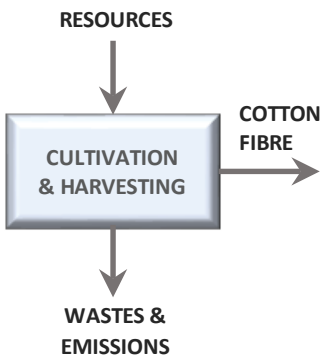
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
COTTON CROP PRODUCTION					
	Water	R		C	Crop residues
	Fertilisers – N and P	R	S	C	Emissions to air
	Pesticides and herbicides	R	S	C	Carry-over to fibre processing Discharge to surface water & groundwater

Figure 15 Resource Inputs and Wastes Arising from Raw Cotton (Crop) Production, and the Applicable Types of SCP Action

In addition to the seeds and plants that form the basis of cotton cultivation, major resource inputs and their effects may be identified as follows:

- *Freshwater*: It is generally recognised that cotton is a relatively water-thirsty crop, involving the consumption of up to $10m^3$ to $20m^3$ freshwater to produce 1kg of cotton. Given that primary agricultural production (including cotton cultivation) accounts for most of the national freshwater consumption, this an issue that the cotton textiles sector cannot avoid;
- *Inorganic nitrogenous and phosphate fertilisers*: though their use may be key to high productivity, their production involves significant GHG emissions, and their application to land causes ammonia and nitrogen oxide emissions to air and nitrate and phosphate to leach into surface waters - see section 3.2;
- *Synthetic chemical pesticides and herbicides*: are hazardous substances by definition and commonly used in the cultivation of cotton. However, their indiscriminate, excessive use can contaminate the crop of raw cotton, leading to a carryover of persistent organic micropollutants into downstream processes and into finished products for sale.

Natural Fibre - Wool

After a steady increase in production since 2000, wool production from sheep, astrakhan, goats and camels (combined) has stabilised from 2014 at about 35 000 tonne per year. The animals are mainly free-grazing,

being brought in annually to be sheared. Less than 10% of the raw wool is exported, the rest is processed within Uzbekistan. Resource consumption and environmental issues are similar to those presented in section 3.2 for animal rearing, though the issues presented by range-grazing animals are minor relative to those of housed animals. However, raw wool may contain traces of pesticides such as organophosphates, synthetic pyrethroids and organochlorine chemicals used to control animal infestation from external parasites and insects.

Silk

Raw silk production involves the cultivation of perennial mulberry trees in plantations or farms, the harvesting of their leaves, and feeding the leaves to silkmoth larvae (silkworms). Raw silk fibre is extracted from the silkworms after they have been killed by steam or hot water. No major resource consumption issues and effects are thought to exist.

Primary Production – Cotton Cultivation: Opportunities to Apply SCP

Regarding the resource consumption issues and effects identified above, SCP may involve:

- *Water consumption*: conservation and efficiency measures to reduce the overall water demand of cotton cultivation involves the application of SCP Tools and measures that are the same, in principle, as in the cultivation of other agricultural crops – see section 3.2;
- *Inorganic fertiliser consumption*: SCP tools and measures related to the use of inorganic fertilisers principally involve the adoption of available good practice guidance[25] as described in section 3.2 concerning agricultural crop production;
- *Synthetic pesticides and herbicides*: adhering to good practice guidance, such as substituting naturally occurring substances, can reduce the quantity of synthetic chemical use. and reduce such undesirable risks. Specific approaches include:
  - Integrated Pest Management[26]: a multifaceted approach to managing insects, adopted by the USA cotton industry;
  - Genetically modified cotton, a widely used technique in which the introduced gene coding for the bacterium *Bacillus thuringiensis* (Bt) produces a self-protecting toxin; and
  - Adopting organic cotton production methods to minimise the use of chemicals.

Secondary Production – Synthetic Fibres: Resources, Effects and SCP Opportunities

The production of synthetic fibres is not undertaken extensively in Uzbekistan for reasons of economy of scale. Most such fibres are imported. Were this to change, then it would be appropriate to adopt regulatory standards equivalent to those adopted in the EU based on the BAT Reference Document for the production of polymers used in the textiles industry.[27]

Secondary Production – Yarns and Fabrics: Resource Inputs and Issues

Textiles production involves many processes, classified as dry or wet. Resource consumption, waste arisings and emissions issues in yarn and fabric production – Figure 16 – differ significantly between the dry and wet processing steps.

Dry Processes: Yarns and Fabrics

The spinning of loose fibre into long lengths of yarn and the weaving and knitting of yarn to produce cloth fabric are generally conducted on a semi-continuous basis using multiple machines on a factory floor. Several other dry processing steps are associated with yarn production. They include the blending of different types of

25 The UNECE Framework Code (2014) for Good Agricultural Practice for Reducing Ammonia Emissions,
26 Cotton from Field to Fabric: https://www.cotton.org/pubs/cottoncounts/fieldtofabric/upload/Cotton-From-Field-to-Fabric-129k-PDF.pdf
27 The latest currently available version of the BAT Reference Document was published in August 2007. Available at: https://eippcb.jrc.ec.europa.eu/reference/

fibre, and carding, in which the entangled mass of fibres is transformed into a filmy web. Apart from the fibre and yarn material inputs, resources consumed in the dry processing of yarn and fabric include the following:

- *Spinning oils* and conditioning agents applied in the spinning process to lubricate the fibres. They have to be completely removed before dyeing or printing, thus contributing to (i) the wastewater organic pollutant load from subsequent wet processes and (ii) emissions in the exhaust air from higher temperature wet processes. The use of spinning lubricants thus generates hard-to-biodegrade mineral oils and other substances;
- *Yarn and knitting machinery lubrication*: yarn is lubricated usually with paraffin wax prior to knitting, whilst mineral oils are widely used to lubricate the needles and other parts of the knitting machinery. The consumption of these oils can range between 4% and 10% of the weight of fabric produced. Waxes and oils are removed downstream in the wet processing of textiles, to wastewater and in emissions to air;
- *Electricity*: used to drive the textile production machinery and the air-exhaust fans used to remove airborne dusts and vapours. The indirect emissions to air arising from electricity consumption depend on the source of energy used in its generation.

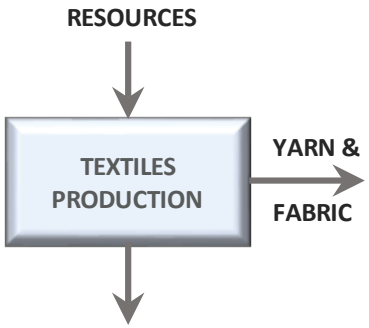
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
TEXTILES PRODUCTION – YARN AND FABRIC					
	Fibres	R		C	Fibre, Yarn and Fabric losses
	Water	R	S	C	Wastewater
	Chemicals	R	S	C	Chemical wastes – in drums and in wastewater
	Energy	R	S		Emissions to air – from the dry processing of fibre, yarn & fabric – and from chemical & energy use

Figure 16 Resource Inputs, Wastes Arising, and Applicable Types of SCP Action in Yarn and Fabric Production

Wet Processes: Yarns and Fabrics

Multiple wet preparation and finishing processes are involved in yarn and fabric production, their deployment dependent on the types of fibre used, the fabric being produced, and the nature of the end products. Wet processes are major consumers of the water, chemicals and energy resource inputs indicated. Processes commonly used include: scouring, carbonising, sizing, desizing, mercerising, bleaching, dyeing, printing, washing and drying; and finishing.[28]

Water, a diverse range of chemicals, and energy are major consumable items. Unless the chemicals are consumed in reactions or fixed in the yarn or fabric product, they will be found in wastewater or in emissions to air. Apart from basic chemicals such as acids, alkalis and hydrogen peroxide, many chemicals used in the wet processing of yarns and fabrics are resistant to biodegradation and possess hazardous properties. Textile mill wastewater also contains the spinning, weaving and knitting lubricants removed in the wet-processes, and residual pesticides present in the natural fibre feedstock supplied to the spinning processes.

28 The unabridged version of the SCP action plan contains brief descriptions of these technical operations. A full listing of the treatment processes is given in the first draft of the updated "Best Available Techniques (BAT) Reference Document for the Textiles Industry, December 2019: available at: https://eippcb.jrc.ec.europa.eu/reference/. The BAT Reference Document for the Textiles Industry produced in July 2003 remains the official adopted BAT source in the EU and may also be considered, available from: https://eippcb.jrc.ec.europa.eu/reference/

Secondary Production – Yarns and Fabrics: SCP Opportunities

Priorities should be the application of good and best practice to increase resource efficiency regarding water, energy and chemicals use, and to substitute more readily biodegradable substances for the oils and chemicals used. The adoption of renewable energy should also be considered.

The interim BAT Conclusions in the EC's first draft of the 'BAT Reference Document for the Textiles Industry, December 2019' is a prime source of information on good and best practice. Key aspects include:

- Elaborate and implement an environmental management system (EMS) – BAT 1;
- Establish, maintain and regularly review an inventory of inputs and outputs – BAT 2;
- Prepare and implement a water management plan – BAT 9;
- Prepare and implement an energy efficiency plan – BAT 10;
- Elaborate and implement a chemicals management system – BAT 13; and
- Prepare and implement a waste management plan – BAT 28.

The SCP tools and measures summarised in Annex A complement, and are integral to, many of the 53 techniques defined in the BAT Reference document.

Secondary Production – End-Product Manufacture: Resource Inputs and Issues

The cutting and sewing of fabric to produce finished product items such as clothing, bedding, towelling, furnishings are dry operations, often undertaken in large workshops. The direct resource inputs and wastes/emissions from these often labour-intensive, operations are largely limited to fabric losses in cutting operations, and the energy consumed in powering the equipment used for fabric cutting/sewing and the provision of space heating and lighting – Figure 17.

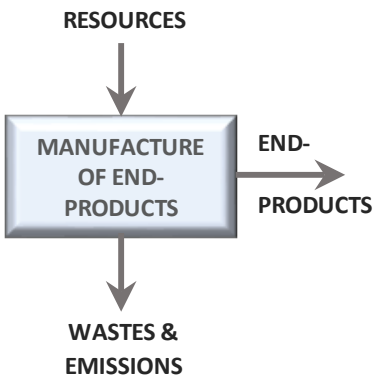
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
MANUFACTURE OF END-PRODUCTS					
	Fabric	R		C	Fabric losses from cutting and sewing operations
	Energy	R	S	C	Indirect emissions to air arising from electricity consumption, space heating and lighting.

Figure 17 Resource Inputs, Wastes Arising, and Applicable Types of SCP Action in the Manufacture of End-Products

However, that is a rather narrow perspective since fabric waste at this stage amplifies the collective resource consumption – and emissions to water, air and land - in <u>all</u> the upstream stages of production.

Secondary Production – Manufacture of End-Products: SCP Opportunities

Areas where SCP may be applied in textile end-product manufacture include[29]:

- *<u>Life-Cycle and Cleaner Design</u>*: Adopting a more holistic, life-cycle viewpoint, significant effort should be made to adopt cleaner design techniques to minimise fabric losses in the manufacture of end-products. Whether efforts should be directed to using more advanced technology to automate product

29 The manufacture of textile end-products is outside the scope of the BAT Reference Document for the Textiles Industry.

manufacture or, if policy prioritises the provision of employment and poverty reduction, to train factory staff in techniques to minimise waste, is a matter for factory managements to decide. Other factors to be considered in applying the SCP approach in textile-product manufacture include:

- The microplastics pollution of water, a contributory cause being the washing of apparel and other products containing synthetic fibres; [30]
- Responsiveness of manufacturers to consumer preferences;
- Potential differences between domestic and export market demands, and how they might evolve over time;
- Intentions to significantly expand the export of textile products to EU and other markets beyond the present focus, given the potentially stricter sustainability demands of those customers may need to be met;
- The extent to which the designers of consumer textile products take account of fabric losses in designing such products. It is those designers, and the enterprises in which they sit, who need to be involved in the practice of cleaner design.

Energy: The use of generic SCP tools such as internal benchmarking, walk-through audits, cause-and-effect analysis and others are well suited to examining energy use in workshops, complementing sources of specialised good practice in the specification, design and maintenance of energy efficient equipment used to make textile end-products.

Recycling Textile Materials: In applying a cleaner design approach to textile products, consideration also needs to be given to the potential incorporation in future of recycled textiles – whether natural fibre or synthetic fibre based. Addressing these issues could involve rethinking the specification of fibre materials (and their mix-composition) used to make yarns, fabrics and end-products.

SCP Opportunities in Textile Clusters

Role of Textile Clusters: Clusters now dominate textiles production. Vertically integrated enterprises that engage in all stages of the value chain from fibre production through to end-product manufacture, their formation provides a sound basis, in principle, for the adoption of a value chain approach in applying SCP. Key elements that clusters may address include:

- Adoption of an environmental management system (EMS) that considers all stages of the value chain from primary production through to end-product manufacture. This would harmonise with the adoption of production-related quality assurance systems;
- Adoption of best practice in textiles secondary production, or as close to best practice as is realistically achievable. The suggested BAT Conclusions in the EC's first draft of the 'BAT Reference Document for the Textiles Industry, December 2019' is a prime source, defining 53 techniques. SCP tools and measures summarised in Annex A complement and are integral to many of the defined BAT;
- Collaboration with the retail sector, working in partnership to help overcome constraints on minimising the generation of textile solid wastes.

Retail Outlets and Consumption of Textile Products

Textile products are made available to customers by retail outlets who, in a market economy, seek to make a profit from meeting customer demand. However, customer demand is uncertain. And, whilst some demand might be unmet (which, in a market economy, may prompt the retailer to order more product), demand can also fall short of supply - resulting in unsold products i.e. textile waste. Also, the household consumption of textile products such as clothing, bedding and carpets involves their wear, cleaning and eventual disposal as

30 See e.g. De Falco et al (April 2019) 'The contribution of washing processes of synthetic clothes to microplastic pollution', available at: https://www.nature.com/articles/s41598-019-43023-x; XiaoZhi Lim (May 2021) 'Microplastics are everywhere - but are they harmful?', available at https://www.nature.com/articles/d41586-021-01143-3; and Alice Horton (2017) 'Microplastics in the Freshwater Environment', Foundation for Water Research, FRR0027, available at http://www.fwr.org/environw/frr0027.pdf

textile waste. In dealing with textile waste, the waste management hierarchy introduced in Chapter 1 should serve as a guide, with priority given, in descending order, to:

Prevention > Preparation for Reuse > Recycling > Other Recovery > Disposal

Prevention: Cleaner design allied to smart responsive ordering, short supply chains, and customer behaviour and attitude are key to the prevention of textile waste.

Preparation for Reuse: The reuse of textile products by other consumers should be undertaken as far as possible subject to minimum quality standards and cultural acceptance.[31] The cascade use of clothing is one aspect: an ecologically sound practice which tends to be shied away from, for social and cultural reasons, by economically upward-moving consumers. At the lowest level, textiles may be repurposed for use as rags etc.

Recycling: The reincorporation of textile products into the production of yarns and fabrics. This may be limited by textile composition i.e. the use of mixed fibres.

Other Recovery: Textiles produced using natural fibres only are biodegradable, so they may be processed into a form that is amenable to treatment by composting with other feedstock, for instance, the resultant compost having agricultural value. Textiles of any composition – natural or synthetic fibres – are combustible to varying extents, so may be burned in waste-to-energy plants.

Disposal: Collection as municipal solid waste and disposed of to landfill.

Life Cycle Analysis: shows that significant consumption and ecological issues arise also from the washing of textile products in use, clothing in particular:

- The carbon footprint of clothes washing can be significant;[32]
- Significant releases of microplastic particles into wastewater and the water environment.

3.4 Energy Value Chain

Scope

The extraction of natural gas, mineral oil (petroleum) and coal, fossil fuel processing, and large-scale combustion facilities such as power generation form the core of the energy value chain depicted in Figure 18. Also shown are the end-uses of energy products. Where used to generate heat in industrial large-scale combustion plants (≥50MWth) they may be regarded as part of the core. Other applications including residential and institutional heating and electricity use, and transport, may be best considered in a cross-sectoral context – see Chapter 4.

Much of the extractive and processing activity indicated in Figure 18 is the subject of BAT Guidance and Reference documentation published by the European Commission (Table 5). These documents provide a comprehensive review and statement of the measures that operators can adopt to prevent waste and environmental pollution, achieve high resource efficiency, mitigate environmental pollution, and reclaim polluted land. They are a vital source of information when seeking to adopt SCP practice in the energy value chain.

31 The Sustainable Clothing Action Plan (SCAP) is a collaborative agreement in the clothing industry encouraging the reuse and repurposing of used clothing. Its signatories and supporters represent over 58% of UK retail sales by volume. The resources made available to those having an interest in SCP related to textiles may be accessed at: https://wrap.org.uk/taking-action/textiles

32 See, for example, WRAP (July 2017) 'Valuing Our Clothes: the Cost of UK Fashion', Figure 1, p.12. Available at https://wrap.org.uk/resources/report/valuing-our-clothes-cost-uk-fashion

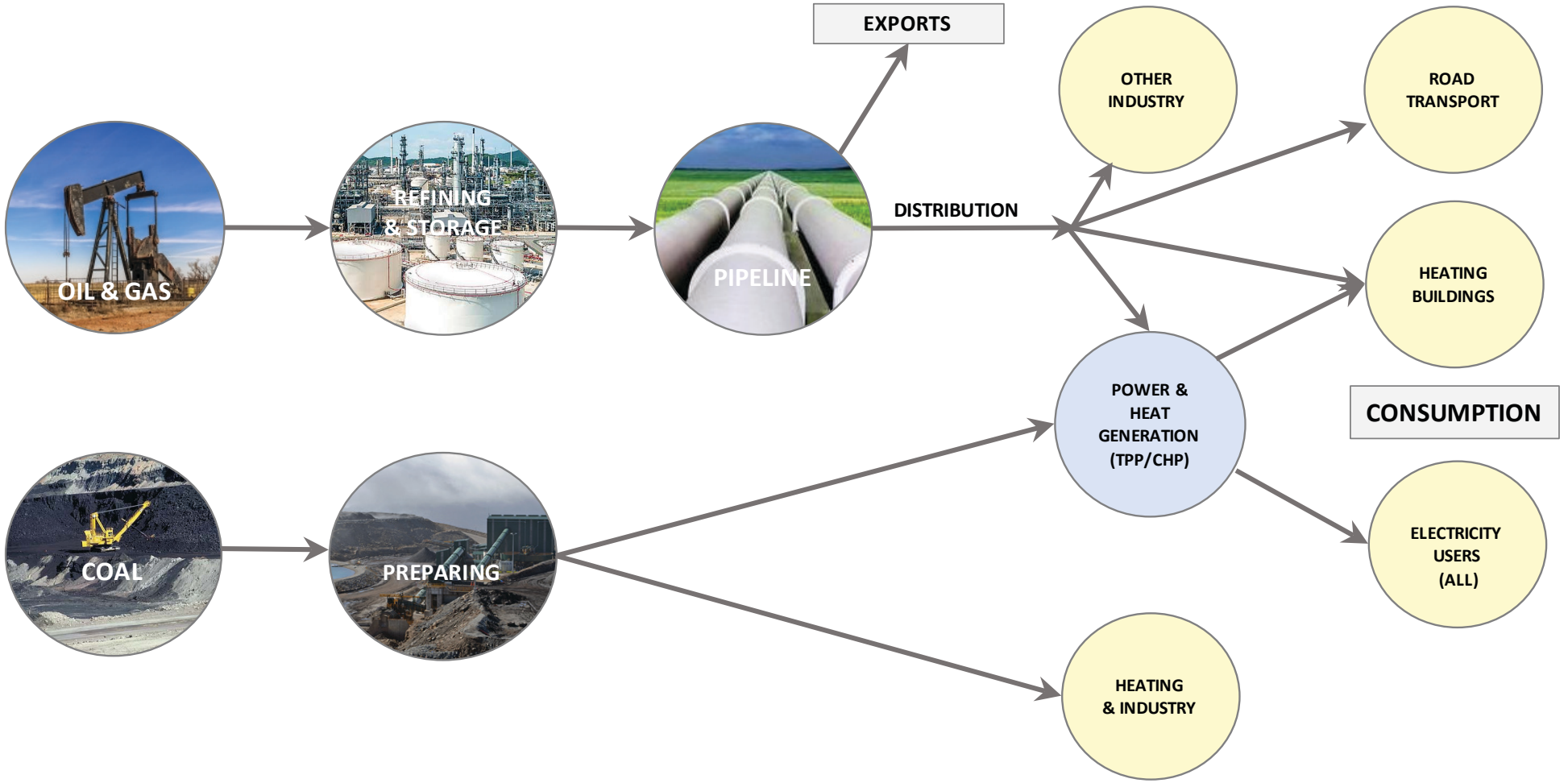


Figure 18 Simplified Mapping of the Energy Value Chain

Table 5 Latest Versions of the BAT Guidance and Reference Documents Published by the European Commission[33]

Sector	BAT Document Title	Publication Year
Extractive Industries	Guidance on Upstream Hydrocarbon Exploration and Production	2019
	Reference for the Management of Waste from Extractive Industries	2018
Processing & Transformation	Reference for the Refining of Mineral Oil and Gas	2015
	Reference for Large Combustion Plants	2017
	Reference for the Manufacture of Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers	2007

Natural Gas and Mineral Oil (Petroleum)

Exploration and Extraction

The Guidance document on the extraction and production of petroleum oil and natural gas covers both off-shore and on-shore production and identifies the major issues impacting the environment. It suggests a risk-based approach to address issues and identifies BAT for each. Having an organisational Health Safety and Environment (HSE) management System is a central recommendation and key to tackling most of the resource consumption, emissions and ecological issues arising from oil and gas exploration and extraction. This BAT document could form the basis for setting future exploration and operational permits and ensuring compliance.

Refining and Distribution

Important issues for the refining of mineral oil and gas are the emissions to air of methane, volatile organic substances, nitrogen oxides, sulphur oxides, ammonia and many others; discharges to water of a host of polluting substances; energy efficiency; and the contamination of soils and groundwater. The BAT Reference Document for the refining of mineral oil and gas addresses most aspects of refinery processing, defining BAT Conclusions for all.

Energy industry leakages result in the release of methane, carbon oxides, nitrogen oxides, sulphur compounds, methanol and other pollutants to air. In recent years, several gas processing facilities have introduced technologies to improve environmental protection, the volume of gas flaring declining from 1.494 billion m^3 in 2013 to 0.788 billion m^3 in 2018.[34]

Whilst there is no policy to adopt BAT into the environmental regulatory approach in Uzbekistan, it would be beneficial to consider its future incorporation in the regulation of heavy industry, including the exploration and processing of natural gas and oil. The relevant BAT documents could be tailored to the Uzbek situation and applied as the basis for setting future exploration and operational permits and ensuring that permit conditions are applied and complied with.

Coal Mining

Uzbekistan's proven coal reserves at the end of 2020 have been assessed as 1.375 billion tonnes, in principle allowing for several hundred years of mining at current production levels.[35] Coal mining's impacts on the environment include large-scale land use, overburden removal and disposal, disturbance of hydrology, acid mine drainage, methane emissions, wastewater and fugitive dust.

33 All BAT Reference documents referred to in the table, and others, are available from: https://eippcb.jrc.ec.europa.eu/reference/
34 UNECE (May 2020) Uzbekistan Environmental Performance Reviews: Third Review – Highlights, p.26.
35 BP Statistical Review of World Energy 2021.

As Alimbev *et al* recommended in their analysis of coal mining in Kazakhstan, preventive measures are needed in addition to mitigation actions.[36] Operators therefore should be required to prepare comprehensive assessments of the potential environmental impact of coal mining – obliged to plan programmes to minimise impacts and to implement them.

Power and Heat Generation

Thermal power plants are fuelled mostly by natural gas (93.9%) and generate about 85% of the electricity and heat generated in Uzbekistan. Total domestic national gas consumption in Uzbekistan has averaged 47.3 billion m^3 per year in the 10-year period prior to the Covid-19 pandemic[37], power generation accounting for about 35% of total consumption.

Fossil-fuelled power plants at or above the 50 MW_{th} threshold capacity in the EU are regulated under the Industrial Emissions Directive and are subject to BAT.[38] Unless designed and operated to high environmental standards – as embodied in BAT – such installations can emit substantial quantities of air pollutants to air. Regarding natural gas fired power plants, the principal air pollutants of potential concern for ambient air quality and human health are NOx.

Though BAT is not part of Uzbekistan's regulatory approach, the relevant BAT Reference documents are a key source of information, assessment and guidance. Tailored to the Uzbek situation they could in future form a basis for setting future operational permits and ensuring compliance. Regarding SCP, these should embrace energy efficiency within the installation, using water and chemicals efficiently, and maximising the productive use of solid residues – bottom ash or slag and fly ashes.

Future Considerations

Significant reductions in fuel fugitive GHG emissions were made in the period up to 2017, achieved by making technological improvements in production and in natural gas distribution systems. Future improvements will require yet more renovation and upgrading of installations, and adopting best practice techniques such as those identified in BAT Reference documents. However, progress here will not necessarily reduce fuel combustion emissions which changed little between 2010 and 2017.

In the short-to-medium term the adoption and implementation of international good and best practices in the oil, gas and coal exploration, extraction and processing sector is the right direction to take regarding SCP. However, in parallel there is a need also to look further ahead to what may potentially be a very different future if export market' commitments to net zero GHG emissions are substantially met. It would have substantial implications for energy producers, the transformation of extracted fossil fuels, and for decarbonisation – the generation of 'blue' hydrogen, carbon-capture-storage (CCS) technologies, renewable energy use, 'green' hydrogen production. It is expected that a "Roadmap" will be developed for the development of "blue" and "green" hydrogen[39] in Uzbekistan based on the results of a study undertaken with World Bank support. The challenge will be to take appropriate policy decisions and other actions based on its analysis and deliberations.

36 T. A. Alimbev et al (2019), IOP Conf. Ser.: Mater. Sci. Eng. 663 012041. Available at: https://www.researchgate.net/publication/337610602_Environmental_problems_in_the_Kazakhstan_coal_industry_and_their_solutions

37 Source: State Statistics Committee of the Republic of Uzbekistan. Over the 10-year period from 2010 to 2019, the annual natural gas consumption has ranged between 41.5 billion m^3 (in 2015) and 54.5 billion m^3 (in 2011), averaging 47.3 billion m^3.

38 Formerly, such plants were regulated in the EU in accord with the Large Combustion Plant Directive.

39 'Blue Hydrogen' is the term used for the production of hydrogen gas by the steam reformation of methane (natural gas), the CO2 (carbon dioxide) by product of this process being separated from the hydrogen and either put to beneficial use in industrial processes or immobilised using CCS technologies. 'Green Hydrogen' is hydrogen produced by the electrolysis of water using electricity generated from renewable energy sources.

4. CROSS-SECTORAL SCP

4.1 Cross-Sectors and Value Chains – Relations and Overlaps

Cross-sectoral approaches are advisable when many value chains call on a specific resource (such as water), and / or generate specific emissions (e.g. GHGs and air pollutants) or outputs (e.g. solid wastes). Such approaches need to recognise the partial overlaps that inevitably exist between value chains and cross-sectors: value-chain and cross-sectional approaches, therefore. should be complementary to each other. Figure 27 illustrates the concept, major examples of which include:

- *Agriculture and water*: regarding the predominance of the water demand for growing crops in the overall quantity of freshwater abstracted; the smaller demands for freshwater in food processing and consumption sectors; and the potential for returning treated wastewater and treated wastewater sludge to land for crop watering and as sources of nutrients;
- *Agriculture, cotton-based textiles, and water*: as above, but noting that the cultivation of cotton is a branch of agricultural crop production;
- *All value chains and GHG emissions mitigation*: all sectors result in GHG emissions and a holistic approach is needed, therefore, to affect national reductions in GHG emissions;
- *Energy and water*: regarding the substantial use of abstracted freshwater as a coolant in oil refining and thermal power plants, and its partial return to surface water;
- *Metals and the recovery of resources from waste*: regarding the production and supply of metal-based goods and, once they have reached the end of their useful lives, the recovery of material resources from the resultant waste; and
- *Agriculture, agri-products and the recovery of resources from waste*: regarding the generation of food waste in all stages of the agriculture and agri-products value chain and the recovery of energy, nutrients and other resource value from these wastes.

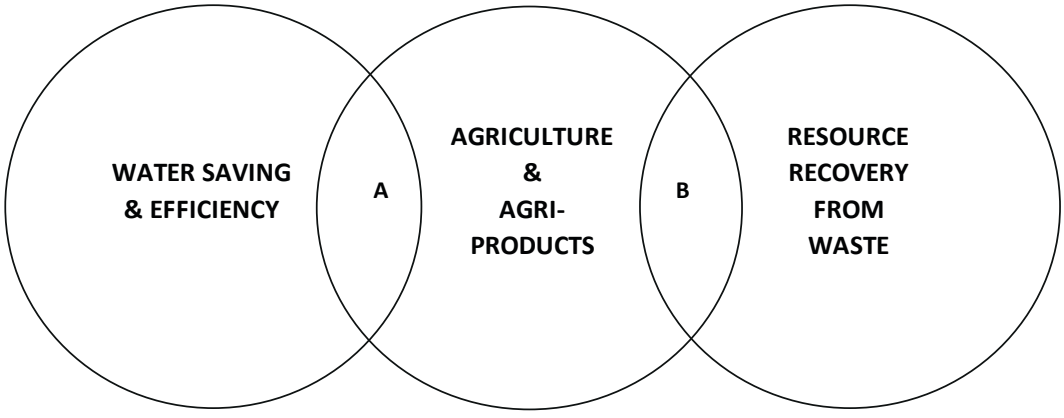


Figure 19 Examples illustrating the overlaps that may occur between value chain and cross-sectoral SCP

Hence a pragmatic approach is required when promoting SCP. For instance, generic SCP may be promoted in a cross-sectoral area, such as water, whilst complementary SCP promotion efforts may target the specifics of value chains such as agriculture, and energy, using tailored materials.

4.2 Water Conservation and Efficiency

Consumption and Goals

Uzbekistan has committed to achieving Sustainable Development Goal 6 regarding 'Safe Water for All' - see Annex C. Most freshwater is consumed in the agricultural sector, see sections 3.2 and 3.3 regarding the agriculture and textile value chains. However, the industrial and energy sectors have grown rapidly in recent years as has their water consumption, and legislation prioritises industry, placing no limits on its water demand. It is thought that the total water demand of the industrial and energy sectors could increase by about 75% between 2020 and 2030. The present Chapter, therefore, addresses the potential for applying the SCP approach in other production and commercial activities, institutions, households, and water distribution networks.

Institutional Developments

According to UNECE, the current policy framework for tackling the consequences of water abstraction and the drastic shrinking of the Aral Sea, and its consequent impacts, focuses on the two most affected regions – the Republic of Karakalpakstan and Khoresm Oblast. Key actions from a water management perspective include:[40]

- Improving the management and rational use of water resources (e.g. by creating local water bodies and modernizing water management infrastructure);
- Restoring ecosystems and biodiversity (e.g. by designating new protected areas, preserving natural water bodies in the Amu Darya delta and planting forest on the dried bed of the Aral Sea);

And, from an impact mitigation perspective:

- Improving health conditions (e.g. by ensuring stable drinking water supply, preventing respiratory diseases and enriching food products with iron, folic acid and iodine);
- Expanding opportunities for employment and income generation;
- Improving infrastructure to ensure socioeconomic development (e.g. by refurbishing existing enterprises and introducing new production facilities).

These are positive actions and consideration should be given to strengthen them, and to strengthening institutional aspects of water resources management at a river basin and lower levels through Uzbekistan. Such policy action would indirectly strengthen considerably the institutional capacity and mechanisms for using water efficiently and in line with SCP philosophy.

The recent (2017-2018) formation of the Ministry of Water Management and the Ministry of Housing and Communal Utilities in 2017–2018 adds focus to the key issues of water resources management and water supply and sanitation. The need to move towards the principles of integrated water resources management (IWRM) and greater stakeholder involvement remains, though, along with the opportunities to better coordinate the activities of various actors and harmonise the use of data collected. Policy movement on this front could include a strong embracement of SCP.

SCP Applied to Water Saving and Efficiency in Industrial Production

Water is used extensively for heat exchange and direct cooling duties and in numerous process applications in heavy industrial and energy sectors including:

- Gas refining;
- Thermal generation of electricity and heat (large combustion plants);

The application of Best Available Techniques (BAT) is required in the EU at most if not all the operations and installations in these energy activities – see section 3.4 – BAT to include good practice techniques for water conservation and water efficiency. Introducing a requirement to consider and apply water-relevant BAT would

40 UNECE (May 2020) Uzbekistan Environmental Performance Reviews: Third Review – Highlights, Box 2, p.5.

make a big contribution to ensuring that water is used efficiently in these sectors. Many of the SCP tools identified in Annex A could usefully be applied in a multitude of secondary production activities also.

The effective pricing of water should be considered as a driver to encourage the voluntary adoption of good practice. However, it is understood that:

- The Government has made progress on reform of tariffs for utility services (including water) by bringing them closer to cost-recovery levels, though tariffs remain below cost-recovery levels;
- The abstraction of water from natural sources is subject to payment of a water-use tax, though water used for irrigation in agriculture is not subjected to taxation. This, and other exemptions from the water tax, weakens the incentive to use water rationally.

If water is undervalued, the costs of its consumption may appear too low to consider measures to improve water efficiency. Financial incentives, offered by tax-breaks for instance, contribute a 'pull-factor', acting to encourage investment in water conservation and efficiency, but are likely to be most effective when the water price is such that water consumption becomes a significant production cost. It is essential, though that water consumption is metered.

SCP Applied to Water Conservation and Efficiency in Other Commercial Activities

Apart from its use in the secondary production processes itemised in Chapter 3, water is used in a wide range of commercial and associated activities in the secondary and tertiary economic sectors. Many of the generic SCP tools identified in Annex A could usefully be applied in these sectors. The caveat that water is paid for on a metered basis and that prices are set appropriately also holds. Generic measures to reduce water consumption and improve water use efficiency may be identified through consulting good practice publications, whilst identifying other measures may require site-specific analysis, investigation and innovative thinking.[41] Measures can range from making simple changes in operational practice to introducing more sophisticated technical measures requiring investment. Respectively, for example, ranging from:

- Equipping water hoses with trigger nozzles, that prevent flow unless trigger pressure is maintained, to ensure that unattended hoses do not discharge water to waste; through to
- Using water sequentially in cascading stages - the wastewater from one stage being used as feedwater to a second, the water quality requirements of the second stage being less strict than in the first stage.

SCP Applied to Water Conservation and Efficiency in Distribution Networks

Harking back to the waste hierarchy and the principle that waste prevention is the first option that should be considered, minimising leakage from distribution systems supplying water to consumers should be a strategic priority. This requires effective metering of the water supplied to distribution systems and the application of effective leak detection and repair technologies. This parallels and should inform the repair and or replacement of sections of the distribution system. Good practice guidance on adopting a strategic approach to minimise leakage, and on the available techniques and technologies, is available and should be considered.[42]

SCP Applied to Water Conservation and Efficiency in Institutions and Households

Institutional settings comprise: Hospitals; Educational establishments; Technical and other Institutes; Public offices - governmental and others; Municipal swimming baths etc; Bathrooms for public use; Watering of public roads (dust suppression) and green open spaces such as ornamental parks and gardens; and miscellaneous others.

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41 See, for example, Waterwise (2009, updated 2019) Water Efficiency Retrofitting: A Best Practice Guide References, available at: https://www.waterwise.org.uk/knowledge-base/water-efficiency-retrofitting-a-best-practice-guide-2009/

42 European Commission (2015), EU Reference document - Good Practices on Leakage Management, available at: https://circabc.europa.eu/sd/a/1ddfba34-e1ce-4888-b031-6c559cb28e47/Good%20Practices%20on%20Leakage%20Management%20-%20Main%20Report_Final.pdf.
Also, see CIWEM Policy Position Paper: Water distribution system leakage in the UK, available at: https://www.ciwem.org/assets/pdf/Policy/Policy%20Position%20Statement/Water-distribution-network-leakage-in-the-UK.pdf

The same spectrum of tools and measures noted above and in Annex A may be applied to improve the efficiency of water use and reduce the net water consumption in institutional and household settings. In households, of course, only the simpler measures will be appropriate. Effective communication is essential. Both to raise people's awareness of the overall need to conserve water, and specifically to inform them of the practical steps they can take to reduce their water use whilst maintaining good levels of hygiene and standards of living.

In kitchen and bathroom settings, simple measures can include communicating to personnel the need to save water by ensuring that, for instance, taps are turned off after use and that leaking taps are repaired promptly. Replacing conventional taps with plunge-bayonet taps (supplying water for a set time) is an example of a specific measure that can also be adopted. Installing water efficient flush-toilets is another good practice measure. Many more examples of good practice are available.

4.3 Resource Recovery from Municipal Solid Waste

Background

Substantial developments have been made in the management of municipal solid waste in recent years and one of the STRUGE priorities is to create a modern solid waste processing system. Specifically:

- Development of sanitary cleaning infrastructure aimed at ensuring full coverage of population with services for collection and removal of solid waste;
- Reducing the volume of solid waste for disposal in landfills, the creation of modern solid waste landfills that meet the requirements of sanitary and environmental standards;
- Using MSW as an alternative source of energy.

Overall, however, the current waste management system is in an immature state of development, with most waste dumped on land. Regarding the recovery of resources from municipal solid waste, the first MSW sorting plant was put into operation in 2018, though the separation or sorting of MSW has not been formally introduced as a national policy. The informal sector and private companies are active, however, in recovering a range of recyclables from waste. A recycling rate of 5-10% has been estimated for 2017 but it might be higher in reality.

Resources Recovery from Waste Including End-of-Life Products (ELP)

Whilst the MSWM Strategy 2019-2028 and STRUGE demonstrate the Government's intention to modernise the system of municipal solid waste management, neither identifies specific measures to reduce the rate of increase in MSW generation (decoupling this from GDP growth); or to foster at-source separation, collection and recycling of ELP such as vehicles, vehicle tyres, batteries embedded in vehicles and electronic equipment, freezers and refrigerators, computers, printers, scanners, televisions, washing machines, smart-phones, light fittings, and other waste electric and electronic equipment (WEEE).

Most such ELP waste streams contain materials that are hazardous to some extent and / or have economic value. Disposing of such products in a manner that ignores their economic value, and the depletion of Natural Capital that it represents, epitomises a linear, "use-throwaway" economy.

Furthermore, key issues such as financing of waste management, and others, need to be addressed satisfactorily in order that MSW management can be upgraded sustainably to the desired level. Six essential building blocks of an enabling environment necessary for a modern MSW management system applying SCP to minimise waste generation and maximise material and energy recovery may be identified. In many respects these building blocks are generic features – applicable wherever SCP is to be applied: a consistent legislative and regulatory framework, institutional capacity and capability, operational infrastructure, sustainable finance, a culture of compliance, and efficient and supportive markets / outlets. Chapter 5 illustrates their importance using resource recovery from waste as an example.

Minimising Solid Waste Generation Rates

A goal for producers, importers and suppliers should be to minimise the quantity of materials used to make and package products for supply to retailers and consumers – whilst retaining product quality and protection against damage in transit. They ought to do this for financial reasons, at least, though they may need encouragement to appreciate the potential to save costs, increase profits, and protect the environment. Extended Producer Responsibility policies though can strengthen the obligations placed on producers, importers and suppliers. They can do this, for instance, through requiring that products placed on the market are repairable – thus extending useful product lives – and may be readily dismantled (for material recovery) when they have reached the end of their useful lives. In both cases the effective rates of waste generation are reduced. The EU's Circular Economy Action Plan embodies such a regulatory approach.

Through behavioural change – which might need to be stimulated through effective communication techniques - consumers also may exert direct and indirect influence on the rates of waste generation. For instance:

Directly, through

- Ensuring effective maintenance and repair of products, so extending their useful lives;
- Choosing not to throw away products unless they are unfit for purpose. And, when disposing of still-serviceable products, trying to pass them on to others, for their use;
- Making full use of consumable items, e.g. using both sides of printing paper;
- Amending their food buying and hospitality behaviour so as to avoid generating excessive food waste;

Indirectly, through

- Their purchasing choices, sending market signals to producers, importers and suppliers that there is significant consumer demand for 'low waste' products.

Where waste disposal strategy includes one or more waste-to-energy plants there will be an in-built conflict of interest regarding paper, cardboard, plastics and textile wastes. These wastes are the combustible components of MSW and a waste-to-energy-plant will be designed assuming a level of wastes arising. Once designed and built there is no or limited incentive for minimising the generation of such wastes.

Strengthening Waste Collection and Resource Recovery - Target Waste Components

Certain components of solid waste should be diverted from disposal with waste regardless of whether waste-to-energy plants are provided. They include end-of-life electrical and electronic appliances; and biodegradable 'wet' wastes.[43] All these wastes either contain hazardous substances or the products of their decay are hazardous. The collection of such wastes separately from mixed 'dry' waste is needed therefore, so they be processed appropriately and rendered safe, and to maximise resource recovery.

Ideally, paper, cardboard, plastics, textiles, miscellaneous metal items, and glass wastes should be collected as separate, segregated waste streams. This maximises the recovery of quality materials for recycling or waste-to-energy-recovery. Where cost and practicability considerations rule out separate collection arrangements, however, waste sorting is needed subsequently: (i) prior to disposal of residual dry waste to landfill, where material recovery is the objective, or (ii) prior to combustion, or of the bottom ashes removed from the combustion unit.

Clinical wastes such as infectious materials and body parts, fluids, needles etc (so-called 'sharps') arising at hospitals and other medical facilities, and waste pharmaceutical products arising in medical facilities and in homes, should also be segregated at source, diverted from collection and disposal with general waste.

Solid waste collection systems need to be configured to allow consumers (households, institutions, hospitality and retail outlets) to dispose of their wastes in ways that are compatible with resource recovery and local waste management strategy, collection arrangements varying dependent on whether waste collection is communal or property-based. Consideration could also be given to making use or a greater use of larger-scale

43 Treatment needs to be undertaken in ways that are consistent with the availability of outlets for treated 'wet' waste and are compatible with regional climatic and practicability considerations.

communal facilities, where households and small businesses may deposit multiple segregated wastes in assigned containers.

Whatever the waste segregation that is expected of the public, households and businesses must be able to fulfil these expectations and do so in practice. If either condition is not satisfied then cross-contamination of wastes will occur, reducing the rate of recovery of useable resources, and increasing the quantity of residual waste sent to landfill. Where waste-to-energy is practised, failure to separate 'wet' from 'dry' waste at source will lead to a carryover of 'wet' waste into the combustion chamber, leading to lower temperatures and less energy recovery.

Consultation with the public on practicable waste collection arrangements is always desirable, and should be supported through the use of effective communication messages and techniques.

Strengthening Waste Collection and Resource Recovery - Strengthening the Markets

Though markets exist in Uzbekistan for some recovered waste streams, such as paper, cardboard, plastics, and metal, relatively resource-rich waste streams such as end-of-life electrical and electronic equipment (WEEE) are typically disposed of with MSW at present. And the markets for recovered material resources such as composted or digested solids from the processing of 'wet' bio-wastes, and energy recovered as biogas, electricity and heat, are immature at best. Adoption of the SCP approach in practice demands that all of the above markets are developed as far as it is reasonable to do so.

Waste electrical and electronic equipment and end-of-life vehicles

Though most high quality electrical and electronic equipment in use in Uzbekistan, such as computers, is imported, an enterprise (Artel) located in Tashkent was formed in 2011 to produce and supply household electrical and electronic goods to the Uzbek, Central Asian and other markets. Its product catalogue includes a range of electrical and electronic equipment.[44] The company also cooperates with international producers, producing their products in compliance with their partners' technical requirements and standards.

Hence there exists a potential local market for the materials that might be recovered from the waste electrical and electronic equipment (WEEE) generated in Uzbekistan. Given the right regulatory push and infrastructural development, it may be possible therefore to create an environment in which materials recovery from WEEE becomes established in Uzbekistan. The recovered materials might be:

- Utilised by existing and potential future producers of electrical and electronic equipment as noted above, whilst
- Any surplus recovered materials might be exported as feedstock to neighbouring countries that have the necessary manufacturing capacity.

An EPR (extended producer responsibility) operator , responsible for implementing the principle of extended obligations of producers (and importers) in Uzbekistan, could play a major operational role here.[45] Its role in resource recovery from end-of-life motor vehicles – imported and domestically produced - could be enhanced in parallel. Actions that might stimulate the formation or strengthening of such a system could include:

- Development of a costed national strategy and plan for the enhanced collection of end-of-life appliances and equipment, their disassembly, the reclamation of resource-rich components and, using existing and planned transport infrastructure, the transfer of recovered materials to active markets for them – whether in Uzbekistan or in neighbouring countries. This strategy and plan would have to consider the characteristics and proximity to resource markets of major cities and regions;
- Amendment of legislation to prohibit the disposal of WEEE to landfill sites (perhaps phased-in over, say, 10 years); to require City and Regional authorities to provide separate containers for the deposition and collection of WEEE – in local communities and at larger scale; and, if not already provided, extending the remit of the EPR operator to include electrical and electronic equipment and end-of-life vehicles;
- Republic and Regional budget provision for investment in necessary infrastructure and establishment costs.

44 https://www.artelgroup.org/catalog-artel/

45 Lessons might be learnt from the experience of the EPR Operator in the Republic of Kazakhstan.

Processed 'wet' waste solids

Subject to climate-related considerations not being an issue for wet waste collection, the biodegradable components of wet biowastes are amenable to treatment by composting and / or anaerobic digestion. And the post-treatment solids may be used beneficially in a number of land-based applications. Other potential constituents of the collected waste, however, may interfere with the treatment process or contaminate the post-treatment organic solids, thereby reducing the quality and usefulness of the product biosolids. Effective communication, alongside the provision of practical household 'wet' waste containers to be emptied into communal containers, may be needed to help overcome such issues.

After a period of storage, both composted and digested solids may be applied to arable agricultural land, communal parkland, and forested land as a source of humus and nutrients, and as cover for landfill sites. It may also be used for land reclamation purposes. Treated biosolids may also be used for household gardening purposes if relevant. Quality requirements are important for use on land on which growing edible crops are grown. This should be factored in if developing a marketing and outreach strategy for the treated biosolids. Such a strategy should be underpinned by a testing regime and communication to effectively convey the positive benefits of using the treated biosolids. And realism would be needed when assigning a financial 'value' to what recipients of the biosolids will be willing to pay for treated biosolids.[46]

Energy from waste

Energy can be recovered from MSW through (i) biogas formed in the heated anaerobic digestion of biosolids in 'wet' waste, and (ii) incineration of the combustible constituents of 'dry' waste. Biogas may be burned to generate heat and electricity, though much of the heat might be needed to meet the process's heating needs. Outlets for any surplus heat energy are likely to be local and would need to be cultivated. Electricity generation, whether in waste-to-energy or digestion plants, will require that grid connections be made.

4.4 Climate Change: Mitigating Greenhouse Gas Emissions

Background and Observations

Over the period 2010 to 2017, Uzbekistan's reported gross GHG emissions decreased by 5.4% from 200.1 to 189.2 million tonne CO_2-eq, while national GDP at constant prices (USD 2015), increased by close to 57%% from $60.9 Billion in 2010 to $95.3 billion in 2017.[47] Related to GDP at constant prices, therefore, reported carbon intensity fell by close to 40% over the period, though the 2017 Intended Nationally Determined Contribution (INDC) of Uzbekistan stipulates that carbon intensity should decrease by 10 per cent from 2010 levels by 2030.[48] A commitment that is repeated in STRUGE 2019-2030. However, the latest year for which Uzbekistan's GHG Emissions Inventory has reported emissions is 2017[49], and an assessment of the progress in meeting the INDC target since then seems not to have been made. Available data suggest that:

- GHG emissions from agriculture increased from 16.0 million tonne in year 2000 to 25.7 and 33.7 million tonnes in 2010 and 2017 respectively, accounting for 17.8% of all GHG emissions in 2017. Growth in livestock raising and the intensive use of synthetic nitrogenous fertilisers are the likely principal causes;
- However, energy sector GHG emissions were predominant in 2017, even though emissions declined in absolute terms since 2000;

46 Analogous experience in the United Kingdom, where much of the sewage sludge generated is treated and recycled to land, suggests that recipients might pay nothing. Authority recycling operations there are undertaken as a cost to the Authority, recovered from the charges on their household and business customers.

47 https://data.worldbank.org/indicator/NY.GDP.MKTP.KD?locations=UZ. The reported GHG emissions did not allow for the absorption of carbon dioxide in Forestry and Other Land Use (FOLU).

48 https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Uzbekistan%20First/INDC%20Uzbekistan%2018-04-2017_Eng.pdf

49 First Biennial Update Report of the Republic of Uzbekistan Under the UN Framework Convention on Climate Change, Tashkent 2021. https://unfccc.int/sites/default/files/resource/FBURUZeng.pdf

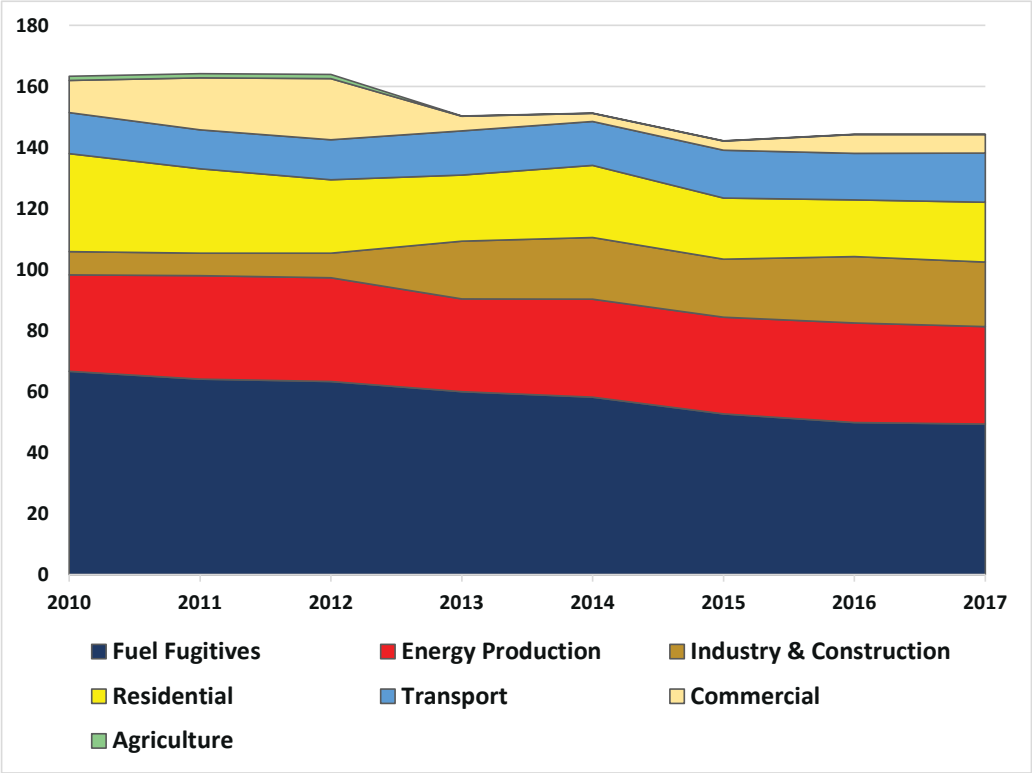


Figure 20 Sectoral Composition of GHG Emissions from the Energy Sector – Fugitive Fuel and Combustion: 2010-2017

- Figure 20 demonstrates that a relatively static overall picture for GHG emissions from the energy sector hides significant sub-sectoral changes, most especially in the industrial and construction, commercial, and residential (heating) sectors;50
- Strikingly, the emissions from fuel combustion in the energy production sector have been fairly static since 2010, averaging 32.3 million tonne CO2-eq per year;
- In contrast, fuel fugitive emissions, i.e. leaks from oil and gas production and from gas distribution systems, etc, have declined progressively by 26% since 2010 to 49.4 million tonne in 2017. Though a big improvement on 2010, fugitive fuel emissions still comprised 34.2% of energy sector GHG emissions in 2017, outweighing those from fuel combustion;
- Residential sector GHG emissions from fuel combustion declined from 32.2 million tonne in 2010 to 19.6 million tonne in 2017, presumably through fuel use changes and heating system improvements;

Based on a summary analysis, achieving Uzbekistan's INDC commitment to 2030 and reducing GHG emissions further in future will likely require concerted action on many fronts, including:

- Further steps to reduce fugitive and point-source GHG emissions from natural gas and oil exploration, production and distribution systems;
- Moving towards a decarbonisation of the existing energy system through carbon capture and storage, (blue and green) hydrogen production, innovations yet to be discovered, and the potential adoption of nuclear energy;
- Effective management to minimise fugitive and point-source GHG emissions in the agricultural sector;
- Widespread adoption of energy efficiency (EE) measures throughout all production and consumption sectors of the economy; and
- Adoption of renewable energy resources to a maximal extent: solar, wind, geothermal, hydro, and bio-mass based.

50 The sharp drop in commercial sector emissions in 2013, accompanied the same year by the step increase in industry and construction emissions, suggests there might have been changes in inventory data methodology at that time.

Energy Efficiency

One of the six strategic priorities developed in STRUGE 2019-2030 is to improve energy efficiency in basic sectors of the economy and to improve the energy efficiency of buildings and transport. Specific energy efficiency goals are that, by 2030, relative to year 2019:

- The specific energy consumption per unit of GDP should decrease by 50%;
- The energy efficiency of industrial enterprises should increase by at least 20%.

Also included in STRUGE is action to raise the awareness of the public more widely on matters of energy efficiency and renewable energy sources. The use of effective communication as a SCP tool differs from most measures in STRUGE 2019-2030, being generic and 'soft' rather than technological. It seeks to change people's behaviour – individually and collectively - and motivate people to search for effective local resource efficiency measures, substitutions and circularities.

There are boundless operational opportunities for improving energy efficiency in the economy and many might be being pursued already, e.g. energy efficiency monitoring and auditing. Energy monitoring and targeting (internal benchmarking) is also a powerful technique that may be used, setting internal benchmarks, stimulating a search for improvement against the benchmark, and assessing performance. It is a far more valuable technique for producers and consumers than the broad-brush approach of external benchmarking.[51]

Many of the SCP tools noted in Annex A are applicable to strengthen energy efficiency. Given there are wide-ranging opportunities for energy saving and efficiency measures, it may be sensible to develop a national strategic 'Roadmap for Energy Conservation and Efficiency, 2022-2030'.[52] Its preparation is included in the SCP Action Plan presented in Chapter 7, as is an SCP Support Mechanism to promote SCP and its adoption.

Also worth considering are regulatory instruments such as prohibiting the placement on the market of energy-consuming appliances that do not comply with minimum energy efficiency standards (taking inspiration from the EU's Eco-Design Regulation); and the voluntary adoption of Eco-Label standards, enabling consumers to take energy efficiency into account when buying energy products. Keeping abreast of developments in the EU's Circular Economy Action Plan and its implementation is also advisable, to be kept under review by the Government.

The inclusion of "green" criteria based on internationally accepted standards for priority areas of public investment and spending is a further policy strand, as recognised by STRUGE 2019-2030. This is an instance where Government may play a powerful role as major influential consumer.

Renewable Energy Resources

STRUGE 2019-2030 envisages the development of renewable energy resources (RES) such that they account for 25% or more of electricity generation.[53] Hydropower already accounts for 14% of power generation so the target relates to increasing RES use for power generation from 14% to 25%. A start has been made with the commissioning in 2021 of a solar plant and beginning the construction of a wind-powered plant. But achieving the STRUGE target by 2030 may be challenging: it will require commitment and political will to make the necessary investments in RES power generation and its integration into the electricity grid, and to introduce financial and other incentives to assist the adoption of small-scale RES-generated power installations. Government, therefore, may wish to consider policies that encourage, incentivise and enable:

- The adoption of small-scale (solar, especially) units on residential housing, apartment blocks, institutions etc in addition to large-scale installations;
- Biogas generation by the anaerobic digestion of farm wastes and MSW 'wet wastes'. Likely to have local significance only, it nevertheless might contribute substantially to energy supply in rural areas.

51 Other SCP policy and application tools relevant to this activity are listed in the full version of the present document. Note: some SCP tools serve policy purposes and have practical application.

52 The full version of the present document provides an indicative scope for such a RoadMap.

53 A significant assumption is that this target relates to electricity generated and not generation capacity.

- Energy storage to help navigate the peaks and troughs of renewable energy supply, and other supply disruptions. Developments in this fast-moving area of renewable energy supply should be monitored and fed into ongoing policy development.

STRUGE 2019-2030 also envisages the development of electric vehicles for road transport. Total GHG emissions from fuel combustion in the transport sector increased from 13.4 million tonne in 2010 to 16.1 million tonne in 2017, since when they may have increased substantially. Whilst electrically powered road vehicles (and trains) reduce air pollutant emissions locally, their effective GHG emissions will depend on how electricity is generated. Promotion of electric-powered mobility, therefore, should be undertaken in parallel with increasing the use of RES for power generation and the potential adoption of CCS in future.

Further Policy Instruments

Further policy instruments that the Government may wish to consider include an Emissions Trading System (ETS) and the introduction of a carbon tax. These would be positive moves, fully consistent with an SCP approach, but would need to be introduced with care to ensure that consumers and producers are not faced with precipitate, steep hikes in costs and prices. Such policy initiatives ought to stimulate energy efficiency; the more efficient use of inorganic fertilisers; and help to encourage the uptake of renewable energy generation at various scales.

Consideration should also be given to preparing annual GHG inventories and biannual GHG emission projections. Functional national emissions inventories for GHGs, ought to be able to capture historic trends in national emissions, year-by-year. Inventories are valuable in enabling retrospective analysis of emission trends but cannot provide insight into future emissions. To fulfil this function it is necessary to link the historic inventory to an emissions projection tool which, loaded with customised policy scenarios, allows the estimation of emissions year by year to a pre-set future date. By this means, the potential effects of alternative policy measures may be assessed quantitatively at an early stage before policy and investments commitments are made. Hence, an emissions projection tool is a powerful aid to policy decision making.

4.5 Ambient Air Quality

Whilst improving ambient air quality and public health are not specified as STRUGE priorities, the implementation of signalled climate change mitigation measures should help deliver these as co-benefits. Significant observations on air quality management (AQM) include the following: [54]

- No air quality standards are defined for particulate matter (PM). The finer PM fraction, PM2.5, is considered the principal air pollutant of concern for health, its potentially toxic composition and ability to penetrate the lungs and blood stream resulting in its association with many human non-infectious diseases.55 Setting standards for PM10 and PM2.5 would bring the Republic's AQM system further into line with good international practice;
- Uzbekistan has a comprehensive air monitoring network, but the monitoring of PM10 and PM2.5 by automatic equipment, along with acquiring technical support for compiling air pollutant emission inventories, should be undertaken as a priority;
- Available data on PM and dust concentrations suggest that the probability of WHO Air Quality Guidelines for the mean concentrations of PM10 being exceeded in cities is high;
- Residential sector emissions contributes to poor air quality. Contributory factors include:
  - Use of firewood and coal in individual stoves and furnaces with low emission heights;
  - Low energy efficiencies in district heating installations resulting from inadequate maintenance and building insulation;
- Industrial emissions of SO2, NOx and total suspended particles (TSP) have accounted for 40%, 5% and 38% of the total national emissions respectively;
- Emission reduction plans for air-polluting industrial sectors are not developed;

54 UNECE. Environmental Performance Reviews – Uzbekistan, Third Review, Highlights, pp. 18-19.

55 WHO Global Air Quality Guidelines, 2021 Update: https://apps.who.int/iris/bitstream/handle/10665/345329/9789240034228-eng.pdf?sequence=1&isAllowed=y

- In 2016, 19% of SO2 emissions and 70% of NOx emissions from stationary sources were caused by thermal power plants (TPPs). Emission limits are generally less stringent in comparison with EU emission standards but TPP modernisation has begun.
- Measures to reduce ammonia emissions from agriculture are not yet widely applied.

Strengthening the air quality management system will take time and resources. Progress in building institutional, technical and human capacity may be required in several areas, including:

- Development and implementation of enabling legislation, including the PM standards indicated above, and the introduction of BAT-inspired regulation of heavy industry;
- Development of functional historic national emission inventories for air pollutants – priority being given to PM2.5, PM10, NOx, SO2, NH3, and NMVOCs;
- Development of national emissions projection capacity, the projections tool being coupled to the national historic emissions inventory to enable policy development;
- Strengthening the air quality monitoring network regarding PM2.5;
- Air quality modelling to enable the impacts on air quality (and public health) of the expected emissions reductions brought about by policy measures to be assessed;
- Source apportionment studies to aid the identification of pollutant sources;
- Interdisciplinary planning of air quality improvement and emissions reduction at national and lower levels, and the implementation of measures.

From a SCP perspective, priority should be given to the first three areas, hence they are included in the SCP Action Plan. They would provide a solid groundwork on which others could build.

5. AN ENABLING ENVIRONMENT FOR SCP UPTAKE

5.1 Building Blocks of an Enabling Environment - Introduction

An enabling environment is one in which actions to achieve desirable outcomes are facilitated and not unduly constrained by external factors. Such an environment is necessary for the SCP 'resource efficiency', 'substitution' and 'circularity' cornerstone principles to be adopted in practice. The concept applies to SCP uptake in all value chains and cross-sectoral areas, though its relevance to the recovery of resources from solid waste - and their economic use and return into the productive sectors of the economy - is especially strong. Hence, the recovery of material and energy resources from municipal solid waste serves as an illustrative example of the concept and the significance of its six key interlocking features or building blocks - see Figure 31. Sections 5.2 to 5.7 introduce the significance of each.

Figure 21 Building Blocks of an SCP Enabling Environment , e.g. for Resource Recovery from Municipal Waste

5.2 Regulatory Framework

Environmental and waste-related legislation - laws and, if applicable, subsidiary regulations - need to reflect and be supportive of high-level goals, as established by national Concepts or other means. Legislation must also be clear, unambiguous, and realistic – capable of being put into practical effect. It needs to establish the direction of travel, specify the mandatory requirements in pursuing high-level goals, and specify the institutional framework and responsibilities. As far as possible, the 'hard-wiring' of technological solutions into legislation should be avoided. Legislation otherwise can become obsolete quite quickly. The need for legislative requirements to be realistic suggests also that when a practice is to be banned (e.g. the disposal of food wastes to landfill), the published regulations should come into force at a given future date, allowing operators sufficient time to introduce new practices and new infrastructure. Not doing so is guaranteed to result in non-compliance, tending to enforce a culture of non-compliance and disrespect for the legislative process.

5.3 Culture of Compliance

What does a culture of compliance mean? It means that society in general tends to act in conformity with legislative requirements, i.e. the law and rules. It does not imply that all individuals and enterprises comply all of the time, but that compliance is the norm, tending to become self-enforcing – setting the standard of behaviour expected of people, institutions and business. In the absence of a culture of compliance, members of society seek out ways to evade their obligations, behaviour that is compounded when enforcement and penalties are weak.

A simple example illustrates the practical significance of having a culture of compliance. Consider the imposition of a weight-based tax on MSW disposed of to landfill sites, the tax being payable by the landfill operator (whether in the public or private sector) to the government's revenue collection arm. Such a tax represents a financial mechanism for increasing the effective costs of waste disposal to landfill relative to the costs of material recovery and recycling. By adjusting the relative costs of waste disposal options via a landfill tax, therefore, the recovery of materials from MSW and the diversion of untreated biowastes to digestion or composting plants - can become commercially viable, which otherwise tends not to be the case.

Box 1 below presents a case study of the imposition of a landfill tax in the UK since 1996. This shows that the landfill tax, supported by other regulatory measures, was highly effective in diverting MSW (non-inert solid wastes) away from landfill whilst not causing a significant increase in illegal dumping. In the absence of a culture of compliance, however, it is improbable that such a financial mechanism would achieve the desired outcome. Far more likely, instead, is that significant quantities of collected MSW would be dumped illegally, forming yet more dump sites.

5.4 Sustainable Finance

Investment funds and finance to sustain operations and infrastructure maintenance are essential for waste management to be effective and meet planning and design goals. Funds may come from several sources, such as:

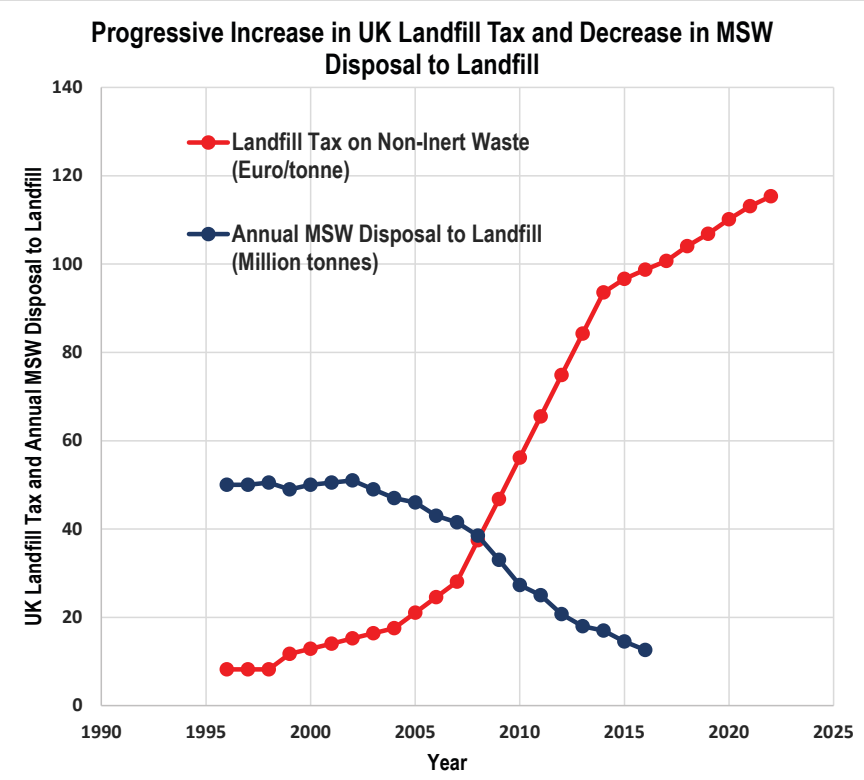
- Cost-recovery from the users of the waste management service, to cover operational and maintenance costs, and debt service charges;
- Government (national, regional, city) partial grant-funding of infrastructure investments;
- Taking on debt to finance infrastructure investments;
- Environmental Funds (e.g. a landfill tax) established to receive tax payments and disburse part of the monies to worthy causes that meet predetermined criteria;
- Income received for the sale of recovered waste materials or energy into the market;
- Government subsidies to operators, to partially meet operational and maintenance costs.

The present status of waste collection and disposal suggests that sustainable finance may be a critical issue in much of Uzbekistan. In the absence of adequate and sustainable finance, however, ambitious waste management aspirations cannot be realised. Over-reliance on government budgets to help meet (subsidise) operational and maintenance costs is probably unwise since changing budgetary circumstances and government priorities risk the sustainability of such finance.

If raising additional sustainable finance from users of waste management services or government is constrained by affordability considerations, it may be prudent to scale-down ambitions to match the available budgets. Constrained finances should be taken into consideration, therefore, when planning future infrastructural developments, whether engineered landfill sites, biowaste treatment processes, or incineration plants equipped with energy recovery.

BOX 1: Tax on Landfilling of Waste – a Case Study from the UK (1996-2020)

In 1996 a landfill tax was introduced in the UK to better reflect the environmental (non-market) costs of landfilling, to recover value more of the waste that is generated, and to dispose of less waste to landfill. The tax has been applied to two categories of waste – inert and non-inert – the latter attracting the higher tax level. The chart below shows the rate of landfill tax for non-inert wastes increasing from £7.00 per tonne in 1996 (about Euro 8.19 at 2021 exchange rate) to almost Euro 100 per tonne in 2016 and Euro 113.1 per tonne in 2021. The tax on inert wastes has been much lower, increasing from Euro 2.3 per tonne in 1996 to 3.6 per tonne in 2021.[56]



Following the introduction of the landfill tax on non-inert wastes (MSW) the quantity of MSW disposed of to landfill in the UK decreased significantly, from about 50 million tonnes in 1996 to 12.6 million tonnes in 2016. Regulatory instruments implementing the Packaging and Landfill Directives (the latter requiring reductions in the quantity of biodegradable waste disposed of to landfill) will have had parallel influences also on practice over that period. There is no evidence that illegal disposal of waste onto land in the UK increased as a result of the landfill tax being applied. However, lessons learned from the application of the landfill tax in the UK include:

- The effectiveness of the tax in diverting waste from landfill was minimal in early years owing to the low tax rate per tonne of waste;
- The much higher rates of tax in later years have led to some exporting of residual waste, in part as refuse derived fuel (RDF) to continental incinerators having spare capacity and lower gate-fees;
- To provide a further driver towards material recovery and recycling, consideration should have been given to impose a tax on waste disposal to incineration plants also (whether or not energy recovery was practised);
- A lower rate of tax than the standard (for non-inert wastes) should have been set for stabilised wastes (outputs from biological treatment plants), providing further stimulus to their adoption.

5.5 Operational Infrastructure

Infrastructural requirements depend on the waste management system adopted. They comprise the methods used to collect household waste and other sources of municipal solid waste, the treatment and disposal of collected wastes; the recovery of materials and energy from waste; the pre-treatment (e.g. sorting) prior to such recovery operations; and the associated equipment, containers and facilities for waste storage, collection and delivery to waste processing and disposal. The infrastructural needs of a modern MSW management system are extensive. Annex D indicates significant issues concerning two representative

56 See Elliott, T. Landfill Tax in the United Kingdom: https://ieep.eu/uploads/articles/attachments/e48ad1c2-dfe4-42a9-b51c-8fa8f6c30b1e/UK%20Landfill%20Tax%20final.pdf?v=63680923242; and https://www.gov.uk/government/statistics/landfill-tax-bulletin/current-and-historic-lft-rates

systems, both requiring consumers to separate their waste into dry and wet fractions prior to collection, appropriate management of wet wastes being required in each alternative system:

- One in which the goal is to recover materials from dry waste for recycling, the residual waste being disposed of to an engineered landfill site; and
- One in which dry waste is fed to a waste-to-energy plant, materials recovery being a secondary consideration.

Each requires sustainable financing for the operations to be carried out effectively and in an environmentally satisfactory way, though the waste-to-energy route is usually considered to incur higher costs.[57]

Additionally, each system should accommodate facilities to enable the separate collection and management of wastes such as end-of-life electronic equipment, batteries, white goods etc, and hazardous household substances (small batteries, paints, solvents, pharmaceuticals, etc). In the absence of appropriate facilities, such wastes are likely to contaminate segregated dry waste streams.

Local civic amenity sites where citizens may dispose of unwanted items in dedicated containers offer one opportunity for the collection of wastes such as: electronic equipment, paints etc, light fittings, white goods (washing machines, freezers etc), and a wide range of other recyclable materials (paper, cardboard, glass, metals, textiles, wood and hardboard, aggregates and more). Once collected, such segregated wastes may be distributed to centralised facilities for further processing. Arrangements need to be in place also for centralised facilities where end-of-life vehicles may be brought to be disassembled into (i) components to be reused in the repair and maintenance of vehicles on the road and (ii) other materials that may be returned as feedstock into the processing and productive sectors of the economy (either nationally or in other countries).

5.6 Markets, Outlets and Demand

Any waste management strategy that involves the recovery of materials or energy from collected waste depends on there being outlets or markets for the recovered material or energy streams. Without there being an active demand for these, the adopted strategy will default to disposal only. But where demand is latent (there but not realised), active communication and promotion of the benefits may be required, perhaps supported by appropriate, tailored legislation.

Some constraints though cannot be waived away, for instance a dispersed population and low national population density, which limit the opportunities to achieve economies of scale in materials recovery and recycling operations. Table 6 considers market outlet and demand issues for materials and energy that typically may be recovered from MSW and end-of-life products.

Table 6 Outlets and demand considerations for various waste recovery streams

Waste Recovery Stream	Market Outlets	Demand Considerations
Energy – electricity (generated in waste-to-energy plants or from biogas)	Domestic	As waste is generated continuously, so should energy generation. However, local electricity demand may be variable. Hence power may need to be fed into the wider grid. Grid operator should coordinate with other sources of electricity supply. Prices received may fluctuate with the prices of other sources of energy.
Energy – steam and hot water (generated in waste-to-energy plants or from biogas)	Domestic – local to generating plant	Local sources of demand may be seasonal or otherwise intermittent. Multiple demand sources might be needed, increasing the costs of distribution infrastructure. Prices received may fluctuate with those of other energy sources. In the absence of demand, waste heat will need to be rejected.
Processed biowaste – digested or composted waste	Domestic – local to processing plant	Stored product might be used in agriculture, for land reclamation, capping residual waste landfill sites, and in parks and other green spaces. It is unlikely that producers will receive much if any payment. Producers will need to promote the benefits of its use and undertake quality assurance. If demand is absent the processed waste may be landfilled.

57 World Bank Group (2018). Decision Maker's Guides for Solid Waste Management Technologies.

Waste Recovery Stream	Market Outlets	Demand Considerations
Food waste from public catering and institutions	Domestic	Waste food is allowed to be used as feed for livestock subject to its refrigerated storage and (for fattening pigs) thermal sterilisation. Disease transmission is a risk if food waste is not treated appropriately.
Materials recovered from end-of-life vehicles	Domestic and export	Road vehicles consumed by the population and business sectors are mostly manufactured elsewhere and imported into Uzbekistan. Consequently the opportunity to recover materials from end-of-life vehicles and to reintroduce them into Uzbekistan's productive sectors as feedstock may be limited. The substantial development of capacity in Uzbekistan's manufacturing sector might relieve this constraint. But a more realistic objective may be to expand and develop operations for vehicle dismantling and material recovery in Uzbekistan (at least in the major conurbations). And to export recovered materials to countries where large-scale manufacturing sectors already exist.
Materials recovered from end-of-life electronic equipment (WEE)	Domestic and export	As above but concerning WEE.
Paper and cardboard	Domestic and export	Established practice and currently promoted and supported by the ban on the export of wastepaper, cardboard and recovered paper, and by the ban on disposal of wastepaper to landfill. Prices paid in the market for all of these separated waste streams will fluctuate with changes in market demand and will depend on contamination levels. For instance, clear glass attracts a higher price than does coloured glass, so their mixing reduces the price to the lower level.
Plastics	Domestic and export	
Metals	Domestic and export	
Glass	Domestic and export	
Timber and hardboard	Domestic and export	
Aggregates	Domestic	

5.7 Institutional Capacity

The institutional challenges involved in moving from a waste management system in which much of the collected waste is dumped, to one in which materials and energy recovery play full and integral roles is respected, should not be underestimated. Waste management organisations need to have adequate capacity in terms of staff numbers, skills and experience. Cities that already have functioning segregated waste collection and recovery operations are likely to be better positioned than others. It may be beneficial, therefore, to make an appraisal of existing institutional capacities nationally and in the regions and large cities, to determine the specific needs for capacity strengthening across the Republic.

More generally, the sustainable adoption of SCP requires that all producers and consumers are aware of the benefits that SCP can bring and have the capability to identify SCP measures. Raising awareness and the development of capability is essential, therefore, and requires concerted efforts over some years. Chapter 6 develops this further, arguing that an SCP Support Mechanism (SCP-SM) will be needed to establish this aspect of an SCP enabling environment.

6. A MECHANISM TO HELP STIMULATE SCP UPTAKE

6.1 Why a Mechanism is Needed

The national SCP Action Plan has, at its heart, further effort by central Government to strengthen Green Policies and ensure that both existing and strengthened policies are applied in practice by regional governments and all relevant stakeholders. Such policies may involve implicit requirements that the productive sectors of the economy make greener investments. For instance, were a Government to impose BAT on large combustion plants, stricter pollutant emission limit values would be set, to be complied with by a specific date; requiring that existing installations make appropriate investments. Table 7 presents a range of areas where 'hard-edged' policy adjustments could be beneficial. Several, such as the economic pricing of consumed resources and an extension of the producer and supplier responsibility, would act to strengthen the enabling environment for SCP without necessarily requiring major investments. Figure 22 represents the twin-track approach of the SCP Action Plan regarding national policy development and its application, including an SCP support mechanism.

Table 7 ''Hard-Edged' Areas for Policy Development to Support SCP Uptake

Areas for Further Development of 'Hard-Edge' Policies to Support SCP	
Pricing of consumed resources – Energy, Water, Materials, Landfill volume	Limits on annual volumes of freshwater abstraction – Specific to water-stressed basins
Extended Producer Responsibility – Producers and suppliers of manufactured products such as electrical and electronic goods, motor vehicles, refrigerators etc – Facilities for receiving end-of-useful-life goods and their dismantlement to enable material resources to be recovered and returned to market	Green Products in the Marketplace – Mandatory minimum product performance standards (e.g. energy and water efficiency) for specified types of goods to be sold in the market – Ecolabelling of goods, enabling consumer choice – Green purchasing codes
Cost-recovery financing of solid waste management operations – from collection through to treatment and disposal – Consistent with resource recovery	Applying BAT as a regulatory principle in specified sectors, e.g. – Energy; Chemicals; Metallurgical; Food, Drink and Milk industries; Textiles
National emission inventories, projections and commitments – GHGs and Air Pollutants – Ratify CLRTAP Gothenburg Protocol	Decarbonising the energy system in the long-term – Use of renewable energy resources – Carbon capture and storage (CCS) – Hydrogen (blue and green)

Noted in Chapter 2 and developed in Chapter 5, there are several strands to an SCP enabling environment, the most notable being a consistent legislative and regulatory framework, institutional capacity and capability, operational infrastructure, sustainable finance, a culture of compliance, and efficient and supportive markets / outlets. All apply strongly when considering SCP in the context of resource recovery from solid waste, but their relative significance in other cross-sectoral areas and in different value chains depends on sector-specific characteristics.

Common to all, though, is the need for adequate institutional and stakeholder capability and capacity. This itself comprises many aspects, but critical to SCP uptake is the stimulation of behavioural change, whether of people acting as householders or in an enterprise or institutional setting. The importance of behavioural change stems from the fact that the application of SCP in practice depends often on stakeholders and actors taking *voluntary action*. Hence people first must first be *aware*, and then *motivated*, and *have practical tools and guidance tailored to their specific needs*. In the short-to-medium term, a mechanism to stimulate behavioural change is needed - distinct from a regulatory approach mandating stakeholder action.

This may be complemented by adjusting the curricula of primary, secondary and tertiary levels of education – this would feed through to longer-term awareness. SCP could be introduced into curricula through, for instance, including appropriate examples to illustrate aspects of physical and life-science subjects.

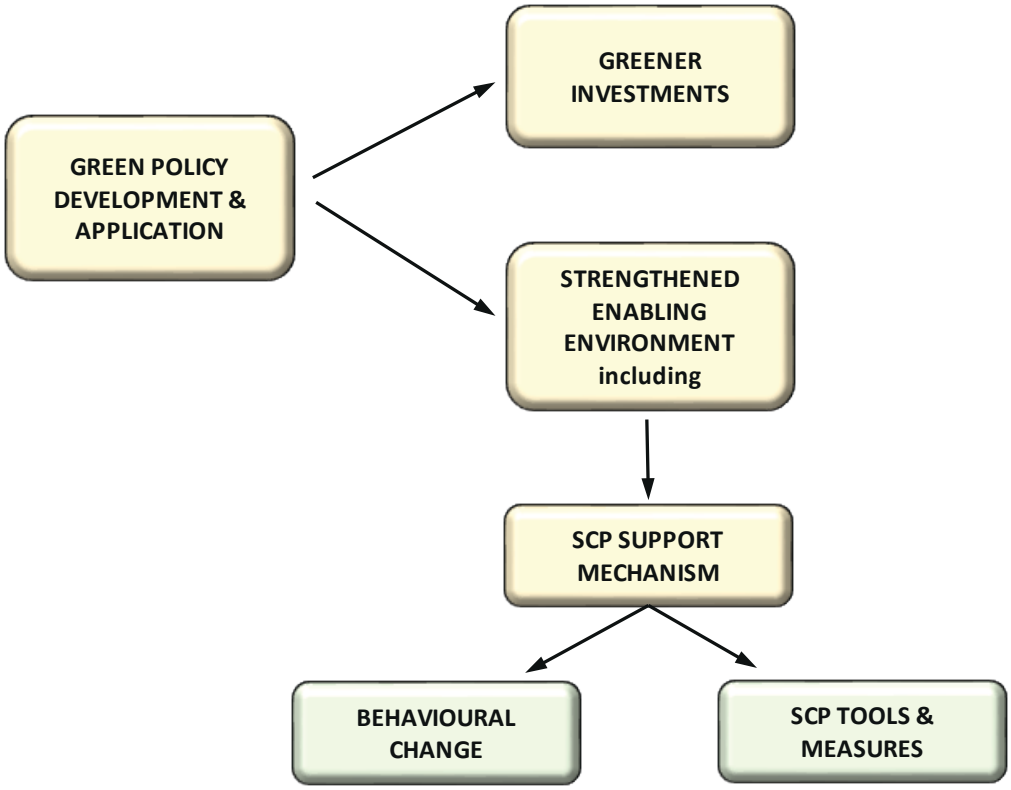


Figure 22 Twin-track representation of the SCP Action Plan, indicating the role of an SCP Support Mechanism

Prompting behavioural change is not easy. For every individual in a household, business or institution that is aware and mindful of the need to change from the old ways of doing things, many more may see no need for change or are unwilling to do so. And simply telling them that change is needed may not work. People can be stubborn. In tackling this resistance to change, effective and sustained communication in which people's concerns are identified and addressed with practical arguments and clear messages is an essential tool. Effective communication can also mean the provision of practical guidance, information and support to motivated consumers and producers. This can help to shift them from a situation in which they are aware but unsure what they can do, or how to do it, to one where they are not only aware but feel empowered.

Many models of behavioural change exist, but all share the same or similar characteristics. A useful illustration is provided in Figure 23. The green buttons represent five behavioural states on a pathway ranging from unawareness on the far left through to fully empowered and active on the far right. Progression along this behavioural pathway is not automatic though, effort is required to help people move along it. The kinds of action needed to drive this progression – essential for voluntary SCP action to follow – is indicated in the boxes above the curve.

Making this effort requires that senior managers in enterprises and institutions, and the heads and or influencers within households, are aware of SCP and either drive or are supportive of efforts to adopt an SCP approach. Even if aware and supportive, though, that is not enough. Without appropriate external support, there are limits to what they can do. An external mechanism that can inject enthusiasm, stimulating action and providing support, is needed. The underlying principles for such a mechanism are provided below. The national Government should apply these when considering their options in determining an appropriate mechanism and its institutional 'home'.

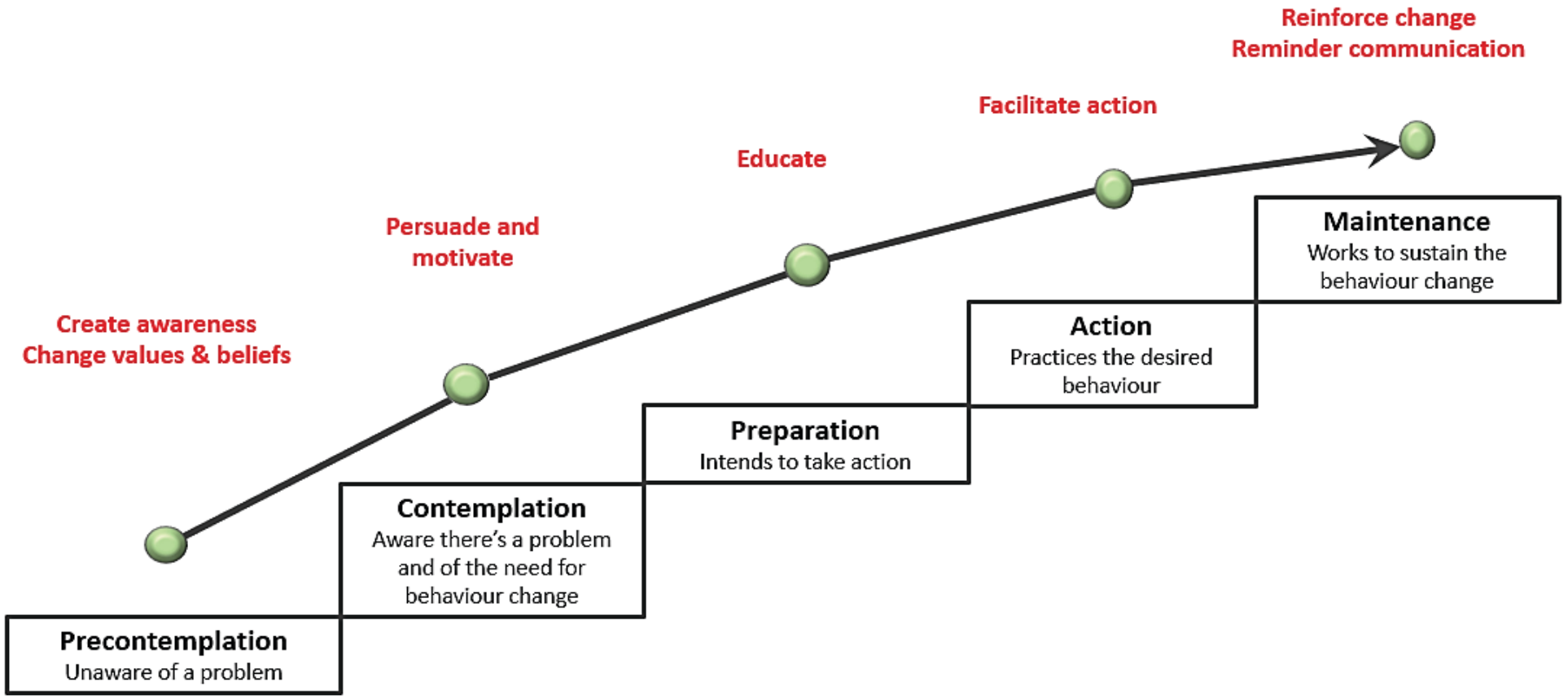


Figure 23 A model for promoting behavioural change that may be adopted to stimulate SCP action

6.2 SCP Support Mechanism: Principles for Effectiveness and Good Governance

An SCP Support Mechanism, effective in raising awareness and stimulating both behavioural change and the active adoption of an SCP approach, should rest on the following principles.

1. The mechanism should receive the full endorsement of the national Government and, ideally, regional governments.
2. Its goals should be to raise awareness of SCP, to stimulate SCP action by stakeholders in the production and consuming branches of the economy, and to transmit SCP tools, information and guidance to stakeholders – thereby enabling their adoption of SCP.
3. The mechanism adopted should focus on promoting the uptake of SCP in the areas covered by the present SCP Action Plan, phased in recognition of Government priorities and initial capacity and capability constraints, i.e. (i) agriculture and agri-products, textiles and energy value chains; and (ii) the cross sectoral areas of freshwater conservation and efficiency of water use, the recovery of resources from municipal solid wastes, reducing GHG emissions, and improving ambient air quality.
4. Sufficient time will be needed for the mechanism to achieve the goals set. Assuming its establishment in 2022-2023, the mechanism should be operational until 2030 – coincident with the time limit for STRUGE – at which time consideration may be given to its potential extension and expanding / revising its remit.
5. Applying the mechanism will require the commitment of financial and human resources. In principle these might be provided via a network of national experts, partially supported perhaps by national and international donors. But the formation, management and financing of that network would be challenging and the risks of waning initial enthusiasm and financial disruptions might be considerable. A more sustainable commitment of resources to enable a functioning mechanism might be to establish an SCP support mechanism within an existing institution – governmental or otherwise – funding and human resources to be 'guaranteed' by central Government so far as that is possible. The institutional 'home' for such a mechanism would need to be determined by Government.
6. If Government decides to establish an SCP support mechanism within an institutional home, it will need to establish management and operational procedures that allow Government Ministries to exercise strategic supervision without becoming involved in day-to-day management.
7. Engaging international donor support (Technical Assistance) for establishing an SCP support mechanism, and developing both the SCP capability and capacity of the mechanism, would accelerate the national uptake of SCP.

Annex D provides examples of how SCP and SCP-related support mechanisms have evolved in one European country (the United Kingdom) and summarises their remits. It also provides indicative Terms of Reference for an institutional unit – should that be the route that Government wishes to pursue – and indicative human resourcing levels. Through the Switch-Asia programme, much experience has been gained in East and South-East Asia also, which could help inform the Government's decision making.

The Institute of Forecasting and Macroeconomic Research (IFMR) under the Ministry of Economic Development and Poverty Reduction has recently established a 'Green Hub' to study and develop the green economy and Green growth in Uzbekistan. This may provide a suitable institutional 'home' for the envisaged SCP-SM, though the capability to engineer behavioural change might need to be grafted on through association with other Uzbek entities.

7. SCP ACTION PLAN: 2022-2030

The SCP Action Plan adopts the principles set out in Chapter 2 and, regarding an SCP Support Mechanism, the principles set out in Chapter 6. Hence the Action Plan shown schematically in Figure 24, and elaborated in Sections 7.1, 7.2 and 7.3, comprises three components:

- National Government policy development;
- Value-Chain actions;
- Cross-Sectoral actions.

Also shown in Figure 24 is the role of regional governments, enterprises, institutions and households in taking SCP action as prompted by the roll-out of SCP-SM thematic strategies and other routes. Some actions are identified in the SCP Action Plan, though the need for others may become apparent as time goes by.

7.1 National Government Policy Development

Actions of the national Government are presented in Table 15. They comprise the following:

1. SCP awareness raising and capacity development for Government officials, building on the introduction provided in June 2022 (Action 0.1);
2. Integrating the SCP approach into a STRUGE Action Plan (Action 0.2);
3. Policy areas for national Government consideration, where policy development and amendment could strengthen the enabling environment for SCP uptake, and help to reinforce the incentives for consumer and producer stakeholders to take action. Chief amongst these are:
   - Commitment to establishing an SCP Support Mechanism (SCP-SM) in line with the principles stated in Chapter 6, for which advice via international Technical Assistance would be beneficial (Actions 0.3 and 0.4);
   - Ensuring the effective operation of the SCP-SM until 2030, subject to performance review. Dependent on the situation prevailing in 2030, the Government may then decide either to extend the SCP-SM's operation or terminate it (Actions 0.5 to 0.8);
   - Policy analyses whose recommendations, if acted upon, could further incentivise changes in consumption and production behaviour in line with the SCP approach. Table 7 in Chapter 6 and Table 8 below identify the policy areas of current potential significance, where effort might be focused (Action 0.9);
4. Government to amend legislation, if and where necessary, to enable the implementation of SCP actions in the value chains and cross-sectoral areas presented in Chapters 3 and 4. The thematic activities of the SCP-SM would be one way to identify further barriers to SCP uptake - potentially solvable by legislative amendment (Action 0.10);
5. Inclusion of SCP-related topics in educational curricula, tailored for use in primary, secondary and tertiary settings to raise the awareness of the coming generations (0.11).

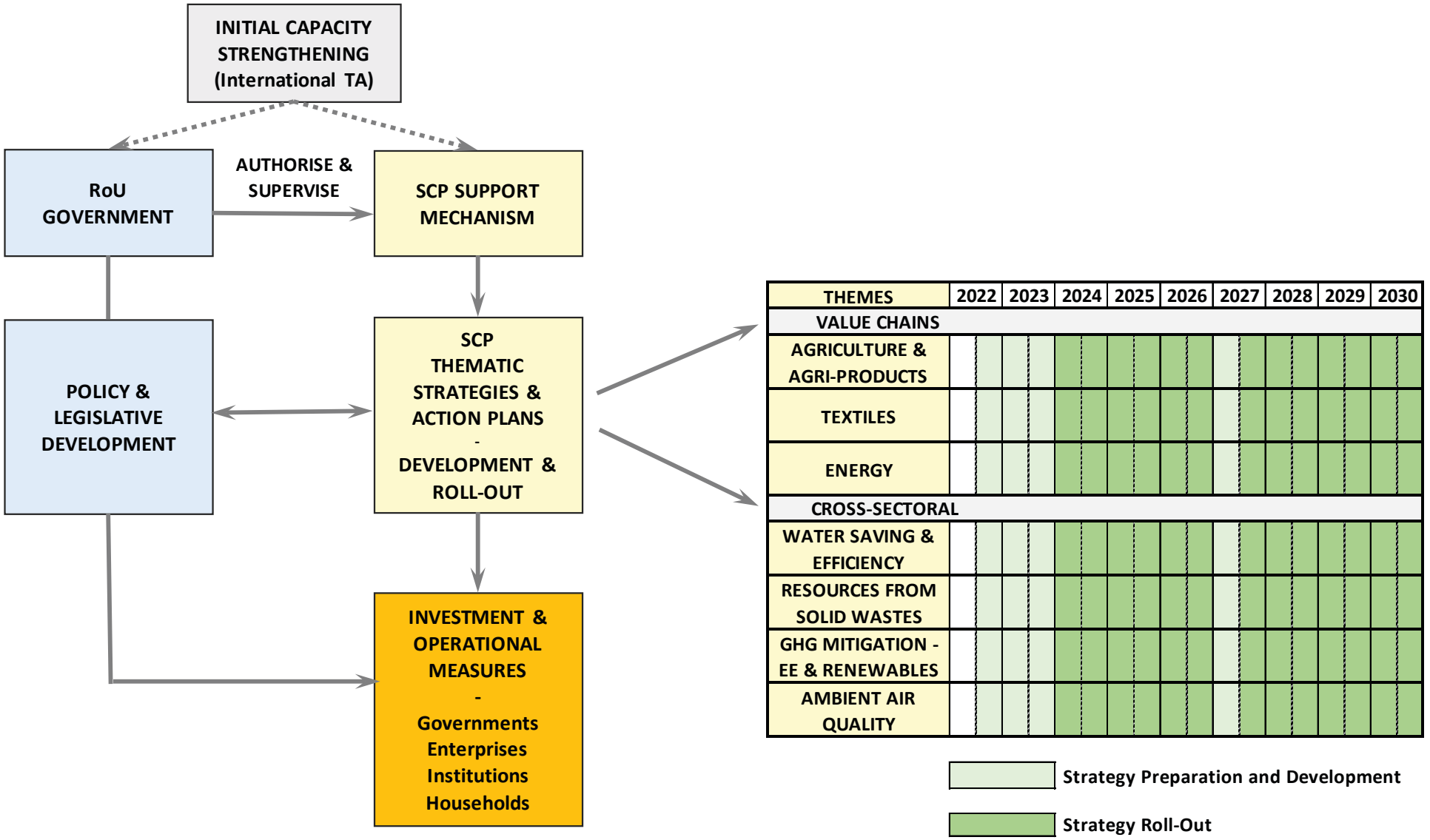


Figure 24 Scope and Structure of the SCP Action Plan

Table 8 National SCP Action 2022-2030 – National Government Policies

No.	ACTIONS – NATIONAL GOVERNMENT POLICY	RESPONSIBLE INSTITUTION / S	PERIOD
0.1	Capacity building for the Government to enhance government's understanding of the SCP approach, supported by international Technical Assistance.	MEDPR (with the support of other relevant Ministries)	2022
0.2	Integrate the SCP approach and action plan into the action plan for STRUGE implementation.	MEDPR (with the support of other relevant Ministries)	2022
ESTABLISH AND MAINTAIN A MECHANISM FOR PROMOTING SCP AND ITS ADOPTION			
0.3	Commit to establishing a funded national SCP Support Mechanism to promote and enable SCP action in value chain and cross-sectoral areas, and to ensure its funding over the period 2023 to 2030 inclusive, subject to a performance review midway (2026/27) through the period.	MEDPR (with the support of other relevant Ministries)	2022
0.4	Secure international assistance to: (i) help prepare detailed Terms of Reference for a SCP-SM that reflect international good practice, (ii) identify in detail its staffing and budget needs, and (iii) provide targeted capacity building for staff in relevant Ministries and the SCP-SM.	MEDPR (with the support of other relevant Ministries)	2022-2024
0.5	Establish a funded national SCP-SM, to promote and enable SCP action in the targeted value chains and cross-sectoral themes. The SCP-SM will provide a focus for raising awareness and the development of knowledge and tools on SCP and their communication. It will engage with sources of practical experience and knowledge in Uzbekistan, Central Asia, and worldwide.	MEDPR (with the support of other relevant Ministries)	2023
0.6	Provide regular strategic supervision of the SCP-SM's operation and progress.	MEDPR (with the support of other relevant Ministries)	2023-2030
0.7	Decide whether to (i) split the SCP-SM into two parallel differentiated operating mechanisms having distinctive themes and (ii) add further, additional themes for action.	MEDPR (with the support of other relevant Ministries)	2026
0.8	Review the performance of the SCP-SM up to 2030 inclusive and decide whether there is then value in extending the programme or, if not, to close it down.	MEDPR (with the support of other relevant Ministries)	2030
POLICY ANALYSIS AND DEVELOPMENT			
0.9	Further analysis with the objective of recommending policy measures to stimulate actors to make sustainable changes in consumption and production behaviour, such changes to result in improved resource efficiency and conservation. Suggested policy areas are: – Pricing of freshwater abstraction for the use of agriculture, industry, power generation, and public supply utilities. Also, the potential roles that other financial instruments might play. – Setting volumetric limits on the annual volumes of freshwater abstracted from respective water basins whose conservation is under threat. – Adoption of the BAT principle as a basis for the environmental regulation of industrial installations potentially capable of causing significant air, water and land pollution – these could be applied, for instance, to textiles production, the production and refining of oil and gas, thermal power plants of a minimum capacity (≥ 50 MWth), and large-scale metallurgical installations.	Ministry of Economy supported by other Ministries (as relevant) (to either undertake the analysis or commission it)	2022-2028

No.	ACTIONS – NATIONAL GOVERNMENT POLICY	RESPONSIBLE INSTITUTION / S	PERIOD
0.9	– Strengthening the financing of MSW management systems in order that modern systems for collection, resource recovery, processing and residual waste disposal may be conducted in a sustainable manner and consistent with household affordability. – Scope for introducing or strengthening green product procurement practice, including the labelling of appliances according to energy efficiency and or water use efficiency, and prohibiting the sale of appliances that fail to meet minimum technical performance criteria regarding energy efficiency, water efficiency, recyclable content, etc; – Adoption of an Extended Producer Responsibility (EPR) obligation on producers and importers of specified manufactured goods, and establish an EPR operator in Uzbekistan. – Measures to stimulate the formation and / or development of facilities in large conurbations to (i) receive and dismantle end-of-life vehicles and waste electronic equipment, (ii) recover materials, and (iii) the utilisation of such recovered materials, whether in Uzbekistan or by exporting to third-party countries where they may be used as feedstock in the productive sectors. – The potential for using financial instruments, including a landfill tax, to support the delivery of the Government's objectives regarding waste management; and the conditions necessary for their successful introduction to deliver results. – Pricing of energy (electricity, natural gas, hot water) supplied to consumers (industry, tertiary business sectors, institutions and households) and its potential to stimulate consumers to use energy wisely. And other financial instruments that may help to overcome potential associated household affordability issues. – The long-term future of the fossil-fuel extraction and power/ heat generating sectors and how they may be integrated into a carbon-neutral future, including decarbonisation of energy use, consistent with meeting international Climate Change commitments. – Transitioning to decarbonised road transport – electricity and or hydrogen-powered vehicles; – Ratification of the protocols to the Convention on Long Range Transboundary Air Pollution (CLRTAP) and the Gothenburg Protocol. Committing to the preparation of annual national emissions inventories for GHGs and air quality pollutants ($PM_{2.5}$, SO_2, NOx, NMVOCs, NH_3), and biennial emission projections for the same.		
LEGISLATIVE DEVELOMENT			
0.10	Amend legislation as required: (i) to enable the implementation of agreed actions in the thematic strategies developed for each value chain and cross-sectoral area, (ii) in response to findings from implementing the action plan, and (iii) to implement agreed policy measures identified from the policy analysis undertaken in action 0.9.	Relevant Ministries	2022-2028
EDUCATION			
0.11	Develop educational curricula and teaching materials tailored for use in primary, secondary and tertiary education, with the aim of informing future generations on the significance of SCP, the need to adopt SCP practices, and how individuals can contribute.	MHSSE & MPE	2025-2030

7.2 Value-Chain Actions

Value-Chain actions are presented in Table 9. They comprise actions to prepare and deliver thematic strategies to promote SCP and achieve SCP uptake in three value chains. The SCP-SM would play a major role in this. Other actions would flow from the roll-out of the strategies. There are three groups of actions:

- Actions A.1 to A.13 in the agriculture and agri-product value chain;
- Actions T.1 to T.11 in the textiles value chain; and
- Action E.1 in the energy value chain: SCP actions regarding energy efficiency and renewable energy are covered in the cross-sectoral action plan, given in Section 9.3.

7.3 Cross-Sectoral Actions

Cross-Sectoral actions are presented in Table 10. They relate to the preparation and delivery of four thematic strategies to promote SCP and achieve SCP uptake. The SCP-SM would play a major role in this. Other actions would flow from the roll-out of the strategies. The four groups of actions are:

- Actions WE.1 to WE.10 concerning water use efficiency and saving;
- Actions RW.1 to RW.11 concerning resource recovery from municipal solid waste;
- Actions GHG.1 to GHG.10 concerning the mitigation of GHG emissions through improving energy efficiency and greater use of renewable energy; and
- Actions AAQ.1 and AAQ.2 concerning ambient air quality improvement.

Table 9 National SCP Action Plan – Value Chain Actions

No.	VALUE-CHAIN ACTIONS	RESPONSIBLE INSTITUTION / S	PERIOD
AGRICULTURE AND AGRI-PRODUCTS			
FIRST SCP THEMATIC STRATEGY			
A.1	Collate and review published benchmark information, good practice documentation, guides, and SCP case studies that may be relevant to the agricultural value chain in Uzbekistan. Also establish contact with organisations active in this field in other countries.	SCP-SM (with international assistance)	2022-2023

No.	VALUE-CHAIN ACTIONS	RESPONSIBLE INSTITUTION / S	PERIOD
A.2	Develop the value chain in a quantitative sense based on the prepared qualitative description and on information held by the MoA, MWR and other bodies. Use this analysis, together with the material collated in action A.1, as a basis for preparing an initial, priority-driven 3 to 4-year thematic strategy to promote and facilitate the application of SCP tools and measures. Its scope may include guidance on, and examples of, good practice; addressing each of the primary, secondary, tertiary and consumption stages of the value chain; and adoption of features of the EU's Farm-to-Fork Strategy appropriate to Uzbekistan's situation. Suggested priority areas are: – Water demand in crops production – making the best use of the available resources; – Food waste – minimising waste arisings at all stages of production and consumption; and, for those wastes that do occur, giving guidance on the necessary infrastructure (and its operation) for their collection, treatment, storage and beneficial use; – GHG emissions from crop growing and animal rearing, and digestion of wastes to produce biogas; – Nutrients (N, P) management in the primary production stage – growing crops & animal rearing; – Pesticides use – to be minimised; and less hazardous substances to be used where possible; – Organically produced food; – Packaging of food and drink products – to be reduced and made more recyclable; – Citizen behaviour change.	SCP-SM – calling on Uzbek centres of knowledge, and international assistance MEDPR, MoA, MWR, SCEEP and others – to review and approve proposed programme of work	2023
A.3	Engage with third parties to prepare benchmark reports, good practice guides, case studies, market intelligence reports etc as identified in the thematic programme (action A.2). SCP-SM staff to review, edit and require revisions as appropriate before approving a final output. SCP-SM to disseminate outputs through a tailored communication programme.	SCP-SM – commissioning and production External bodies – prepare drafts	2023-2026
A.4	Prepare impact assessments on the uptake and effectiveness of major thematic outputs, reporting the assessments back to the MEDPR, MoA, SCEEP and to the SCP-SM.	External institutions	2024-2026
SECOND SCP THEMATIC STRATEGY			
A.5	Prepare a second-stage, prioritised 3 to 4-year thematic strategy to further promote and facilitate the application of the SCP approach in this value chain; for review and, after necessary revisions, Government approval. Some continuation of first-stage activity may be undertaken but new areas not covered in the first stage may also be addressed.	SCP-SM MEDPR, MoA and SCEEP	2026-2027
A.6	Implement the second-stage strategy, disseminating outputs through a communication programme (as in action A.3), and conduct further impact assessments.	SCP-SM and external institutions	2027-2030
OTHER ACTIONS			
A.7	Undertake trials, as necessary, to evaluate and demonstrate the beneficial uses of treated food wastes in agriculture and other land-based applications; prepare code of good practice and promote its use to farmers and others.	Ministry of Agriculture with the assistance of the SCP-SM and technical institutes	2023-2030

No.	VALUE-CHAIN ACTIONS	RESPONSIBLE INSTITUTION / S	PERIOD
A.8	Provide the necessary resources and infrastructure to enable: (i) the collection and processing of food wastes arising from households, the hospitality and food retail sectors, and food and drink production sectors; and (ii) and the beneficial use of treated food wastes.	City and Regional Governments	2023-2030
A.9	Enterprises engaged in the food and drink production and retail sectors to raise their individual and collective awareness of priority issues in the value chain - as identified in the thematic strategy. And establish voluntary business partnerships to take effective steps to achieve pre-set improvement targets concerning these issues. (This action to be stimulated by national and city / regional Government, the SCP-SM, the media, and the voices of citizens and citizen organisations.)	Advanced farms, major producers and retailers of food & drink products	2023-2030
A.10	Enterprises engaged in the hospitality sector (restaurants, hotels etc) to respond positively to Governmental, SCP-SM, media, and NGO messaging on the need to reduce food waste, how this can be done, and the changes in behaviour needed to achieve it. Take necessary practical steps, including investments if appropriate, to reduce food waste and collect efficiently wastes arising.	Hospitality Sector & City / Regional Governments	2023-2030
A.11	Households and Institutions (Hospitals, Educational establishments, Prisons, Government offices, Technical Institutes etc) where food and drink are consumed to respond positively to Governmental, SCP-SM, media and NGO messaging on the need to reduce food waste, how this can be done, and the changes in behaviour that can help the collection and treatment of the food wastes that do occur.	Consumers and Institutions	2023-2030
A.12	Engage actively in Citizen Behaviour Change initiatives in support of the SCP-SM, focusing on what individuals acting alone and as members of households, institutions and enterprises can do to minimise food waste.	NGOs and the Media	2023-2030
A.13	Provide training and capacity strengthening to all stakeholders in the Agriculture and Agri-products value chain	SCP-SM, NGOs and Training Institutions (with international assistance)	2024-2030
TEXTILES			
TEXTILE CLUSTER ACTIONS			
T.1	Develop and implement integrated pest management (IPM) plans for primary natural fibre production, for cotton production especially.	Textile Clusters	2023-2025
T.2	Elaborate and implement environmental management system (EMS) covering all production stages (including fibre production) of the value chain within a Cluster's control. Regarding its secondary production processes, the EMS should include the following aspects: (i) an inventory of inputs and outputs, (ii) a water management plan, (iii) an energy efficiency plan, (iv) a chemicals management plan, and (v) a waste management plan. The IPM plan should form an integral aspect of the EMS.	Textile Clusters	2023-2025
T.3	Review the range of available BAT and adopt appropriate operational and investment techniques when practicable and feasible to do so.	Textile Clusters	2023-2030
T.4	Adopt cleaner design practices for textile product manufacture in collaboration with the retail sector in Uzbekistan, taking into consideration also the demand trends in export markets. Objectives should include minimising all forms of waste and substituting less potentially harmful chemical agents.	Textile Clusters	2024-2030

No.	VALUE-CHAIN ACTIONS	RESPONSIBLE INSTITUTION / S	PERIOD
T.5	Receive training in the use of SCP Tools recommended for application in the secondary production stages of textiles production, and adopt these tools in the textile production mills so as to improve resource use efficiency.	Textile Clusters	2024-2030
FIRST SCP THEMATIC STRATEGY			
T.6	Collate and review published benchmark information, good practice documentation, guides, and SCP case studies that may be relevant to the textiles value chain in Uzbekistan. Also establish contact with organisations active in this field in other countries as the basis for forming potential cooperative partnerships in future.	SCP-SM (with international assistance)	2022-2023
T.7	Develop the value chain in a quantitative sense based on information held by the MEDPR, MoA, MWR and other bodies. Use this analysis, together with the material collated in action T.6, as a basis for preparing an initial, priority-driven 3 to 4-year thematic strategy to promote and facilitate the application of SCP good practice in textile clusters, retail outlets and the consumers of textile products. Suggested areas for action include: – SCP tools applicable to textiles production and the provision of training to personnel in the textile clusters – making the best use of the available resources; – Minimising the losses as waste of textile fabrics and textile products – in part through cleaner design – and developing initiatives that encourage retailers and customers to engage in product reuse and recycling in line with the waste management hierarchy; – Behavioural change programmes addressing members of the public (identifying how they as individuals can make a difference), retail sector personnel, and personnel in textile clusters – whether they work in natural fibre production or in a factory environment.	SCP-SM – calling on Uzbek centres of knowledge, and international assistance MEDPR, MoA, MWR, SCEEP and others – to review and approve proposed programme of work	2023
T.8	Engage with third parties to prepare benchmark reports, good practice guides, case studies, market intelligence reports etc as identified in the thematic programme (action T.7). SCP-SM staff to review, edit and require revisions as appropriate before approving a final output. Outputs to be marketed through a tailored communication programme by the SCP-SM.	SCP-SM – commissioning and production External bodies – prepare drafts	2023-2026
T.9	Prepare impact assessments on the uptake and effectiveness of major thematic outputs, reporting the assessments back to the MEDPR, MoA, SCEEP and SCP-SM.	External institutions	2024-2026
SECOND SCP THEMATIC STRATEGY			
T.10	Prepare a second-stage, prioritised 3 to 4-year thematic strategy to further promote and facilitate the application of the SCP approach in this value chain; for review and, after necessary revisions, Government approval. Some continuation of first stage activity may be undertaken but new areas not covered in the first stage should also be addressed.	SCP-SM MEDPR, MoA, SCEEP	2026-2027
T.11	Implement the second-stage strategy, marketing the products through a communication programme (as in action T.8), and conduct further impact assessments.	SCP-SM and external institutions	2027-2030

No.	VALUE-CHAIN ACTIONS	RESPONSIBLE INSTITUTION / S	PERIOD
ENERGY			
ADOPTION AND APPLICATION OF BEST AVAILABLE TECHNQUES (BAT)			
E.1	Consider the adoption of BAT as a regulatory basis for governing the environmental performance of gas, oil and coal extraction, the refining of gas and oil, large-scale combustion (≥50 MWth) plants, and heavy industry such as acid and fertiliser production. And, if BAT is to be adopted, develop BAT Reference documents tailored to the Uzbek industrial status and conditions; and roll-out the issue of operating permits with conditions, and operate, maintain and self-monitor installations in accordance with permit conditions.	MEDPR, SCEEP Permitting Departments Enterprises	2022-2030

Table 10 National SCP Action Plan – Cross-Sectoral Actions

No.	CROSS-SECTORAL ACTIONS	RESPONSIBLE INSTITUTION / S	PERIOD
WATER SAVING AND EFFICIENCY			
FIRST SCP THEMATIC STRATEGY			
WE.1	Collate and review published benchmark information, good practice documentation, guides, and SCP case studies that may be relevant to the efficient use of water by consumers (households and institutions), in primary and secondary production and in tertiary business sectors. Water use in agriculture to be considered in parallel in agriculture value-chain actions. Establish contact with organisations active in this field in other countries.	SCP-SM (with international assistance)	2022-2023
WE.2	Prepare an initial, priority-driven 3 to 4-year thematic strategy to promote and facilitate the application of SCP tools and measures to conserve water and use it efficiently. The thematic strategy should complement and parallel that for the Agriculture and Agri-products value chain, addressing water use in the primary, secondary, and tertiary business sectors and for household and institutional consumption. (Water use for crop growing may be handled within the thematic strategies for agriculture and textiles.)	SCP-SM – calling on Uzbek centres of knowledge, and international assistance MEDPR and SCEEP – to review and approve the thematic programme	2023-2024
WE.3	Engage with third parties to prepare benchmark reports, good practice guides, case studies, etc as identified in the thematic programme (action WE.2). SCP-SM staff to review, edit and require revisions as appropriate before approving a final output. SCP-SM to disseminate outputs via a tailored communication programme.	SCP-SM – commissioning and production External bodies – prepare drafts	2023-2026
WE.4	Prepare impact assessments on the uptake and effectiveness of major thematic outputs, reporting the assessments back to MENR, the Ministry of Industry and to the SCP-SM.	External institutions	2024-2026
SECOND SCP THEMATIC STRATEGY			
WE.5	Prepare a second-stage, prioritised 3 to 4-year thematic strategy to further promote and facilitate the application of SCP for improved water use efficiency; for review and Government approval. Some continuation of first stage activity may be undertaken but new areas not covered in the first stage may also be addressed.	SCP-SM MEDPR, SCEEP, MHCS, MWR	2026-2027

No.	CROSS-SECTORAL ACTIONS	RESPONSIBLE INSTITUTION / S	PERIOD
WE.6	Prepare new and revised products, disseminate them through a communication programme (as in action WE.3), and conduct further impact assessments.	SCP-SM and external institutions	2027-2030
OTHER ACTIONS			
WE.7	Enterprises engaged in the processing and manufacturing industries (secondary production) to: (i) raise their awareness of the need to use water wisely and efficiently, as identified in the thematic strategy, and (ii) adopt available SCP tools to help them identify water saving and efficiency measures. (This action to be stimulated by national and city / regional Governments, the SCP-SM, the media, and the voices of citizens and citizen organisations.)	Enterprises	2023-2030
WE.8	Households, institutions (Hospitals, Educational establishments, Prisons, Government offices, Technical Institutes etc), enterprises engaged in the hospitality sector (restaurants, hotels etc), all business offices, and such like, to respond positively to Governmental, SCP-SM, media, and NGO messaging on the need to improve water use efficiency, how this can be done, and the changes in behaviour that may achieve it. Take necessary practical steps, including investments where appropriate, to reduce water waste.	All consumers of water - households, institutions, and enterprises in tertiary business sectors	2023-2030
WE.9	Engage actively in Citizen Behaviour Change initiatives in support of the SCP-SM, focusing on the promotion of the actions that individuals acting alone and as members of households, institutions and enterprises can take to use water wisely.	NGOs and the Media	2023-2030
WE.10	Provide training and capacity strengthening on why and how to save water: targeted at users of water in the primary, secondary and tertiary business sectors and in institutions.	SCP-SM, NGOs and Training Institutions (with international assistance)	2024-2030
RESOURCE RECOVERY FROM MUNICIPAL SOLID WASTES			
THEMATIC STRATEGY ACTIONS			
RW.1	Collate and review published benchmark information, good practice documentation, guides, and case studies relevant to SCP and resource recovery from the integrated management of MSW, biodegradable waste, waste electrical and electronic equipment (WEEE) and end-of-life vehicles. Also, establish contact with organisations active in this field in other countries and keep up-to-date with developments in the EU's Green Deal and Circular Economy Action Plan.	SCP-SM (with international assistance)	2022-2023

No.	CROSS-SECTORAL ACTIONS	RESPONSIBLE INSTITUTION / S	PERIOD
RW.2	Prepare an initial, priority-driven 3 to 4-year thematic strategy to promote and facilitate the application of the SCP approach and use of good practice to reduce the net disposal of MSW to landfill. To be achieved mainly through maximising the recovery of recyclable materials (and or energy) – including potentially the separate collection of waste electrical and electronic devices and their deposition at large-scale community sites. But also through reducing packaging use and other measures to minimise MSW generation. This strategy will need to take into consideration the outcome of a review of 'wet waste' collection and management (action RW.1). The initial strategy might need to be amended, consequent on the findings of the policy analyses undertaken as suggested in action 0.9; or, the results of policy analysis might be incorporated in a second-stage strategy, 2026-2030 (action RW.4). In developing the solid waste thematic strategy, consideration should also be paid to the ongoing EU's Green Deal and Circular Economy Action Plan, especially: – Sustainable Product Policy Framework ; – Policy Initiative: Less Waste, More Value; – Farm to Fork Strategy.	SCP-SM – calling on Uzbek centres of knowledge, and international assistance MEDPR, MHCS, MWR - to review and approve the thematic programme.	2023-2024
RW.3	Implement the strategy and undertake independent impact assessments ./	SCP-SM supported by external institutions	2023-2026
RW.4	Prepare and implement a second-stage thematic strategy, incorporating independent assessments of the impacts of key outputs - as in the initial strategy (actions RW.2 and RW.3).	SCP-SM	2026-2030
OTHER ACTIONS			
RW.5	Subject to the adoption of IPR obligations, support the development of infrastructure to disassemble WEEE and recover reusable and recyclable components, for use as raw materials in domestic consumer goods production and or for export.	MEDPR	2024-2030
RW.6	Provide the necessary resources and infrastructure to enable: (i) the separate collection of wet wastes, dry wastes and end-of-life equipment arising at households, institutions and tertiary business sectors; (ii) the processing of each separate waste stream; (iii) the transfer of recovered resources to markets for recycling or use; and (iv) the disposal of residual wastes to engineered landfill.	City and Regional Governments	2024-2030
RW.7	Enterprises engaged in the processing and manufacturing industries, including those engaged in waste recycling, to raise their individual and collective awareness of priority issues in solid waste management - as identified in the thematic strategy. And to take effective steps to achieve voluntarily-set improvement targets. (These actions to be stimulated by national and city / regional Government, the SCP-SM, media, and the voices of citizens and citizen organisations.)	Enterprises	2024-2030
RW.8	Tertiary sector businesses, and institutions, to respond positively to Governmental, SCP-SM, media, and NGO messaging on the need to reduce MSW arisings, SCP's role in achieving this, and the necessary changes in behaviour. Take practical steps, including investments where appropriate, to reduce waste and to collect efficiently such wastes that do arise.	Tertiary Enterprises, Institutions & City / Regional Governments	2024-2030

No.	CROSS-SECTORAL ACTIONS	RESPONSIBLE INSTITUTION / S	PERIOD
RW.9	Households to respond positively to Governmental, SCP-SM, media and NGO messaging on the need to reduce solid waste arisings, how this can be done, separate wastes at source, and the changes in behaviour that can help achieve this.	Consumers	2024-2030
RW.10	Engage actively in Citizen Behaviour Change initiatives in support of the SCP-SM, focusing on the promotion of what individuals acting alone and as members of households, institutions and enterprises can do to minimise the generation of MSW, its effective separation at source into distinct fractions, and to maximise the recovery and recycling potential of all wastes.	NGOs and the Media	2024-2030
RW.11	Provide training and capacity strengthening for all stakeholders on why and how to minimise waste arisings and maximise the recovery of resources form those wastes that do arise.	SCP-SM, NGOs and Training Institutions	2024-2030
CLIMATE CHANGE: MITIGATION OF GREENHOUSE GAS EMISSIONS			
THEMATIC STRATEGY: ENERGY EFFICIENCY			
GHG.1	Collate and review published benchmark information and good practice documentation on energy efficiency in the processing and manufacturing industries, energy-using appliances, district heating systems, and buildings. Collate case studies on how energy efficiency can be increased. Establish contact with organisations active in this field in other countries and keep abreast of ongoing developments in the EU's Green Deal and Circular Economy Action Plan.	SCP-SM (together with international assistance)	2023-2025
GHG.2	Prepare and implement a priority-driven thematic strategy to promote energy efficiency and energy conservation to all consumers. The strategy should take into account ongoing action GHG.3, the proposed preparation of an energy efficiency road map, developments in the EU's Green Deal and its implementation, and energy efficiency action planning in other Central Asian Republics.	SCP-SM – partnering as appropriate with Uzbek centres of knowledge MEDPR, MoE, SCEEP – to review and approve the thematic programme	2024-2030
GHG.3	Develop and implement a national energy efficiency road map, consistent with the SCP-SM and thematic strategy (action GHG.2).	MoE	2024-2030
GHG.4	Households, institutions (Hospitals, Educational establishments, Prisons, Government offices, Technical Institutes etc), enterprises engaged in the tertiary business sectors including retail outlets, hospitality (restaurants, hotels etc), and all business offices, to respond positively to Governmental, SCP-SM, media, and NGO messaging on energy conservation and efficiency. Take practical steps, including investments where appropriate, to reduce energy waste.	Households, Institutions, Tertiary sector Businesses, and all offices - consumers of energy	2024-2030
GHG.5	Engage actively in Citizen Behaviour Change initiatives in support of the SCP-SM, focusing on the promotion of actions that individuals can take to use energy more efficiently – whether acting alone or as members of households, institutions and enterprises.	NGOs and the Media	2024-2030
GHG.6	Provide training and capacity strengthening on energy conservation and improving energy efficiency, targeting users of energy in primary, secondary and tertiary businesses and institutions.	SCP-SM, NGOs and Training Institutions (with international assistance)	2024-2030

No.	CROSS-SECTORAL ACTIONS	RESPONSIBLE INSTITUTION / S	PERIOD
THEMATIC STRATEGY: RENEWABLE ENERGY RESOURCES			
GHG.7	Collate and review published benchmark information, good practice documentation, and case studies on how renewable energy resources (including food wastes and other bio-wastes) may be developed and used. Establish contact with organisations active in this field in other countries and keep abreast of ongoing developments in the EU's Green Deal and Circular Economy Action Plan and elsewhere in Central Asia.	SCP-SM (together with international assistance)	2023-2025
GHG.8	Prepare and implement a priority-driven thematic strategy to promote the use of renewable energy resources where available and appropriate. The strategy should consider ongoing developments in the EU's Green Deal and its implementation, elsewhere in Central Asia, and other countries as appropriate.	SCP-SM –with Uzbek centres of knowledge MEDPR, MoE, SCEEP – review & approve the thematic programme	2024-2030
OTHER ACTIONS: GHG EMISSION INVENTORIES AND PROJECTIONS			
GHG.9	Building on national emissions inventories to date, prepare annual national inventories for GHG emissions (to include CO_2, CH_4, N_2O and others). Adopt and implement a policy of continuous improvement of the inventory should be adopted, incorporating planned methodological improvements. If needed, seek capacity strengthening support from international sources.	Uzhydromet	2023-2030
GHG.10	Building on action GHG.9, prepare national emissions projections to 2030 and beyond for GHGs. Projections should be prepared biennially (e.g. 2024, 2026, etc) for defined scenarios including at least (1) assuming existing policies and measures and (2) assuming additional policies and measures to meet environmental goals and objectives. Inter-Ministry cooperation and collaboration will be needed to develop robust emissions reduction plans. Seek further capacity strengthening support from international sources for undertaking this activity, if appropriate.	Uzhydromet	2024-2030
IMPROVING AMBIENT AIR QUALITY			
AIR POLLUTANT EMISSION INVENTORIES AND PROJECTIONS			
AAQ.1	Building on national emissions inventories undertaken to date, prepare annual national inventories for air pollutant emissions ($PM_{2.5}$, SO_2, NOx, NMVOCs, NH_3). Also prepare separate emissions inventories for Tashkent and other substantial cities and towns whose populations could be exposed to air pollution. In addition to the annual updating, adopt a policy of continuous improvement of the inventory, incorporating planned methodological improvements. If needed, seek capacity strengthening support from international sources to assist undertaking this activity.	Uzhydromet	2023-2030
AAQ.2	Building on action AAQ.2, prepare national emissions projections to 2030 and beyond for air quality pollutants and consider doing the same for Tashkent and other populous cities. Projections should be prepared biennially (e.g. 2024, 2026, etc) for defined scenarios including at least (1) assuming existing policies and measures and (2) assuming additional policies and measures to meet environmental goals and objectives. Inter-Ministry cooperation and collaboration is needed to develop robust emissions reduction plans. Seek further capacity strengthening support from international sources for undertaking this activity, if appropriate.	Uzhydromet	2024-2030

ANNEX A: Glossary of SCP Tools, Measures and Terminology

Baseline Assessment: an initial identification and quantitative assessment of the resources consumed by an entity (institutions, buildings, processes and operations). In order that a 'fresh pair of eyes' is brought to bear, the assessment is best led and undertaken by personnel without direct experience of the entity's daily operations. This technique may utilise a number of the others mentioned below, and any available, relevant information. Its use helps the identification of priority areas, where action should be focused to minimise resource use in the short-medium term and deploy more radical measures longer-term.

BAT Reference Documentation: Published by the European Commission (EC) these documents on Best Available Techniques (BAT) identify definitively those technologies and operational practices that provide the best protection for the environment and human health. Though the economic costs are taken into consideration also. Prepared for given production sectors, they are updated periodically, and are mandatory for those sectors. Governments of countries that are not Member States (MS) of the EU may adapt these documents to suit their national circumstances. They provide an authoritative source of guidance on potential measures.

Benchmarking - external: comparing the efficiency of resource use (electricity, coal, gas, steam, water, materials, etc.) with that of comparable institutions, buildings, processes and operations. It requires metering of the resources being consumed. Typically, comparisons are made with average, or ranges of, resource consumption values – e.g. KWh/tonne product, m^3 water / m^3 milk processed – in the public domain or published by accredited institutions guaranteeing respondent confidentiality. Use of this broad-brush technique can provide a 'wake-up call' to stimulate a search for efficiency measures and can be useful at a policy level.

Benchmarking – internal: A powerful technique that may be used by any institution, office, or enterprise to monitor and analyse resource use in a process or operation, inform the search for measures to achieve efficiency gains, and determine the savings once measures have been implemented – providing valuable information feed-back. Similarly, it may also be used to analyse material wastage rates. The technique is often referred to as '**monitoring and targeting**'. As with external benchmarking, its use requires the metering of resource consumption and material wastage in parallel with a measurement of production over the same time. In essence, the measured resource consumption of a defined operation, over a defined interval of time - typically per month, or per batch, depending on the nature of the production process - is plotted against a relevant measure of production over the same period of time. The graphs may be easily prepared using a simple spreadsheet program and yield quantitative information which can be used to help drive the search for efficiency measures and determine the resource savings made once efficiency measures have been implemented.

Carbon Footprinting: A tool or methodology to calculate the total greenhouse gas (GHG) emissions caused by an individual, event, organization, service, place or product, expressed as carbon dioxide equivalent. Carbon footprinting is related to carbon accounting and life-cycle analysis. Greenhouse gases, including the carbon-containing gases carbon dioxide and methane, can be emitted through the burning of fossil fuels, land clearance and the production and consumption of food, manufactured goods, materials (including cement and steel, etc), wood, roads, buildings, transportation and other services. It may be calculated as a carbon dioxide equivalent using the relevant 100-year global warming potential. Once the carbon footprint of a specific organisation, activity or product has been identified, it may be compared with that of other entities, activities and products and actions devised to reduce the footprint.

Carbon Pricing / Taxes: Assigning a price for the (input and intrinsic) carbon content of energy and other products is a mechanism whereby carbon-rich products will, all else being the same, be more expensive than alternative products, leading to less of the former and more of the latter being bought and consumed. It is a tool available to government to use, either by setting a carbon price, or by issuing a limited number of carbon quotas, leaving it to 'carbon market' forces to determine the carbon price. Effectively designed, this mechanism may be used to help implement a national GHG emissions reduction strategy. Its effects range from the short-term, rising prices affecting immediate consumer choices, to the longer term, sending firm signals on future price changes to producers and consumers.

Champions: A member of an enterprise's staff appointed as a 'champion' to stimulate broad-based interest and to push through measures to use resources efficiently and stimulate product redesign. Enterprises have found that appointing such a champion – someone who is genuinely interested and motivated – helps to motivate others in the enterprise and to sustain initial pushes for improvement.

Cleaner Design: a technique in which a critical examination is made into how a product is made, its resource consumption when in use, its durability and ease of repair, and the ease of its dismantling at the end of its working life. The objective of this examination is to identify and implement production changes that (i) minimise the number of components, quantity of materials, and, where possible, the hazardous nature of the materials used to produce a product, and (ii) enable the recovery of materials and components from end-of-life products to be maximised. Forming part of a Cleaner Design exercise, **Life-Cycle-Analysis** may be undertaken in parallel.

Communication: Effective communication is an indispensable tool to raise awareness and understanding amongst all stakeholder interests of the need to take action, and to stimulate their interest in, and motivation to contribute to, the formation of a Green Economy - for which SCP is such a significant aspect. Stakeholder groups on which targeted communication activities should focus include the production sectors – primary through to tertiary – and, just as important, all consumer groups. The latter range from households, governmental and non-governmental institutions, through to all manner of enterprises purchasing intermediate products. Effective consumer-oriented communication is important since motivated consumers will form a major driver of demand for greener products – placing pressure on producers and suppliers to meet this demand. All manner of media and other techniques – including educational programmes - may be used to achieve effective communication.

Consumer Awareness, Interest, Motivation and Behaviour: The behaviour of households and other consumers whose awareness is raised, and have become interested and motivated, will be changed in many ways. For instance, they will demand and search out greener products, will be less tolerant of waste and more likely to separate at-source and recycle the wastes they do generate. They may drive less aggressively on the roads, consider vehicles that are more fuel-efficient when changing their cars, and they may seek out opportunities to reduce household energy consumption. Achieving such changes in consumer behaviour requires sustained Communication effort, targeting both the young and more mature members of society.

Consumption and Procurement: See Green Purchasing Criteria / Codes

Counter-Current Washing / Heat Exchange: where possible, washing or heating / cooling an intermediate or final product in counter-current mode as opposed to batch mode. This makes a more efficient use of the washing medium, whether the washing or solvent medium (or heat exchange fluid) is water or some other substance.

Dematerialisation: Substitution of a digital service for a physical product. Examples include the availability of music and films on demand via the internet, as opposed to buying CDs and DVDs, the availability of e-Books, and the submission of forms, letters and invoices electronically instead of by paper via the mail service.

Eco-design Product Standards: a requirement that appliances such as electrical, electronic and heating equipment placed on the commercial market must meet minimum energy efficiency limits.

Education: Closely linked to and forming part of a long-term communication strategy, curricula for specific age groups, from junior school through to university undergraduate study, may be adapted to include SCP and Green Economy concepts. This tool provides a long-term, bottom-up approach to mainstreaming SCP in society.

Emission Projections – GHGs and Air Quality Pollutants (AQP): Where policies are in place requiring quantitative reductions in emissions to air by specified dates, emission projection tools are indispensable aids to policy makers. Whether GHGs or AQPs are the subject of the policy, they enable decision takers to examine the potential impacts of implementing alternative or complementary policy options and measures. Projection tools are ineluctably linked to historic emission inventories and their quality. Both inventories and projections need to reflect adequately the influences of alternative technologies and their (expected) uptake on activity levels and emission factors. AQPs commonly included in inventories and projections are SO_2, NOx, NMVOCs, NH_3, $PM_{2.5}$ and PM_{10}. See **Carbon footprinting** also.

Energy Audits: the collection, processing and analysis of data on using energy resources for the purpose of assessing the possibility and potential for energy saving and the preparation of a conclusion.

Environmental Management System (EMS): An EMS, such as ISO14001, is a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency. It is applicable for large and most small businesses, institutions and government departments and agencies.

Financial Incentives: They represent the 'pull' mechanism in contrast to the 'push' provided by the **Pricing** tools concerning Carbon and Publicly Delivered Goods. Financial incentives to encourage greener consumption and production come in various guises. They can include (time-limited) subsidies on greener consumable goods, investment grants, low-interest loans for green investments, favourable tax allowances for innovative research or investments, etc.

Fishbone Analysis: Also known as root cause analysis, an aid to determining the root causes of resource inefficiencies. The results of such an analysis may be represented diagrammatically – hence its name. The technique questions why a given source of resource inefficiency prevails and may deploy 'brain-storming' sessions to help identify the deeper causes and find solutions.

Forestry Stewardship: A certification system for the sustainable management of forests and woodland in order to ensure that timber extraction is not exploitive and is compatible with maintaining biodiversity.

Good Practice Guides and Case Studies: Guides provide practical information on how to get started and use many of the other SCP tools, whilst Case Studies summarise the real-life experience of entities in identifying opportunities and implementing identified measures. Complementary to reports on external benchmarks, Good Practice documents may be cross-sectoral or have a sectoral focus.

Green Purchasing Criteria / Codes Requiring that all products purchased by an entity meet minimum environmental criteria is a tool whose widespread adoption encourages the greater supply of green goods and services and discourages the supply of goods and services that fail to meet such criteria. Entities that may employ such Purchase Codes include governmental and non-governmental institutions, and enterprises in multiple sectors including retail outlets.

Heat Exchanger Networks: Utilising the heat content of liquor or heat exchange fluid output from one production unit to provide the heat needed by a second production unit.

Innovation: Research and innovation as a tool can lead to improvements in existing processes, production and supply of goods and services, and the design and development of new, greener technologies and techniques. Sectoral-specific innovation and its application in practice is perhaps most relevant to **Mapping** and driving improvements in Key **Value Chains**.

Life-Cycle-Analysis: An analytical process in which all the resources consumed during the production, use and post-working life management of a product are estimated; similarly, the emissions to air, discharges to water, and solid wastes generated. This far-reaching analysis may include, for instance, estimating the energy consumed (and emissions generated) in producing the materials of which the product is made. The outcome of this analysis may be presented as a map or process flow chart, which helps to identify the most resource-intensive stages of a product's life. Undertaken as part of a **Cleaner Design** process, it informs radical thinking on how to transform products and reduce their carbon and environmental footprints.

Mapping the Sectoral Value Chain: A technique to help visualise the major stages involved from a product's production through to its final consumption and end of life. It also helps in identifying the cross-links to other sectoral activities. It may be used to help focus concerted action to minimise waste throughout the value-chain and to stimulate a search for ways in which minimised waste streams may be recovered and reused in other sectors.

Mass and Energy Balances: A standard technique which relies on the principles of conservation of mass and conservation of energy. Its use can help to identify previously unrecognised waste streams and energy losses.

Metering, Monitoring and Sampling: The means by which quantitative data are obtained, enabling the use of most of the other SCP tools noted here. The systems adopted for data collection and capture should be proportionate to goals and systematic.

Prevention of Waste: See **Waste Management Hierarchy**.

Pricing of Publicly Delivered Goods: Electricity and water are examples of publicly delivered goods and services. If priced at or below the costs of provision, or of the value of the benefits conferred, users – including large-scale production installations – may be encouraged to use more of the resource than is strictly necessary, and their incentive to minimise its use may be minimal. On the other hand, progressively raising the prices for such public goods increases the incentives to reduce their consumption. Also, establishing a framework for future increases in price sends advance signals to users, providing them with time to take resource efficiency action.

Producer Responsibility: Policy requirement placed on the producers of certain products whose end-of-life disposal represents a significant waste of material resources and is environmentally damaging. In present and former EU Member States producers have the responsibility to recover materials from and recycle end-of-life products that include goods such as road vehicles, batteries, electronic goods, and packaging. Though it predates the EU's Circular Economy (CE) approach, the Producer Responsibility principle lies at the heart of the CE and its focus on identified product value chains.

Product-as-a-Service: Producers or suppliers retain ownership of a product, leasing it out to customers as a service, and are responsible for managing its end-of-life dismantling, material recovery, recycling and disposal. Examples include electronic goods and vehicles.

Recovery and Recycling: See **Waste Management Hierarchy**.

Reformulation: Reformulation of a product to substitute harmless for harmful components to the maximum extent possible while maintaining product quality. A prime example is the reformulation of paints to minimise their organic solvent content, replacing them with water, thereby reducing the emissions to air of non-methane volatile organic compounds (NMVOC) when paint is applied.

Resource Efficiency & Waste Minimisation Club (Informal Associations): Representatives of enterprises or entities in a given area meeting informally to share experience on searching for resource efficiency and waste minimisation opportunities, and their implementation of measures. Experience shows that such associations, providing the opportunity to learn from the efforts of others, can be helpful in stimulating ideas for change. This holds even when the entities involved lie in different sectors, since their reticence due to competition fears are lessened.

Reuse: See **Waste Management Hierarchy**.

SCP Support Mechanism: An institutional tool that Governments may use to catalyse SCP activity at local level across the country. The United Kingdom (UK) government, for instance, funded several multi-year programmes[58] that operated at arms-length from the Government in the energy sector (*Energy Technology Support Unit, ETSU*) and business waste minimisation (*Envirowise*), developing benchmarking reports, good practice guides and case studies, market reports, and actively marketing them via comprehensive communication campaigns, and periodically evaluating the impacts of the communication programmes. Superseding these programmes in the UK, the Waste and Resources Action Programme (WRAP) provides, amongst other things, market intelligence reports on secondary materials. Action on food and textile wastes has been a major focus of its activities. SCP Support Mechanisms can play a vital role in helping to secure an enabling environment for the practice of SCP to flourish.

Separation of Wastes at Source: Whether applied to solid waste, wastewater or gaseous streams it is a basic principle of waste recovery and recycling that, wherever possible, concentrated should not be mixed with dilute streams and dissimilar streams should not be mixed. Failure to do so is liable to (i) increase the costs of resource recovery and recycling above what they could be and (ii) contaminate the recovered resource or recyclate. Both factors may jeopardise the practicality and viability of waste recovery and

58 For example: the Energy Technology Support Unit (ETSU) in the energy sector and Envirowise for business waste minimisation.

recycling. This principle is enshrined also in the management of end-of-life products subject to **Extended Producer Responsibility**.

Walk-through Audit: Inspection of the conduct of normal (and abnormal) operations to visually identify sources of waste, whether of materials, water, or energy. Undertaken as part of a **Baseline Assessment**, a 'fresh pair of eyes' is best brought to bear, the walk-through-audit undertaken by personnel without direct experience of the entity's daily operations. Having identified the sources of waste, the root causes may be identified using **Fishbone Analysis** involving plant personnel. Solutions may then be found, and measures implemented.

Waste Management Hierarchy: This hierarchy expresses schematically the favoured forms of waste management options from an environmental and sustainability perspective. It ranks options by priority order considering: prevention, preparation for reuse, recycling, other recovery, and disposal. See the closing part of Section 1.3 for an explanation of the concept and definitions of the ranked options.

ANNEX B: International Experience of SCP Support Mechanisms and Illustrative Terms of Reference

Three examples of good international practice are summarised below. They illustrate the evolution of operational SCP-related support mechanisms (units) in the UK since the first of these mechanisms was established in the 1990s. Each aimed to stimulate producers and, increasingly, consumers to adopt an SCP-related approach. Their remits initially were rather technocratic and narrow in scope, confined first to energy efficiency and then to waste reduction. But in the past decade and more the scope of the remaining mechanism now extends to cover broader aspects of SCP, the Circular Economy and climate neutrality (net-zero GHG emissions). Its role in catalysing informal group activity and voluntary partnerships has grown also.

B.1 UK 1: Energy Efficiency Best Practice Programme (EEBPP)

The UK Government initiated the EEBPP to encourage the spread of energy efficient technologies and techniques throughout UK industry and the national building stock. By the year 2000 it had stimulated annual savings worth €957 million (1990 prices[59]) – equivalent to a reduction in carbon dioxide emissions of about 18 million tonnes per year. This represented excellent value for an annual expenditure of only €24 million of public money.

The EEBPP formed a bridge across which knowledge and application experience passed effectively from the 'haves' to the 'have nots', adopting a systematic approach that:

- Identified the relevant knowledge needed by the target audience or audiences;
- Prepared, packaged and disseminated the knowledge appropriately for that audience; and
- Continually assessed the programme's impact, making changes as necessary.

Technical input on all aspects relating to buildings was provided by the UK's Building Research Establishment (BRE), and by the UK's Energy Technology Support Unit (ETSU) for industrial energy use. Where lack of knowledge was the primary barrier to improved performance – delivering higher profits for business, or providing affordable warmth for low-income households - the Best Practice approach was shown to play a key role. It provided help and advice through telephone helplines, the internet, publications[60], seminars, workshops and conferences, site energy surveys, and building design advice consultancies. The programme made it easier for those responsible for energy use and energy efficiency to get the information needed to save energy, money, and carbon dioxide emissions. Typical examples of how organisations and individuals in the buildings sector benefitted from the programme included:

- A local government's investment in energy efficiency measures for their housing stock improved living conditions and reduced tenants' heating bills by 45%;
- A city general hospital saved €83,700 a year by using combined heat and power (CHP).
- Industrial buildings in the UK saved an additional 0.5 million tonnes of carbon a year as a result of the programme.

The EEBPP was successful mainly because it formed a cooperative partnership with business sector associations, professional institutions and the many consultants and sub-contractors who worked on the programme. Other reasons for success included:

- The approach appealed to senior management as structured, effective, and complementary to good management practice;
- The information provided was useful, impartial, authoritative, and available free of charge;
- It provided a route whereby good Research and Development (R&D) projects were supported and then encouraged to market.

The power of the Best Practice approach was confirmed by the fact that other sectors in the UK economy, such as the construction industry, adopted this method of improving their performance. As did other countries,

59 Adopting a GB Pound to Euro exchange rate of €1 to £0.83605 (17 January 2022)

60 https://www.cibse.org/knowledge/knowledge-items-(1)/knowledge-archive/energy-efficiency-best-practice-programme-archive

including Canada, South Africa, New Zealand, and Australia. By 2004, responsibility for the EEBPP in the UK transferred to the Energy Saving Trust[61] (for housing issues) and the Carbon Trust[62] (for all other areas).

B.2 UK 2: Envirowise

Jointly funded and overseen by two Government Departments, one responsible for the Environment, Food and Rural Affairs (DEFRA) and the other for Trade and Industry, the UK Government established the Environmental Technology Best Practice Programme – later rebranded as 'Envirowise' – in 1994. Its initial remit was to achieve the goal of delivering annual savings of €191 million for industry within six years. Total funding for the period 1994-2000 was set at about €19 million at 1994 prices.

Designed along similar lines to the EEBPP, the Envirowise Programme was hosted by ETSU and implemented under contract to the UK Government. Quarterly progress reports were prepared for Departmental representatives, and meetings held at which proposals for new thematic strategies and deliverable outputs were also reviewed. The programme was dedicated to putting the sustainable use of resources at the heart of UK business practice. Envirowise provided free practical advice to help UK businesses increase profits and reduce their environmental impact. The promoted benefits to business of increasing resource use efficiency included:

- Increased productivity;
- Greater return on investment;
- Staying competitive;
- More effective use of resources to generate profits
- Reduced operating costs;
- Improved environmental performance.

Envirowise offered a range of free services to help companies improve their resource efficiency, including free advice from Envirowise experts through a Help Line; best practice events and practical workshops that offer an ideal way to examine resource efficiency issues and discuss opportunities; and a variety of publications that provided up-to-date information on resource efficiency issues, advice and successes. Over the years until 2009 when it was subsumed into the Waste and Resources Action Programme (WRAP), Envirowise addressed many business sectors. They ranged from those engaged in manufacturing and food processing, for instance, to the retail supply chain and offices. In parallel, generic cross-sectoral themes were also covered, including solid waste minimisation, packaging, water saving, and cleaner design.

B.3 UK 3: Waste and Resources Action Programme (WRAP)

Established as a not-for-profit company in 2000, WRAP became a charity in 2014, its goal, "a world where resources are used sustainably".[63] Based in the UK and with projects around the world it works with businesses, governments, citizens and charities to make the planet a healthier, safer place. WRAP's evidence-based approach inspires action in areas that create the most waste. In striving for a circular economy, it works with like-minded partners to cut waste, promote sustainability, and share knowledge.

The 2008/2009 financial crisis resulted in operational budget cuts leading to the Envirowise Programme and other DEFRA funded 'green' programmes[64] to be subsumed in 2009 into WRAP. Thus streamlining operations and achieving economies of scale in backroom (overhead) activities. WRAP's core funding is from the UK's DEFRA (Department for Environment, Food and Rural Affairs), the devolved governments of Northern Ireland, Scotland, and Wales, and from the EU. Also, some of the revenues raised from the UK's Landfill Tax (see section 5.3) have been allocated to WRAP. And further funding is provided by Charitable Trusts and initiative-based corporate sponsorship and partnership working.

61 https://energysavingtrust.org.uk/
62 https://www.carbontrust.com/
63 https://wrap.org.uk
64 Other programmes subsumed into WRAP were the National Industrial Symbiosis Programme (NISP), the Centre for Remanufacturing and Reuse, the Construction Resources and Waste Platform, Action Sustainability, and the Business Resource Efficiency and Waste (BREW) centre for local authorities.

Aspects of WRAP's approach and activities are rooted in the earlier work of EEBPP and Envirowise, but the approach has been modernised and greater emphasis is now placed on citizen and corporate behaviour and rather less on the relatively more technocratic stance of earlier programmes. Table 11 profiles WRAP's current activities, sectors, services, and the resources it makes available.[65] A good example of WRAP's approach is its toolkit to help businesses implement "Whole Chain Food Waste Reduction Plans" (WCPs), a key deliverable of a Food Waste Reduction Roadmap and contributing to meeting Target 12.3 of the UN's Sustainable Development Goals (Annex C). Figure 25 indicates the systematic, cyclical approach.

Figure 25 Five-stage process for WCPs and developing a culture of continuous approval – food waste

Table 11 Profile of WRAP's target sectors, services, activities, and the resources it makes available

Sectors	Issues - Taking Action
Farmers and Growers	Climate Change – Circular Economy
Hospitality & Food Services	
Local Authorities (Governments)	Plastic Packaging
Manufacturers	
National Governments & Departments	Food and Drink
Non-Governmental Organisations (NGOs)	
Packaging Producers	Textiles
Retailers & Brands	
Textile Producers & Designers	Waste Collection & Recycling – Delivering for Government, Key Operational Areas, Collection Consistency, Markets & Materials, Technical Support
Trade Associations	Citizen Behaviour Change – Clear on Plastics, Love Food Hate Waste, Love Your Clothes, Recycle Now
Waste Management & Reprocessors	

65 The WRAP website provides full details.

WRAP Works By	Services Provided	Resources Made Available by WRAP
Gathering evidence	Business Voluntary Agreements	Reports
Collaboration	Citizen Behaviour Change	Guides
Facilitation and delivery	Technical Support	Case Studies
Evaluation	Grants and Investments	Tools
	Policy and Insights	Campaign Assets

B.4 Indicative Terms of Reference for SCP Support Mechanism

A national SCP Support Mechanism should promote the SCP approach and stimulate SCP action in priority value chains and cross-sectoral areas. Targeting the Government's priorities, the SCP-SM will provide a focus for the development of knowledge and tools relevant to SCP and their communication. The Unit will engage with sources of practical experience and knowledge in Uzbekistan, the Central Asia region, and worldwide, to identify and develop SCP know-how, which will be communicated and applied through (renewable) three-to-four-year thematic strategies. Each thematic strategy should include the preparation of materials and undertaking of activities selected from the following indicative, non-exclusive list:

- Web-pages on an SCP-SM website;
- Benchmark reports on resource consumption and resource efficiency – within Uzbekistan (anonymising the information) and between Kazakh and international performance levels;
- Guides to good practice in key areas;
- Guides to the practical use of selected, relevant SCP tools, including step-by-step tuition manuals on how to apply the techniques;
- Short, practical training sessions in the use of selected SCP tools;
- Case studies that demonstrate where good practice techniques and SCP tools have been applied in Uzbekistan or, failing that, in other countries – preferably those having broadly similar and relevant characteristics;
- SCP awareness raising for producers, consumers, and institutions;
- Updated thematic intelligence reports, e.g. on markets for recovered waste materials, and legislative status and changes affecting consumers and producers;
- Digital videos demonstrating the use of selected guides and tools;
- A 'Helpline' that might be manned by members of staff (on a rota) of the SCP-SM, providing a means for consumers and producers make contact with the SCP-SM: to raise questions, seek information, and request publications (ideally downloaded from the SCP-SM website);
- Access to limited staff advice and support to stakeholders on request;
- Marketing and disseminating thematic 'products' through tailored communication activities, e.g. website, newsletter, news updates, 'information flyers' alerting stakeholders to the availability of Guides, etc, promotion via seminars, workshops, roundtables, training and other physical or virtual events.
- Impact assessment made by an independent body to estimate uptake and resource savings made, etc, identify lessons learnt, and provide feed-back to the responsible Ministries.

The SCP-SM should report on a regular basis to the Ministry of Economy, perhaps providing progress reports on a quarterly or half-yearly frequency. Prior to undertaking work on a thematic strategy, the SCP-SM should prepare a draft proposal for the scope of the strategy and submit it to the Ministry of Economy (and other relevant Ministries), for review; only starting work once approval has been granted.

The preparation of thematic products such as indicated above (good practice guides and case studies, benchmarking reports, digital videos, awareness raising, and training) may be undertaken by third-party institutions (businesses, consultants, R & D institutions, NGOs, etc) under contract to the SCP-SM. In which case, the SCP-SM occupies the role of commissioner and editor. If third-party preparation is not feasible in practice, the SCP-SM will need to undertake such activity in-house, its capacity first bolstered through international Technical Assistance.

Indicative Staffing Needs

SCP-SM staffing levels will depend on the scope of its remit - the number of themes covered and whether materials are developed in-house or externally. Table 12 indicates staffing levels based on the assumption that five thematic strategies are covered and that dissemination materials are commissioned and edited by SCP-SM staff but drafted externally by institutions having specific sectoral expertise. Actual staffing and budgetary needs will need to be identified through detailed analysis. An action to make this analysis is included in the SCP Action Plan.

Table 12 Illustrative initial staffing levels for an SCP Support Mechanism

Staff	Numbers
Manager	1
Deputy Manager	1
Technical Officers	6
Marketing & Communication Officers	3
Website development and management	1
Support Staff: Secretarial, IT, technical editing, general	3

Future Arrangements and Scope of a SCP Support Mechanism

After an initial operational period of, say, four years, allowing the growth of SCP experience and development of SCP capacity, it might be appropriate to split the Mechanism's operation in two. The areas of responsibility might then be sub-divided: provision for a decision point in 2026 is included in the action plan. Potentially, subject to need and the availability of funding, the remit of the Mechanism / s could be expanded at any time to address other sectors of the economy.

ANNEX C: UN Sustainable Development Goals Relevant to SCP

In accordance with the resolution of the General Assembly No. 70/1 "Transforming our world: the 2030 Agenda for Sustainable Development", adopted on September 25, 2015, the Republic of Uzbekistan has undertaken to implement the Sustainable Development Goals (SDGs) by 2030, developed by the UN as a "Plan for a better, more sustainable future for all" (17 goals and 169 related targets). In this regard, the following resolution of the Cabinet of Ministers was adopted:

Resolution of the Cabinet of Ministers of the Republic of Uzbekistan "On measures to implement National goals and targets in the field of sustainable development for the period up to 2030" No. 841 dated 20/10/2018.

This Resolution:

- Approved the National Goals and Targets in the field of sustainable development for the period up to 2030;
- Identified 16 goals (SDGs) and 125 targets to be achieved by 2030;
- Formed the Coordination Council for implementation of National Goals and Targets in the field of sustainable development for the period up to 2030;
- Approved the "Roadmap" for the implementation of National Goals and Targets for Sustainable Development for the period up to 2030.

The principal SDG of relevance to an SCP is Goal 12, "*Ensure the transition to sustainable (responsible) consumption and production*". However, others are also relevant, as indicated in Table 13. Regarding Goal 12, though, the main indicators of achievement in Uzbekistan as of 26.03.2021 are presented below. In order to monitor the implementation of SDG indicators in the Republic of Uzbekistan, a special website was launched (nsdg.stat.uz) with the support of UNDP. The main targets and indicators of Goal 12 are:

1. Implement the 10-year action strategy for sustainable consumption and production (Rio + 20 2012)
2. By 2030, achieve the environmentally sound management of chemicals and all wastes throughout their entire life cycle in accordance with agreed international principles and substantially reduce their release to air, water and soil in order to minimize their negative impact on human health and the environment.
3. By 2030, substantially reduce the volume of waste by taking measures to prevent, reduce, recycle, and reuse waste.
4. Encourage companies, especially large ones, to adopt sustainable production practices and to reflect sustainability information in their reports.
5. Expand the use of environmental standards in public procurement.
6. By 2030, provide the population with relevant information on sustainable development and lifestyles in harmony with nature.
7. Develop and implement tools to monitor the sustainable development impact of tourism that contributes to job creation, local culture and production.
8. Rationalize inefficient and wasteful subsidies for fossil fuels by addressing market imbalances in the light of national circumstances, including by reforming taxation and phasing out subsidies where they exist to account for their environmental impacts fully taking into account the special needs and conditions of the country and minimizing possible negative consequences for their development in such a way as to protect the interests of the needy and socially vulnerable segments of the population.

Table 13 Sustainable Development Goals (SDGs) and Specific Targets Relevant to STRUGE and SCP

SDGs and Selected Targets	
SDG.02	**End hunger, achieve food security and improved nutrition and promote sustainable agriculture**
SDG.03	**Ensure healthy lives and promote wellbeing for all at all ages**
3.9	By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.
SDG.06	**Ensure availability and sustainable management of water and sanitation for all**
6.1	By 2030, ensure universal access to safe drinking water
6.2	By 2030, ensure universal and equitable access to adequate sanitation and hygiene, paying special attention to the needs of the socially vulnerable segments of the population
6.3	By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
6.4	By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity
6.5	By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate
6.6	By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
6.a	By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies
SDG.07	**Ensure access to affordable, reliable, sustainable and modern energy for all**
SDG.08	**Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all**
8.4	Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead
SDG.09	**Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation**
9.2	Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries
9.4	By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities
9.5	Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending
9.b	Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities

SDGs and Selected Targets	
SDG.11	**Make cities and human settlements inclusive, safe, resilient and sustainable**
11.6	By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management
11.b	By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels
SDG.12	**Ensure sustainable consumption and production patterns**
12.1	Implement the 10-year framework of programmes on sustainable consumption and production, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries
12.2	By 2030, achieve the sustainable management and efficient use of natural resources
12.3	By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses
12.4	By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment
12.5	By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse
12.6	Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle
12.7	Promote public procurement practices that are sustainable, in accordance with national policies and priorities
12.8	By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature
12.a	Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production
12.b	Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products
12.c	Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities
SDG.13	**Take urgent action to combat climate change and its impacts**
13.2	Integrate climate change measures into national policies, strategies and planning
13.3	Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
SDG.15	**Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss**

ANNEX D: Infrastructure Needs for Recovering Resources from MSW

Infrastructure needed to implement material and energy recovery from two alternative management systems

Materials Recovery and Landfill	Waste-to-Energy
Containers for collection of waste: Dry waste[1] Wet waste[2]	Containers for collection of waste: Dry waste[1] Wet waste[2]
Vehicles to collect and deliver dry waste	Vehicles to collect and deliver dry waste
Vehicles to collect and deliver wet waste	Vehicles to collect and deliver wet waste
Process wet waste: Anaerobic digestion or composting[3] Biogas recovery & use (digestion)	Process wet waste: Anaerobic digestion or composting[3] Biogas recovery & use (digestion)
Storage and the beneficial use of the processed wet waste[4]	Storage and the beneficial use of the processed wet waste[4], or its disposal to landfill
Sorting of mixed dry waste[5] to recover materials for which recycling markets may exist: Paper Cardboard Plastics Metals Glass	Sorting of mixed dry waste[5] to remove recyclable non-combustible materials, for which markets may exist: Metals Glass An alternative is to recover metals from the bottom ashes (note 10)
Storage and transfer of recovered materials to recycling plants, in Uzbekistan or other countries[6], for their reintroduction to the productive sectors	Storage and transfer of recovered materials to recycling plants, in Uzbekistan or other countries[6], for their reintroduction to the productive sectors
Transfer and disposal of residual solid waste stream to an engineered landfill site equipped with: Impermeable lining[7] Leachate recovery and a system to treat and dispose of the leachate generated Capping of each cell once filled to prevent biogas leakage Biogas recovery system and facility to flare or beneficially use the gas produced[8] Monitoring of the site during its operation and after cell closures, reporting on environmental performance	Incineration of sorted dry waste[3], with: Energy recovery (as steam, electricity and hot watery) and its beneficial use[7] Bottom ash removal Flue gas treatment system to remove particulate matter (PM)[8] (electrostatic precipitators or bag filters, scrubbers); acid gases HCl, HF, SOx (alkaline scrubbers) and NOx (de-NOx processes); and residual volatile metals, Hg and Cd especially (activated carbon adsorption); Process and emissions monitoring & reporting
-	Fly-ash collection and its disposal to a hazardous waste landfill site[9]
-	Bottom ash removal and putting to beneficial use.[10] Alternatively, disposal to landfill.
Notes	
1: In addition to recyclable components, dry waste contains over 20 percent of non-classified material – potentially including hazardous household items. Inefficient arrangements for the separation and collection of wet wastes will result in their contamination of the 'dry' waste.	1: As note 1, opposite. The inclusion of batteries and other items containing hazardous substances will result in the emission of metals from the boiler (as vapour and particulate matter). Contamination by wet waste will reduce the heating value of the burnt waste and might cause operational variability.
2: Wet waste comprises food waste, green waste and other organic components. Where its processing by digestion is planned, pre-treatment to remove bulky items may be needed.	2: As note 2, opposite.

Materials Recovery and Landfill	Waste-to-Energy
3: The anaerobic digestion and composting of waste is a subject of the EC BAT Reference Document on Waste Treatment (2018).	3: As note 3, opposite. In EU Member States, the BAT Reference Document on Waste Incineration (2019) also applies.[66]
4: Use of processed wet waste (subject to regulatory requirements) can include application to agricultural land, land reclamation and landfill cover. Disposal to engineered landfill is the default alternative option.	4: As note 4, opposite.
5: Recovered materials will be contaminated - reducing the value of recovered materials - to a much greater extent than if wastes are segregated into their components at source (by households) and collected as separate streams.	5: Sorting of dry waste prior to its combustion may be restricted to the recovery of non-combustibles such as glass and metal. Their recovery from bottom ash is an alternative option (note 9).
6: In principle it is much better to recycle recovered materials in country, fostering such enterprises but, in the absence of economies of scale, the costs of recovery operations might lead to recovered materials being not competitive on price.	6: As note 6, opposite.
7: Given wet waste contamination, high-strength organic leachate can be expected to form in the (anaerobic environment of the) landfill. This needs to be collected, treated and disposed of safely to avoid water pollution.	7: In addition to the preheating of the combustion air supply, surplus energy in the flue gases may be used to raise steam, generate electricity and produce hot water. Outlets for the recovered energy have to be secure as has payment in turn.
8: As above, the generation of biogas should be expected and the gas collected for use, or flared, to minimise GHG emissions and the risk of explosion.	8: Particulate emissions from the boiler stage include products of incomplete production, adsorbed metals (such as Cd, Pb, Zn) that, being relatively volatile, may volatilise in the combustion chamber. The operational parameters of the combustion stage (temperature, residence time, surplus oxygen levels) have to be appropriate to ensure maximal burn out of the waste. A comprehensive sequence of process clean-up steps is essential, nevertheless, to treat flue gases prior to their safe release to air, in order to protect human health. Care has to be taken to ensure that gas temperatures in the particulate material stages lie outside the range where dioxins & furans may form as a result of *de novo* synthesis.
-	9: Fly ash from waste incineration plants should be regarded as a hazardous waste. Disposal to landfill cells designed to receive such waste is the norm.
-	10: Metals may be recovered from bottom ash for transfer to recycling plants in Uzbekistan or other countries. Followed by storage for a further 6-20 weeks, bottom ash may then be used in road construction or as an aggregate for concrete[67]. Disposal to landfill otherwise.

66 https://eippcb.jrc.ec.europa.eu/reference/

67 CEWEP Bottom Ash Fact Sheet. https://www.cewep.eu/wp-content/uploads/2017/09/FINAL-Bottom-Ash-factsheet.pdf

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