Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan

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SUSTAINABLE CONSUMPTION AND PRODUCTION ACTION PLAN

REPUBLIC OF KAZAKHSTAN

ABRIDGED EDITION

Acknowledgement

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LIST OF ACRONYMS

AQM	Air Quality Management
AQP	Air Quality Pollutants
BAT	Best Available Techniques
bcm	Billion Cubic Metres
Blue Hydrogen	'Blue Hydrogen' is 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.
CCS	Carbon Capture and Storage
CE	Circular Economy
CEAP	Circular Economy Action Plan
CH_4	Methane
CHP	Combined Heat and Power
CIS	Commonwealth of (Newly) Independent States
CLRTAP	Convention on Long Range Transport of Air Pollutants
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
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
GEAP	Green Economy Action Plan
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.
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
ISO	International Organization for Standards
LCA	Lifecycle Assessment
MEGNR	Ministry of Ecology, Geology and Natural Resources
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
MWth	MegaWatt Thermal
MS	Member State of the European Union
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
OECD	Organization for Economic Cooperation and Development
PM	Airborne Particulate Matter. PM_{10} is the concentration in air of all PM whose aerodynamic 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
SCP	Sustainable Consumption and Production
SCP-SM	SCP Support Mechanism
SDG	Sustainable Development Goal
SO_2	Sulphur Dioxide
TA	Technical Assistance
TI	Tracking Indicator and Indicators
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 Electrical and Electronic Equipment
WHO	World Health Organization
WRAP	Waste & Resources Action Programme
WWTP	Wastewater 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. 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'.*[1]

The United Nations Environment Program (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*'.[2]

Regardless of the definition of SCP, 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

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.

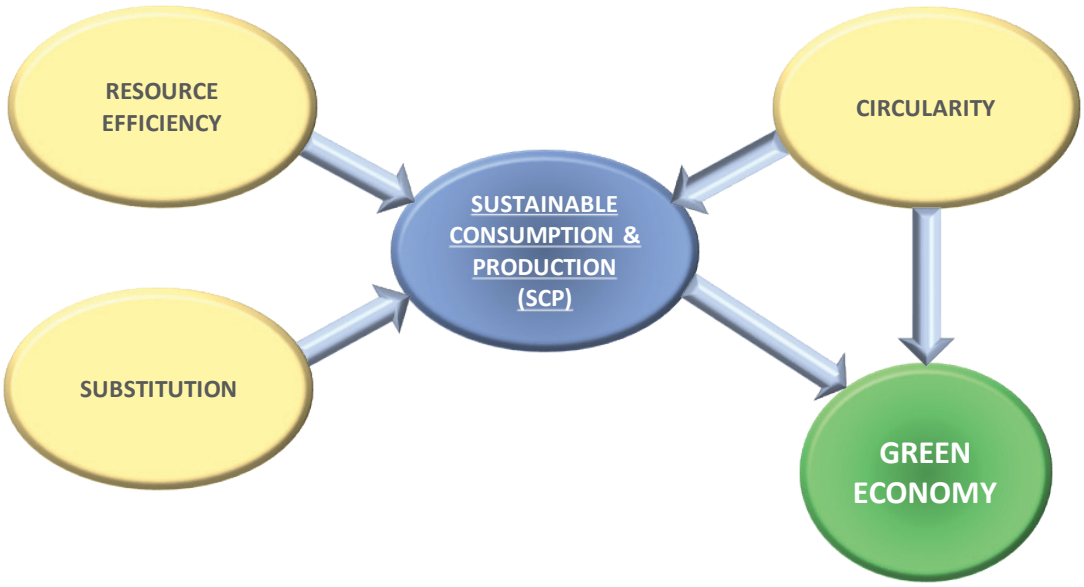


Figure 1: SCP, together with Circularity, contributes to delivering a Green Economy

1 Oslo Symposium, 1994: https://enb.iisd.org/consume/oslo004.html

2 UNEP, 2011, Sustainable Consumption and Production: A Handbook for Policymakakers, Global Edition, p. 10. The online PDF be freely downloaded from Research Gate: https://www.researchgate.net/publication/324583885_Sustainable_Consumption_and_Production_A_Handbook_for_Policy_Makers

Understanding each of these concepts helps us develop our appreciation for 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 recognises and places an emphasis on the role not only of producers but of consumers, and this latter group includes governments, institutions, members of the public, and businesses. Each of the three concepts is described below; Section 1.2 introduces the roles of governments, 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 insulation
- Adopt water-saving techniques to reduce the net freshwater consumption of agricultural and industrial production
- Optimise product design and production operations so that fewer resources are consumed in making and using consumer products
- Consumers purchase resource efficient products (incentivised by eco-labelling and communication messaging, for example)

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

- Produce, buy, and use paints that contain fewer, 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 method involves saving resources by recycling or reusing a product or waste stream. A fuller 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 from resource use (see Section 1.3). It thus affects product design, production, end-of-life product management and consumer behaviour, and includes waste recycling (solid, liquid, gaseous), as for example:

- 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 etc.
- 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, and reusing or recycling whatever waste is produced
- Adopting necessary systems and infrastructure to enable the recovery and reuse/recycling of constituent components and materials from products that have reached the end of their lives

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 must also 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 policy requirements are enforceable
- SCP tools and associated information are made available for producers and suppliers to use
- Entities in the productive and supply sectors have the capacity to apply SCP tools and, where their capacity is limited, receive capacity-building training and advisory support

- 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
- 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 producers and suppliers
- Similarly, policy and what it implies for consumers – households and others – is communicated effectively to consumers
- Consumers are motivated to buy green products, and producers and suppliers are motivated to supply them
- Government ministries and departments purchase goods and services in accordance with the government's Green Economy agenda, consistent with SCP principles and concepts
- Financial resources are available to catalyse all of the above, and economically disadvantaged members of society are treated fairly

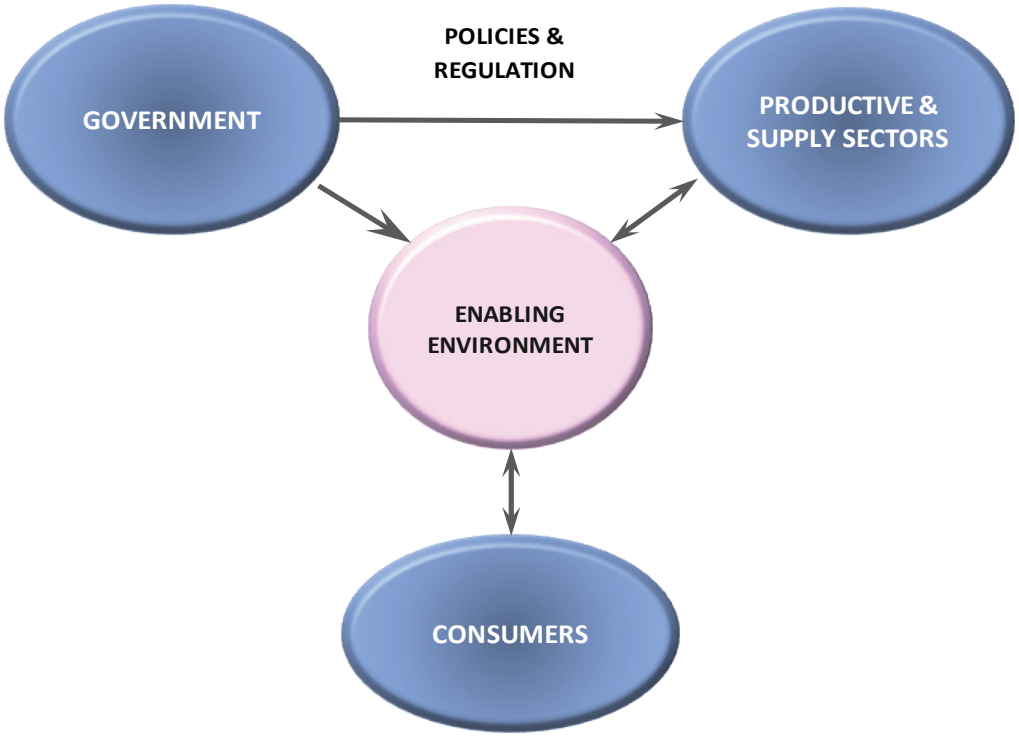


Figure 2: Schematic illustration of a need for an enabling environment to interface with Government, productive and supply sectors, and consumers

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. In particular, for those entities in key value-added chains, the measures include taking coordinated action to respond to the national Green Economy agenda. Consumers, as purchasers of intermediate goods and services, are also implicated in these measures.

Consumers

Consumers can be private, business or government, for whom different instruments and approaches are available to facilitate action. The roles of consumers 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 the source before their collection, and disposing of end-of-life products defined in accordance 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 – to shift 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 energy substitution, resource efficiency, recycling, and (solid, liquid and gaseous) waste management measures that have been adopted, the Republic of Kazakhstan's economy bears an uncomfortably close resemblance to the linear model.

Circular Economy

In contrast, as indicated in Figure 3 and Annex D, 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 production, and until the end of its useful life. It involves all sectors of the economy, for instance:

- **Primary sectors:** agriculture, forestry, fisheries, water abstraction/extraction, 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, 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, the hospitality sector, private transport, all users of goods and services in all sectors irrespective of their being produced in-country or imported, and all external users of goods and services exported from Kazakhstan[3]

3 See Annex B of the long version of the SCP Action Plan.

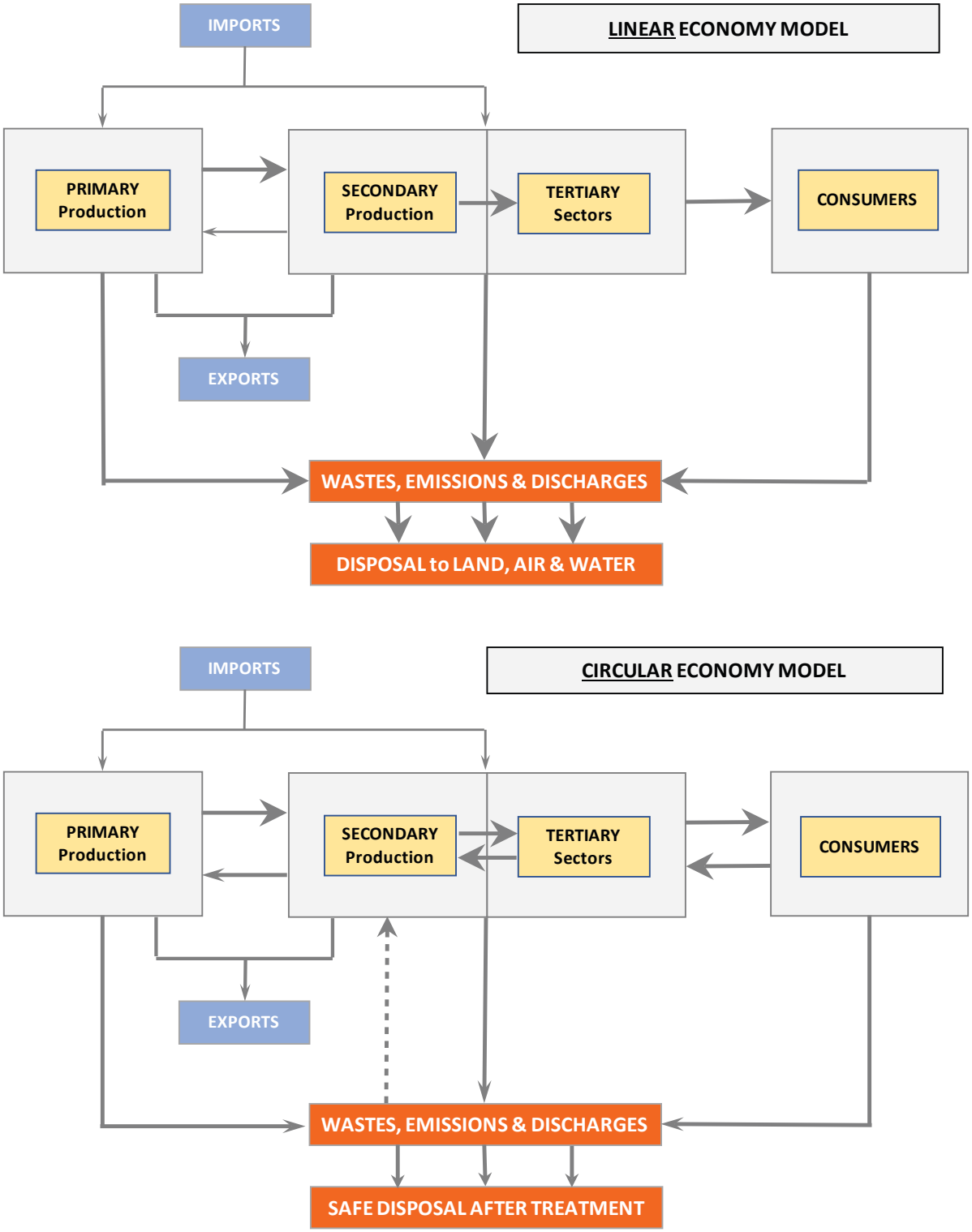


Fig. 3. Simplified schematic illustration of the differences between linear and circular economies

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**, which is a key concept within the EU's Green Deal.[4] **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

4 See Annex B of the long version of the SCP Action Plan.

- Minimising greenhouse gas (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 fewer GHGs, although it does not entirely 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 along with their biodiversity

- Adapting agricultural practices to minimise, where elimination is not feasible, the use of inorganic nitrogenous and phosphate fertilisers, pesticides and other chemicals; minimising emissions to air from arable cultivation, animal manures management, and crop residues management; and minimising, reusing or recycling agricultural solid wastes

- Minimising all food wastes downstream of agricultural production and, where feasible, recovering and recycling them. 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 fertiliser in agriculture

- Designing all material products and packaging through applying the principles of sustainable production as embodied in the examples of 'Circularity' noted in section 1.1 and Annex B.1., along with 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 within Kazakhstan.

Figure 4 shows an alternative visualisation of a Circular Economy, commonly referred to as a 'Butterfly Diagram', developed by the Ellen MacArthur Foundation.[5] 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.[6]

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.

5 https://ellenmacarthurfoundation.org/circular-economy-diagram
6 https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview

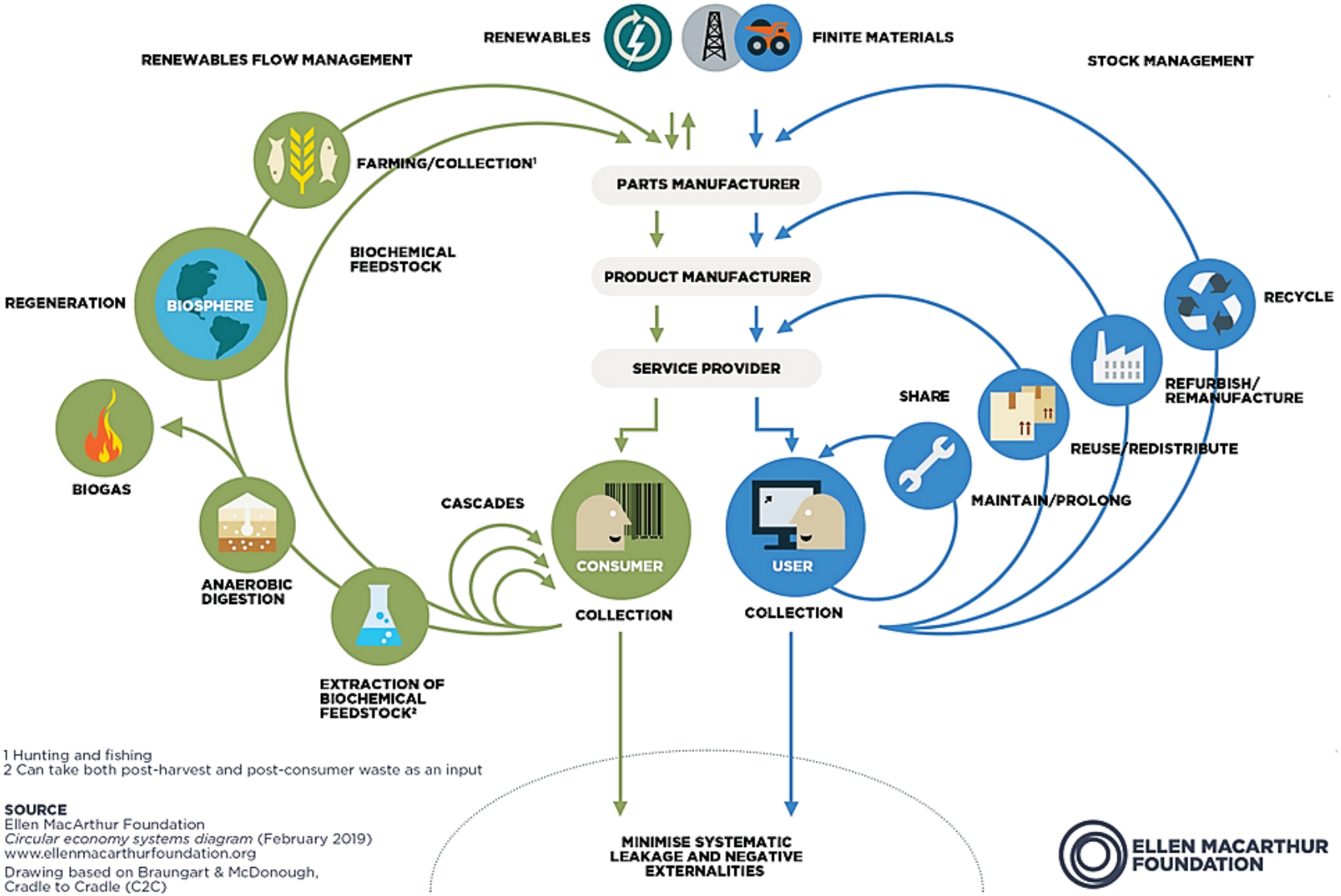


Figure 4: Butterfly Diagram' Visualisation of a Circular Economy

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.

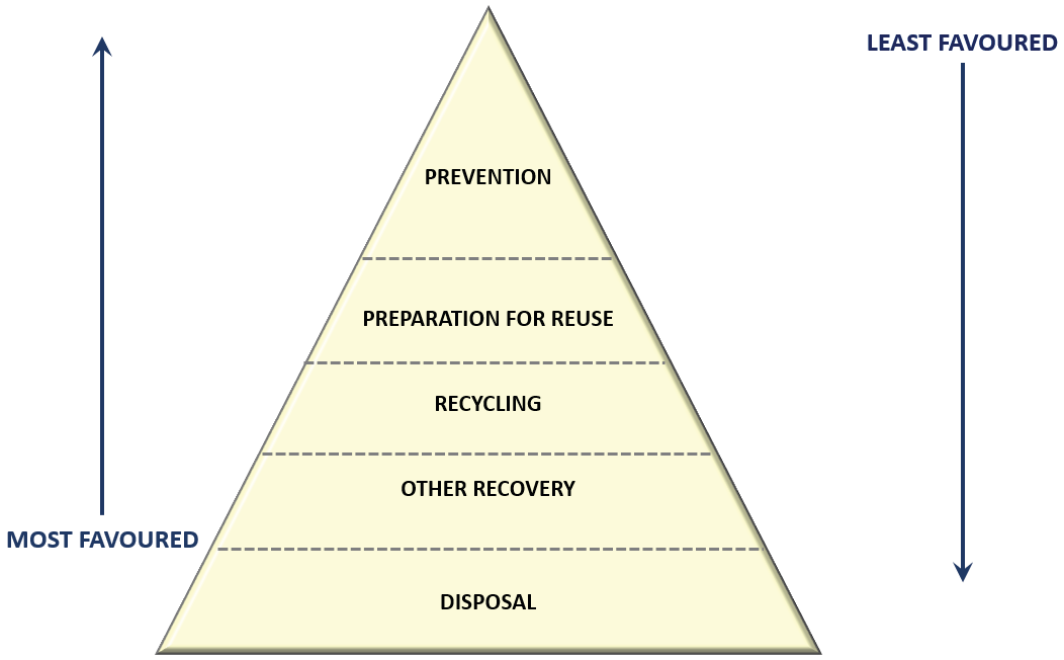


Figure 5: Waste Management Hierarchy

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, and in particular, Article 4:

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.[7]

7 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0098

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 of Goal	Examples of Contributing Policies
The link between national economic growth and resource consumption/waste generation is broken	Broaden the national Green Economy Concept (GEC) 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' - introduction of '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, 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 - setting a mandatory requirement that public sector bodies adopt minimum 'Green Public Procurement' criteria - introducing CE practices in best available techniques (BAT) reference documents
	Broaden the national Green Economy Concept (GEC) to embrace the 'Less Waste, More Value' component of the EU's CEAP, to include: - creation of a well-functioning market for secondary raw materials, including the export of high-grade recovered/recycled materials to product-producing countries - mandatory at-source separation 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 exploring 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 Concept (GEC) 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, their analysis, reporting and time-bound review

Example of 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 Concept (GEC) 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 publicising progress in achieving these targets - setting national targets for renewable energy use as a share of the total energy consumption, and publicising progress in achieving these targets - committing to gasification to replace coal as the source of energy for electricity generation and residential heating, while 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 fewer GHG emissions are generated.
	Establish an appropriate set of stage-based Target Indicators to track progress, and systems to collect the necessary data, their analysis, reporting and time-bound review
Urban ambient air quality to satisfy World Health Organization (WHO) recommended limit values by 2050	Broaden the national Green Economy Concept (GEC) 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 air quality management (AQP) emissions - committing to the preparation of a National Air Pollution Control Plan (NAPCP) in line with 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 (and restricting imports prior to that date)
	Establish an appropriate set of stage-based Target Indicators to track progress, and systems to collect the necessary data, their analysis, reporting and time-bound review
The water demands of the general public and of the nation's productive sectors are met while at the same time 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 concept, to include: - sustainable quantitative limits set 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 implementing the strategy, tailored where appropriate, in each water basin - committing to explore pricing and financial instruments as a means to reduce net freshwater demand as a component of these national and basin strategies
	Establish an appropriate set of staged Target Indicators to track progress, and systems to collect the necessary data, their analysis, reporting and time-bound 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, while unforeseen regulatory ambiguities and enforcement weaknesses can also be issues. 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 this process requires resources, and maximum use should always be made of existing data-collection systems.

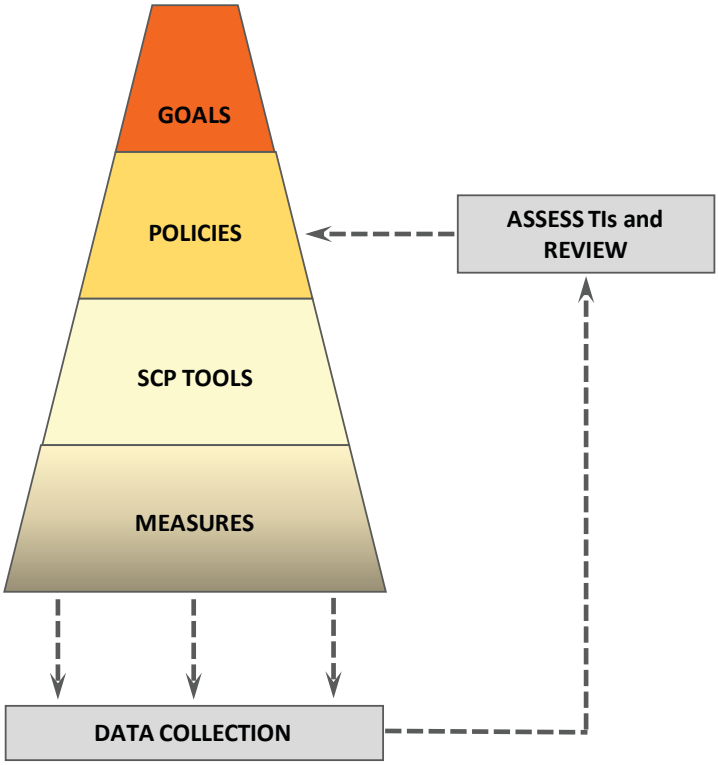


Figure 6: Hierarchy of goals, policies, tools and measures, and monitoring outcomes via Tracking Indicators

The use of tracking indicator/indicators (TIs) can help government and other stakeholders track progress in the achievement of policy goals. Interim, time-bound targets for 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, while Table 2 provides non-exhaustive examples. 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	Prohibit the disposal of biodegradable waste in 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	GHG emissions inventory and projections policy to tool Benchmarking (external and internal) of energy use in processes & operations Energy efficiency audits	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
Measures	Separate wastes at the source and separate collection Install and operate anaerobic digestion and composting plants to process bio-wastes Put the processed bio-waste to beneficial use	All energy efficiency measures Incentivise the generation of renewable energy and its use Production of 'blue' hydrogen from gas Carbon Capture and Storage technology	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

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 may be especially useful. To illustrate the relevance of the various SCP Tools and measures at different stages of a product life-cycle, Table 3 presents a sample of those that are 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. Chapter 3 explores three such value chains – agriculture and agri-products, energy, and metals.

Resources are consumed, and one or several waste streams are generated, at each stage of a value chain. **SCP actions apply to each stage** on these value chain maps. 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: One example – e.g. Agriculture – Considering crop and animal product chains – to show application of some of the SCP tools and measures in a product's life

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-harmful 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 in Republic of Kazakhstan:

1) First is to align its duration to that of the current Green Economy Concept (GEC) Action Plan, and Kazakhstan's commitments to the Sustainable Development Goal SDG12 and other SDG Goals, i.e. to the year 2030. The GEC and SDG commitments are key drivers for a green and circular economy in Kazakhstan. Hence it makes sense to align the SCP Action Plan with them in terms of timescale. Towards the end of the decade the Action Plan could be revised and updated.

2) However, the GEC was adopted in 2013 and could not at that time fully embrace the SCP philosophy. The introduction of SCP into a revision of the GEC, as a contributory means of GEC delivery, thus lay outside the scope of preparing the SCP Action Plan. This linkage is recommended in the current SCP Action Plan. However, the opportunity has been taken to stretch the boundaries for sectoral SCP action beyond that of the current GEC Action Plan, e.g. significant mining and refining activities are included in the SCP Action Plan – see points 6 and 7 below.

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 economic sector in which SCP is to be mainstreamed.

4) While the legislative and regulatory framework has undergone significant development over time, there is always room for improvement and refinement. Policy areas where further Government consideration and action might support the promotion and uptake of SCP are therefore identified in this 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 voluntary SCP action and provide actors with appropriate tools and guidance, therefore, should be regarded as an essential element of an SCP action plan. Its implementation will contribute significantly to strengthening institutional capacity and capability within an enabling environment; its role being complementary to but distinct from that of legislation and regulation.

   The underlying principles for such a role are provided in Chapter 6 as an aid to the Government's determination of an appropriate mechanism and its institutional 'home'.

6) While 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 capacity overstretch. 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. Efforts may then be built-up over time and 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 the current GEC Action Plan, (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 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 landfill, with significant amounts of packaging waste.

Energy (Oil, Gas, Coal) – Mining, Refining, Energy Transformation, and 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, significant sources of the ambient air pollutants ($PM_{2.5}$, NOx, SO_2, NMVOCs) that may contribute to the poor air quality experienced in some cities and urban areas.

Metals – Ore Mining, Smelting and Refining, Metallurgical production: another value chain that is a major source of national wealth but has the potential to cause significant pollution of air, water and land. It is also a major consumer of resources. Relative to the energy value chain, that for ferrous and non-ferrous is shorter since most of the metals produced are exported.

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. Hence 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***, 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 GEC Concept and national SDG commitments. They also reflect some of the EU's Green Deal's priorities.

2.2 SCP Action Plan – Short Version: Signposting and Correlation with Long Version

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 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. Three major value chains are identified: (i) agriculture and agri-products; (ii) the extraction, processing and use of fossil fuels (gas, oil and coal); and (iii) the mining of metal ores, and their processing for export and domestic use. Four cross-sectoral themes are identified: (a) freshwater conservation and efficient use; (b) resources recovery (materials and/or energy) from municipal solid waste; (c) reducing national GHG emissions in response to climate change – requiring action on energy efficiency (resource efficiency cornerstone), adoption of renewable energy sources (substitution cornerstone), and shifting towards a decarbonised energy system in the longer term; and (d) ambient air quality. Table 4 of this Chapter correlates the Long Version with the Abridged Version of the SCP Action Plan.

Chapter 3 addresses three strategic value chains: agriculture and agri-products, energy, and metals. 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 addresses the four major cross-sectoral themes of water saving and efficient water use, recovering resources (materials and energy) from municipal solid waste, mitigating Climate Change - reducing GHG emissions by increasing energy efficiency and using renewable energy sources, and ambient air quality. It summarises the major issues arising in each area and the scope for using SCP to improve resource efficiency and reduce ecological impacts.

Chapter 5 develops the concept of an enabling environment for mainstreaming the SCP approach in strategic value chains and major cross-sectoral themes, an environment in which SCP uptake may flourish. Six elements of an enabling environment are identified: 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 may vary between specific value chains and cross-sector areas, dependent on their characteristics. Their importance is illustrated using resource recovery from municipal solid waste as an exemplar cross-sectoral issue.

Chapter 6 introduces the need for a mechanism to promote and stimulate the adoption of SCP 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. And it points to international experience (summarised in Annex B) illustrating how such mechanisms may evolve over time.

Chapter 7 presents the SCP Action Plan to 2030, derived from the analysis presented in the preceding chapters and the reviews of national and EU policies presented in the Annexes to the Long Version of the SCP Action Plan.

Annex A: introduces and provides brief descriptions of SCP Tools that may be useful.

Annex B summarises the evolution and experience of SCP Support Mechanisms in one OECD state (the UK) and, by way of example, provides indicative Terms of Reference and potential staffing needs.

Annex C indicates the range of infrastructure needed to implement two alternative means of resource recovery from municipal solids wastes, an example to illustrate the operational infrastructure aspect of the enabling environment.

Annex D notes the SDGs and SDG Indicators relevant to SCP.

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

Long Version Content	Transferred to Abridged Version as
Chap. 1: Sustainable Consumption and Production	
Three 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**.
Underlying Principles; and Signposting	Signposting recast to reflect the regrouping of value chains and cross-sectors.
Sect. 2.3 Structural Composition of the Economy	Omitted
Chap. 3: SCP and the Agriculture Value Chain	**Chap. 3**: an abridged version.
Chap. 4: SCP, Water Conservation and Water Efficiency	**Chap. 4**: an abridged version.
Chap. 5: SCP – Resource Recovery from Municipal Solid Waste (MSW)	
Issues Raised in the Green Economy Concept of 2013 and GEAP; Management of MSW and End-of-Life Products; Minimising Solid Waste Generation Rates; and Strengthening of Waste collection and Resource Recovery	**Chap. 4**: an abridged version.
Sect. 5.3 Building Blocks of an Enabling Environment for Resources Recovery	**Chap. 5**: tailored to illustrate the generic role of an enabling environment; and **Annex C**: Comparison of infrastructure requirements for alternative systems.
Chap. 6: SCP and the Energy Value Chain	
Sect. 6.1 to 6.5: Scope; Mineral Oil and Natural Gas; Coal Mining; Power and Heat Generation – Coal and Gas-Fuelled Large Combustion Plants	**Chap. 3**: an abridged version.
Sect. 6.6 to 6.8: Energy Efficiency; Renewable Energy; Ambient Air Quality	**Chap. 4**: an abridged version.
Chap. 7: SCP and the Metals Value Chain	**Chap. 3**: an abridged version.
Chap. 8: A Mechanism to Stimulate SCP Uptake is Needed	**Chap. 6**.
Chap. 9: SCP Action Plan: 2022-2030	**Chap. 7**: Text and Tables restructured, and Figure recast, to better reflect the three-pronged Action Plan
Annex A: National Policies, Regulations and International Commitments Relevant to the Republic of Kazakhstan's Green Economy Action Plan (GEAP)	Omitted
Annex B: Comparative Analysis of Priorities – the EU's Circular Economy Action Plan and the Republic of Kazakhstan's GEAP	Omitted
Annex C: UN Sustainable Development Goals Relevant to SCP	**Annex D**
Annex D: International Experience of SCP Support Mechanisms & Illustrative ToR	**Annex B**

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
- 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 affected stakeholders, informing them of the reasons why action is necessary. Environmental issues arising in each stage or step also may also be 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 the sector's range and complexity and its many discrete steps. Neither fishing nor forestry are shown in the value chain, since the significance of these activities is local rather than national, even though the principles outlined below apply to both. Broadly speaking, each step 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

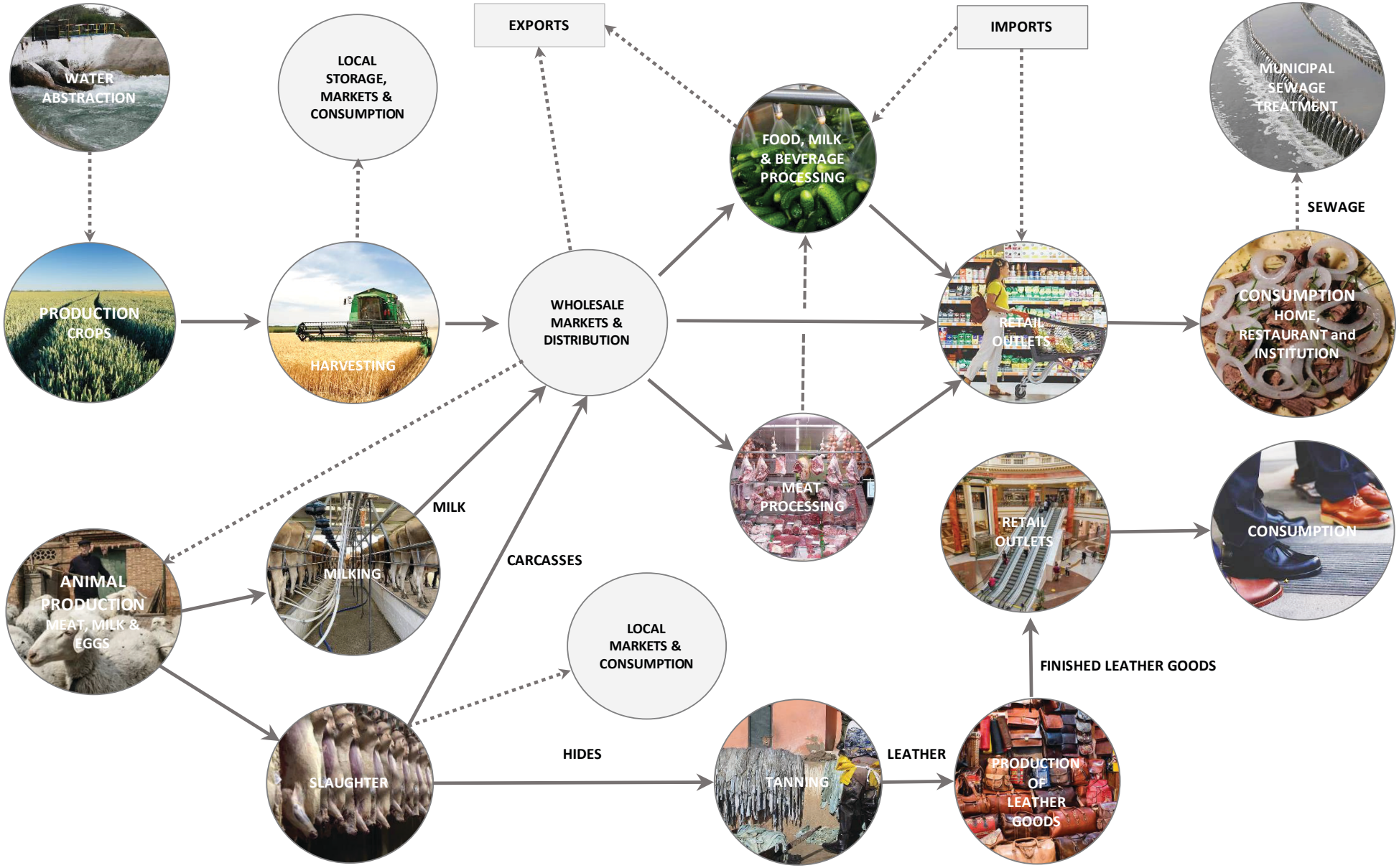


Figure 7: Mapping of the Product Chains for Agriculture, Agriculturally-Derived Products, and Consumption

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.[8]

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.

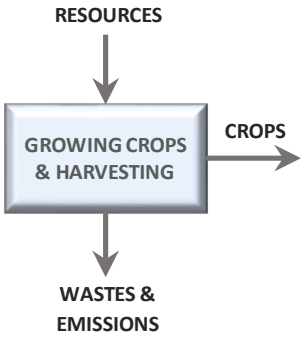
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
CROP PRODUCTION					
	Water	R		C	Crop spoilage – food waste
	Fertilisers – N and P	R	S	C	Crop residues
	Pesticides and herbicides	R	S	C	Emissions to air
	Seeds		S	C	Discharge to surface water & groundwater

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 8 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.[9]
- *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 – and, potentially, the leaching of nitrates into soils and surface waters. While 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, if applied to the surfaces of growing fruit and vegetables for example, 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.

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

9 Most of Kazakhstan's rivers are transboundary. The freshwater demands of countries in which the headwaters of these rivers lie is an issue that Kazakhstan cannot directly control. Hence, exacerbating the pressures faced in Kazakhstan.

Additionally, solid wastes are generated:

- *Post-harvest crop residues*: following the ban on field burning in 2020,[10] these should be managed in an ecologically sound manner, though for farmers 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.[11] 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 while 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 while 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.

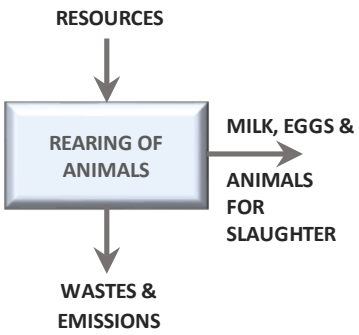
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
(HOUSED) ANIMAL REARING					
	Food – including additives	R	S	C	Manure – faeces & urine, bedding
	Water – drinking, cleaning	R			Emissions to air – ammonia, methane
	Bedding	R	S	C	Wastewater
	Energy – ventilation, heat	R			

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.[12] 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.[13] 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 if operations are conducted close to inhabited areas. Manures need to be collected, treated and

10 Order of the Minister of Agriculture of the Republic of Kazakhstan dated January 17, 2020, No.7.

11 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.

12 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.

13 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.

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. While 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 while 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
- *'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[14] 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[15]
  - *Organic farming*: seeks, among 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.[16] 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

Animal Rearing

Adopting an SCP approach in animal rearing involves, among other things: (i) adopting good practice to manage the nitrogen cycle in a holistic manner[17] (ii) minimising GHG emissions, and (iii) appropriate management of the wastewaters generated:

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

15 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

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

17 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.

- *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[18] 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

    (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[19]

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.

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.[20] 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.

18 Ammonia emissions in the animal housing may be treated by supplying vented air to the biogas burners.
19 Where climatic factors prevent such operations, it may be necessary to develop alternative good practice approaches.
20 https://eippcb.jrc.ec.europa.eu/reference/slaughterhouses-and-animals-products-industries

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.

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

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:

- 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 – wines and other brewing liquors to make brandy, vodka and other high-strength liquors
- Freezing of meat, vegetables and fruits for sale
- Meat processing, e.g. to make mince, sausages, etc.
- Milling of cereal grains
- Packaging (primary and secondary) of foods and beverages
- Pet food production
- Pickling of vegetables, mushrooms 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: [21]

  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); while some may be used as an indirect coolant, the spent coolant being relatively uncontaminated. While 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.

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.

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

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.[22]

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[23], and of applicable BAT, but is over 270 pages long.[24] 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.[25]

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.

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22 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.

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

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

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

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 among 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.

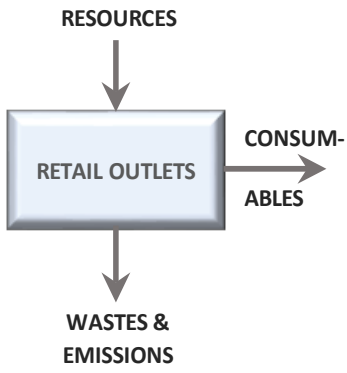
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
RETAIL OUTLETS					
	Foodstuffs etc.	R		C	Food wastes
	Packaging	R	S	C	Packaging wastes
	Energy – heating, chilling, freezing, lighting, etc.	R	S	C	Other solid wastes including used lamps & other equipment
	Water	R			Emissions to air – including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

While 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. While 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.[26] 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.[27] 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.[28] 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.
  - 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

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

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

28 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.

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:

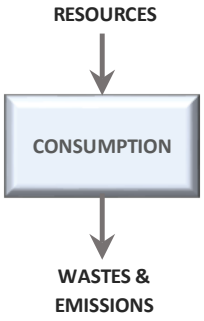
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
CONSUMPTION					
	Foodstuffs including beverages	R			Food wastes
	Energy – cooking, heating, chilling, freezing	R	S		Packaging wastes
	Appliances – cooking, chilling, freezing	R	S	C	Wastewater
	Water – cooking, cleaning	R			Emissions – direct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

By-products of animal rearing, leather products having reached the end of their useful lives 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 are 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, MWTPs 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. But 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.[29]
  - 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 and nutrients (nitrogen and phosphorus) in agricultural crop production and on pasture.[30] Anaerobic treatment is one such treatment, producing biogas which may be used as a renewable energy source. 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

29 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.

30 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.

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 in Kazakhstan. 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.

3.2 Energy Value Chain

Figure 14 indicates the extent of the energy value chain, omitting the production of nitrogenous from natural gas. In the EU, regulation of most such extractive and large-scale activity applies BAT principles, as published by the European Commission (Table 5). Integral to SCP practice in the primary and secondary stages of the value chain, the BAT documents provide a comprehensive set of measures to prevent waste and pollution, and achieve high resource efficiency. The International Green Technologies & Investment Projects Centre (IGTIPC) is currently engaged in producing tailored versions of these documents.

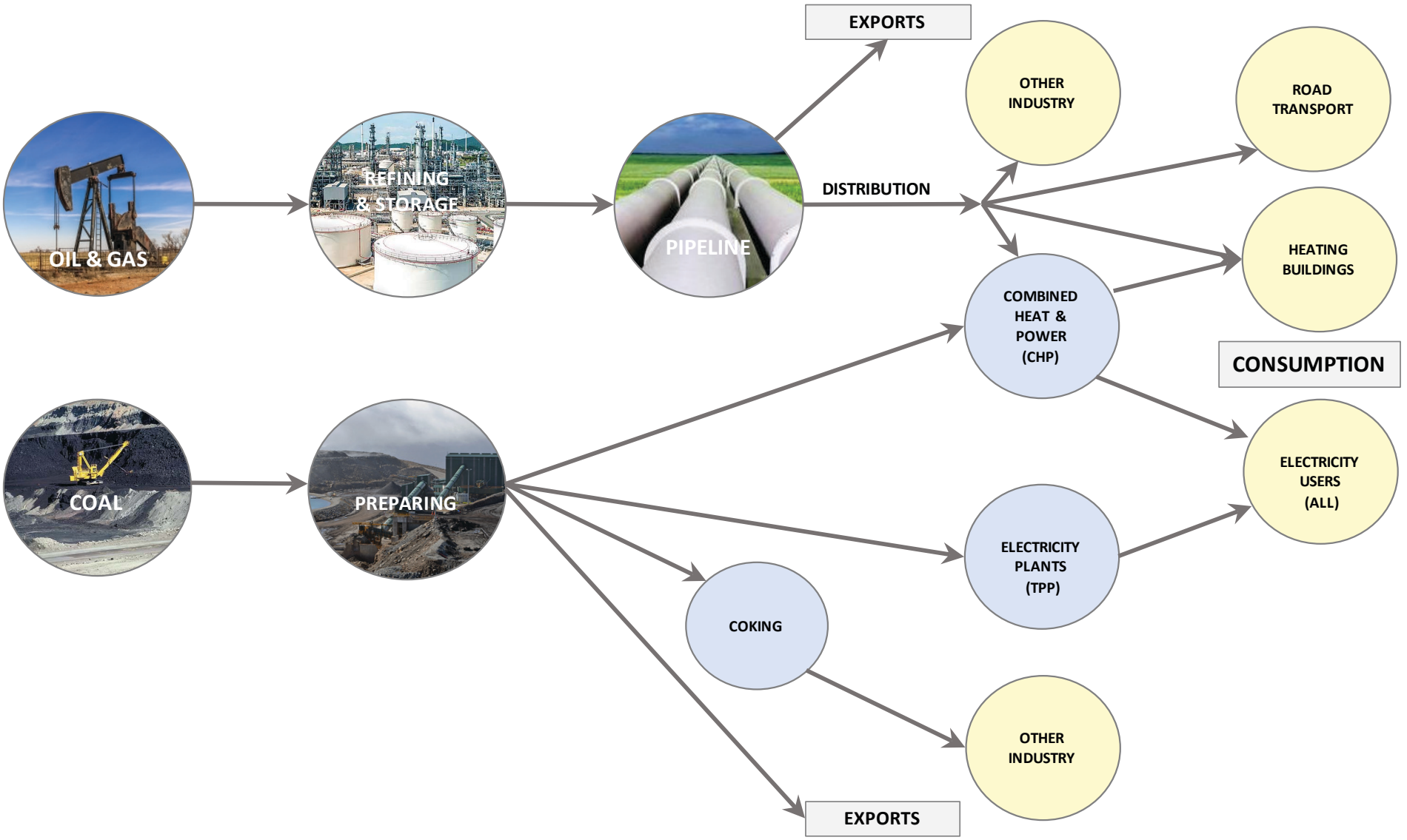


Figure 14: Simplified Mapping of the Energy Value Chain

Table 5: Latest Versions of the BAT Guidance and Reference Documents Published by the European Commission[31]

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

The extraction, refining, and large-scale combustion of mineral oil (petroleum), natural gas and coal – in parallel with legacy issues and associated inefficiencies in energy use in the power, heating, road transport and other sectors – makes a significant contribution to the relatively high level of national per capita GHG emissions. Also, to substantial environmental damage in terms of degraded land, water pollution, air pollutant emissions and air pollution. SCP applied to the reduction of GHG and air pollutant emissions from energy use is considered in Chapter 4.

Petroleum (Mineral Oil) and Natural Gas

Exploration and Extraction

The BAT 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 that impact the environment. It suggests a risk-based approach to address the issues and identifies BAT for each. Having an organisational Health Safety and Environment (HSE) management System is a recommendation that is common to most. The issues identified are:

- Management of drilling muds and drill cuttings including treatment, recycling and disposal
- Handling and storage of chemicals
- Handling and storage of hydrocarbons
- Energy efficiency; recommending a whole of field-life approach to energy management (based on life-cycle analysis)
- Flaring and venting of gases
- Fugitive emissions (to air)
- Management of production water arising in the hydrocarbon reservoir and from the use of chemicals at the production facility
- Management of drainage water arising from spillages, process and other systems
- Facility decommissioning and aftercare
- Environmental monitoring

It is understood that the activities in this sector are among those for which the IGTIPC is preparing BAT documents tailored to the Kazakh situation. Once adopted, the relevant BAT documents should form the basis for setting future exploration and operational permits and ensuring that permit conditions are applied and complied with.

Refining

Energy efficiency is a salient issue for refinery operation. Other important issues are the emissions to air of GHGs, volatile organic substances, nitrogen oxides, sulphur oxides, ammonia, carbon monoxide, dust and many other substances; the release to water of oil, benzene, and heavy metals etc.; and the prevention of emissions to soil and groundwater.

The EC's BAT Reference Document for the refining of mineral oil and gas addresses all significant refinery processes, and the tailored version being prepared by the IGTIPC ought to form a firm basis for embedding SCP in this stage of the value chain, enabling refinery permit conditions to be set, enforced and complied with in future.

31 All BAT Reference documents referred to in the table, and others, are available from: https://eippcb.jrc.ec.europa.eu/reference/

Coal Mining

Kazakhstan has enormous coal reserves, fuelling all of Kazakhstan's thermal power generation plants (TPP), and most of the combined heat and power plants (CHP), to date. The Green Economy Action Plan to 2030 (action No. 33), however, calls for a transition to natural gas fired CHPs in Nur-Sultan, Almaty and Shymkent.

Issues associated with surface mining include large-scale land use, overburden removal and disposal, disturbance of hydrology, acid mine drainage and fugitive dust emissions. The dumping of overburden in piles around the mines results in its exposure to the weather and to air.[32] Acid mine drainage arising from the oxidation of pyrite (iron sulphide) and other sulphides exposed to air can give rise to chronic and substantial pollution.

As both UNECE and Alimbev *et al*[33] have recommended, preventive measures are needed in addition to mitigation. Operators therefore should be required to prepare comprehensive assessments of the potential environmental impact of coal mining – and plan and implement programmes for minimising those impacts. BAT Reference documents prepared by IGTIPC should be formulated to provide guidance to operators on how to prevent and minimise the impacts of coal mining in Kazakh conditions. To be effective, though, it may be necessary to extend the scope of such documentation beyond that of the EU's BAT Reference for the Management of Waste from Extractive Industries.

Power and Heat Generation – Coal and Gas-Fuelled Large Combustion Plants

A mix of energy sources is used to generate electricity and hot water; predominantly coal, natural gas, hydro and, more recently, solar and wind. Figure 15 provides an approximate distribution in installed capacity (MW) by installation type in Kazakhstan, although it likely underestimates the installed renewables capacity. All the thermal power plants, and almost all installed CHP plant capacity, are at or exceed the 50 MWth Large Combustion Plant threshold capacity for their regulation[34] through BAT in the EU.

Unless designed and operated to high environmental standards – embodied in BAT – such installations can emit substantial quantities of air pollutants to air. Of principal concern for air quality and human health are $PM_{2.5}$, PM_{10}, SO_2, and NOx – but there are others. IGTIPC'S preparation of BAT documents tailored to national conditions should set a firm basis for the adoption of SCP in this sector.

Looking longer term, the dominance of fossil fuels in the generation of heat and power may be questionable for achieving a goal of Net-Zero GHG emissions. Policy will need strengthening in areas such as:

- The potential for increasing the power-generation role of solar and wind energy – at present there are just two significant installations and the scope for expansion could be significant. In addition to centralised installations, the adoption of small-scale (solar, especially) units on residential housing, apartment blocks, institutions etc. – should also be considered, for which incentive schemes to catalyse adoption could be designed.
- The necessity for energy storage to help navigate the peaks and troughs of renewable energy supply, and other supply disruptions. Developments in the fast-moving renewable energy supply field should be monitored and fed into ongoing policy development.
- Adoption of nuclear power generation capacity – as the producer of about 40% of the world's uranium, this would seem to be a sensible way forward so long as the installation or installations is designed and operated to high safety and environmental standards.
- In the medium-long term, for Kazakhstan to meet its Net-Zero commitments while also using fossil fuels for large-scale power and heat generation, it is likely that carbon-capture technology will be needed. A close watch, therefore, should be kept on developments to prove the practical and economic status of such technology at full-scale.
- The potential role that may be played by biogas generated in the anaerobic digestion of farm wastes and MSW 'wet wastes'. Though locally useful, the surplus energy may be relatively small after meeting process heating needs.
- Developments in energy efficiency in multiple areas of the economy, which will act to reduce the demand for power and heat and, in turn, reduced emissions to air of both GHGs and air pollutants.

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32 UNECE. Environmental Performance Reviews – Kazakhstan, Third Review, Highlights. Available at: https://unece.org/DAM/env/epr/epr_studies/Leaflet/Highlights_3rd_EPR_Kazakhstan.pdf. See also, T. A. Alimbev et al (2019), Environmental problems in the Kazakhstan coal industry and their solutions, IOP Conf. Ser.: Mater. Sci. Eng. 663 012041: https://www.researchgate.net/publication/337610602_Environmental_problems_in_the_Kazakhstan_coal_industry_and_their_solutions

33 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

34 Industrial Emissions Directive (IED), Directive 2010/75/EU of the European Parliament and the Council. The rules of its application are under revision – see https://ec.europa.eu/commission/presscorner/detail/en/QANDA_22_2239 - to align the Directive's application more closely with the EU's Green Deal.

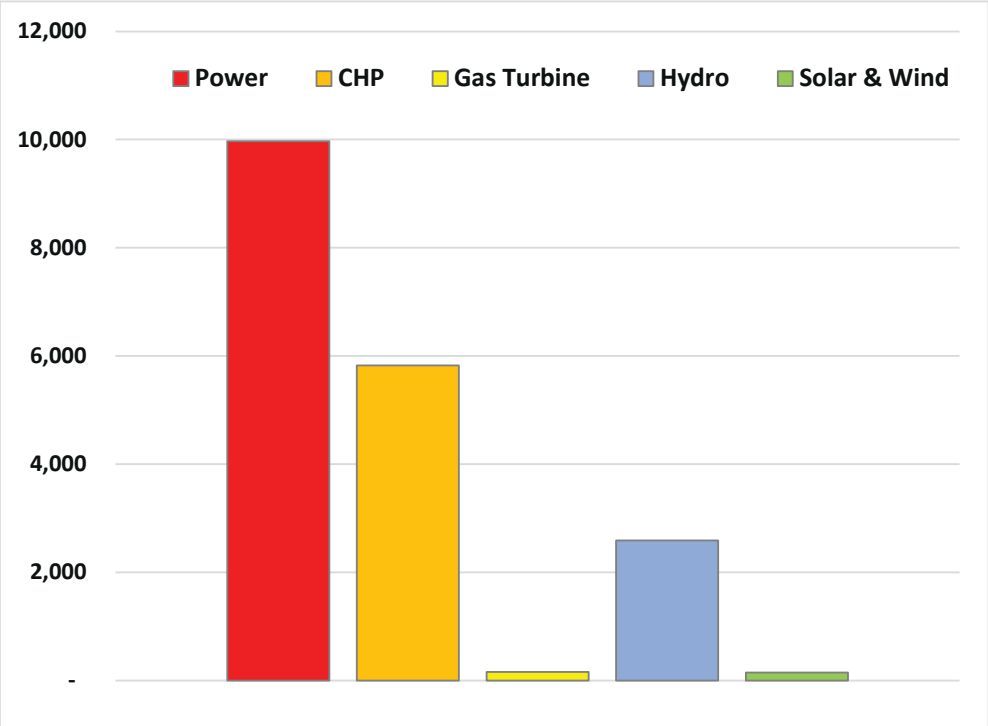

Figure 15: Approximate Distribution of Installed Generating Capacity (MW) by Type

Future Considerations

In the short-to-medium term, the adoption and implementation of international good and best practices in the exploration, extraction and processing of oil, gas and coal is the right way to go regarding SCP. But looking further ahead to a potentially very different future is also recommended. With most countries of Europe committed to net zero GHG emissions by 2050, for instance, Europe's delivery on that commitment could change the nature and geographical focus of demand quite considerably in the medium-to-longer term.

Such developments, in Europe and elsewhere, could transform the energy value chain in future. This observation should not be taken as negative for the future exploitation of Kazakhstan's very significant energy reserves, but it would have substantial implications. For the transformation of extracted fossil fuels, their decarbonisation – generation of 'blue' hydrogen for instance, and for ancillary processing.

It is suggested, therefore, that the Government considers the policy and investment implications for Kazakhstan of a world in which the decarbonisation of energy supply and its use becomes substantial reality and not just a goal. And, based on its analysis and deliberations, to take appropriate policy decisions and other actions.

3.4 Metals Value Chain

Scope of The Value Chain

The mining of metallic ores and their downstream processing are extensive and economically significant. However, mining and processing are responsible for substantial damage in terms of degraded land, accumulated rock and spoil waste, water pollution, and significant GHG and air pollutant emissions to air. The metals value chain is indicated schematically in Figure 16.

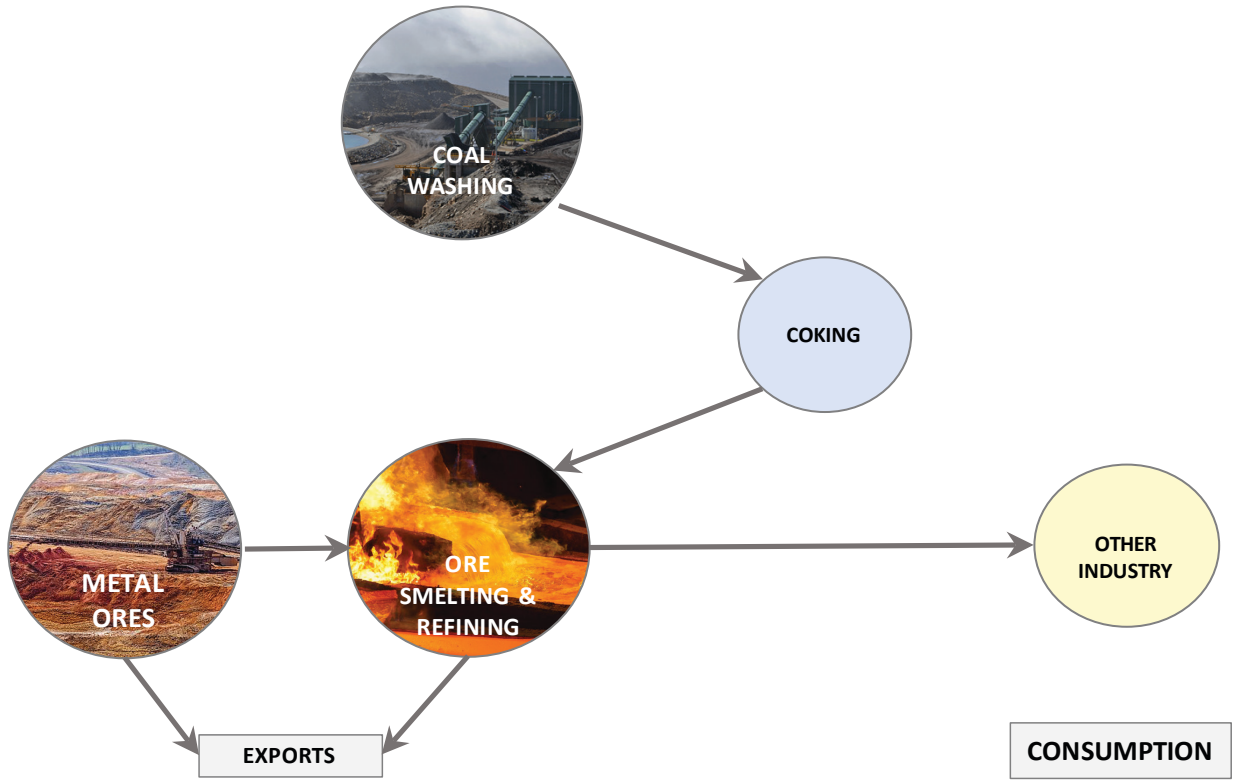

Figure 16: Simplified Mapping of the Metals Value Chain

Much product is exported and producers and exporters might be wise to consider the pressures faced by importers and their requirements. These could include the energy consumption and GHG emissions associated with imported materials and goods. In future years, for instance, it is possible that the EU may impose a carbon border tax on imports to the EU as a part of its Net Zero climate change policy component in the Green Deal.

Metal Ores Mining and Refining

The extractive and processing activities indicated above are the subject of BAT Guidance and Reference documents published by the European Commission (Table 6), which IGTIPC is tailoring to national conditions. As in the energy value chain, this tailored BAT documentation is integral to introducing SCP into the metals value chain in the near-to-medium future.

Table 6: Latest Versions of the BAT Guidance and Reference Documents Published by the European Commission[35]

Sector	BAT Document Title	Publication Year
Extractive Industries	Reference for the Management of Waste from Extractive Industries	2018
Processing & Transformation	Reference for Iron and Steel Production	2013
	Reference for the Ferrous Metals Processing Industry (Final Draft)	2021
	Reference for the Non-Ferrous Metals Industries	2017
	Reference for Smitheries and Foundries[36]	2005

Consequently, the SCP Action Plan for the metals value chain focuses on the medium-term preparation and roll-out of relevant BAT Reference documents, and their implementation.

35 All the BAT Reference documents referred to in the table are available from: https://eippcb.jrc.ec.europa.eu/reference/

36 Under review, the report of the kick-off meeting held in the autumn of 2019 for the revision of the Smitheries and Foundries BAT Reference Document is available here: https://eippcb.jrc.ec.europa.eu/reference/intensive-rearing-poultry-or-pigs-0.

Metal Working and Engineering Sectors

The engineering sector in Kazakhstan includes the manufacture of some electrical equipment, machinery, vehicles and trailers. However, considering the 11-month period January to November 2021, its economic value is small compared to ore mining and metallurgical processing.[37] Hence, specific SCP actions are not proposed at this time. The recommended preparation of a thematic strategy concerning the metals value chain would provide a future opportunity to revisit this sub-sector and develop appropriate SCP actions. Energy efficiency, emissions to air, solid waste management and recycling are among the SCP issues that could be addressed in a future strategy (Chapter 7), building on the recommended cross-sectoral activity.

For instance, there may be an opportunity to develop economic activity this sector in the short-to-medium term through the dismantling and preparation of end-of life products such as vehicles, electrical and electronic appliances, etc. in the waste management sector (Chapters 4 and 5).

37 Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, Bureau of National statistics (January-November 2021), Socio-economic development of the Republic of Kazakhstan - Statistical Bulletin

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, should therefore be complementary to each other. Figure 17 illustrates the concept of overlap, 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 therefore needed to bring about a reduction 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
- *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

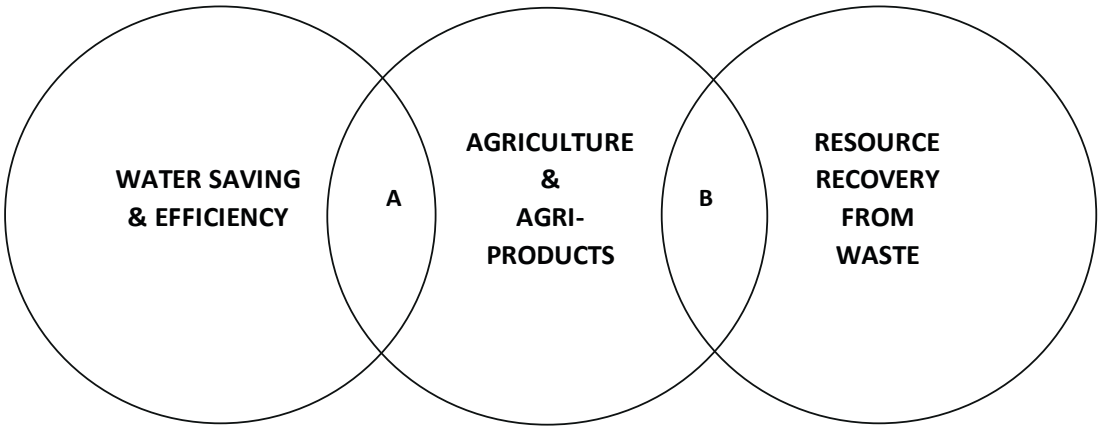

Figure 17: Examples illustrating the overlaps that may occur between value chain and cross-sectoral SCP

Hence a pragmatic approach is required when promoting SCP. For instance, generic SCP may be promoted in a cross-sectoral area, such as water, while 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

Background

The Republic of Kazakhstan's Green Economy Concept (GEC) of 2013 cited the address of the President in *Strategy Kazakhstan 2050* in which sustainable water use was described as a critical issue for the Nation. The GEC indicated the levels of water saving that could be expected from implementing measures in the agricultural, industrial and public supply (municipal) sectors, projecting they would be sufficient to meet the

estimated gap between demand and supply (under conditions of business as usual) in 2030. At a national level the agricultural sector accounts for over two-thirds of Kazakhstan's freshwater consumption, hence most of the looked-for savings would naturally be in this sector. Chapter 3 of the present document emphasised the significance of water consumption as an issue for the agricultural value chain and indicated relevant SCP tools and measures to help address it.

Hence this section of the present Chapter focuses on the cross-sectoral application of SCP to conserving water and its efficient use in other sectors of the economy: industrial production, water distribution networks, other commercial activities, and in institutions and households.

SCP Applied to Water Conservation and Efficiency in Industrial Production

Water is used extensively for heating and cooling duties and in numerous process applications in the energy and metals sectors including:

- Oil and gas refining
- Coal washing
- Large combustion plants generating heat, steam and electricity
- Coke production and refining/treating the off-gases
- Metal ore processing – its concentration, smelting, and subsequent refining
- Other metallurgical processes

In the EU the application of BAT principles in these sectors is obligatory, including the adoption of good practice techniques for water conservation and water efficiency. While in Kazakhstan the 2019 revision of the Environmental Code has strengthened the national provisions for the introduction of BAT-based integrated permitting, to be coordinated by the IGTIPC. The Centre plans to develop a number of BAT Reference Documents over five years, the first permits to be issued towards the late 2020s: large combustion plants have been assigned a high priority.[38] Many of the SCP tools introduced in Annex A may be applied in efforts to achieve water savings and increased water efficiency.

An SCP Support Mechanism[39] could help to promote and facilitate the introduction of such techniques in the heavy industrial sectors subject to BAT. However, the pricing of water – assuming consumption is metered and paid for – is a primary driver of voluntary action. If water is undervalued its cost may appear too low to warrant investments in measures to improve water efficiency. Financial incentives, such as tax breaks, also contribute a 'pull-factor', acting to encourage investment in water conservation and efficiency. They are likely to be effective only when the price of water is such that its use is a significant production cost.

SCP Applied to Water Conservation and Efficiency in Distribution Networks

Referring to the waste hierarchy noted in Chapter 1 and the principle that waste prevention is the first option that should be considered in a waste reduction strategy, minimising leakage from distribution systems should be a strategic priority. This requires effective metering of the water supplied to such 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.[40]

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38 Marit Hjort (May 2019), 'BAT Approaches Around the World'. Workshop to Promote the Ratification of Technical Protocols of the UNECE Air Convention with Focus on Countries in the EECCA Region. OECD Better Policies for Better Lives. https://unece.org/fileadmin/DAM/env/documents/2019/AIR/Capacity_Building/BAT_workshop_2019/1_3_OECD_BATproject_Hjort.pdf

39 The principles on which a mechanism ought to be based are presented in Chapter 8. The appropriate host and scope of action is for Government to decide, but the International Green Technologies and Investments Centre could play a role in helping to promote the SCP approach in the energy and heavy industrial production sector.

40 References. 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

SCP Applied to Water Conservation and Efficiency in Other Commercial Activities

As noted above, water pricing and financial incentives can be powerful 'push and pull' factors, respectively, to stimulate investment in water conservation and efficiency measures. These mechanisms are applicable to the management of water demand wherever water consumption is metered and paid for.

Apart from its use in major processes in heavy industrial and energy production installations, and in food and beverage production, water is used in a wide range of commercial and associated activities in the secondary and tertiary economic sectors: e.g. for cleaning floors and other surfaces; as a heating and cooling agent; in processing operations; watering commercial green spaces; vehicle and clothes washing; and for sanitary purposes. Many of the SCP tools and techniques introduced in Annex A may be applied to help identify the scope for water savings, raised efficiency, and effective measures.

Generic measures to reduce water consumption and improve water use efficiency may be identified through consulting good practice publications, while 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.

SCP Applied to Water Conservation and Efficiency in Institutions and Households

A wide range of institutional settings use water: hospitals; educational establishments – kindergartens, schools, universities, etc.; research and development institutes; public offices, governmental and others; swimming pools; bathrooms for public use; watering of public roads (dust suppression) and green open spaces; ornamental water fountains; and so on.

Improving the efficiency of water use and reducing the net water consumption in institutional and household settings involves the same spectrum of SCP tools and measures noted above, though only the simpler measures will be appropriate for households. Effective communication is essential. Both to raise household awareness on water saving and to inform them of the practical steps they can take while maintaining hygiene and a good standard of living.

4.3 Resource Recovery from Municipal Solid Waste

Issues Raised in the Green Economy Concept of 2013 and GEAP

The Green Economy Concept of 2013 repeated some well-known, long-standing issues concerning (solid) waste management in Kazakhstan, several of which continue to be problematic, including the status of systems for managing the municipal solid waste (MSW) generated by households, commerce and institutions: Specific issues include:

- Waste volumes expected to grow 50% by 2025, in line with economic growth (GDP)
- Low collection rates, typically about 25%, outside of the main cities
- Low rate of processing and recycling of the collected wastes, the provision of at-source waste separation being patchy and poorly developed
- Transfer and disposal of collected waste to uncontrolled dumps and substandard authorised landfill sites
- Inadequate cost-recovery, leading to financing levels that leave municipal waste management systems starved of investment and operational funds[42]

The current GEAP (Green Economy Action Plan, 2021–2030) contains eight actions to improve MSW management. But without effectively addressing the financing issue highlighted above, it is hard to see how MSW management can be upgraded sustainably. Adequate operational funding and investment finance is one of the components of an enabling environment (see Chapter 5) needed for effective SCP application. This applies to all areas of SCP application but is particularly relevant to the recovery of resources from MSW. Nor does the GEAP identify **specific** measures to reduce the rate of increase in MSW generation (decoupling this from GDP growth); or to implement at source separation and collection of end-of-life products to increase the rate of effective recycling (resource efficiency).

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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 The EU funded project 'Environmental Policy Instruments' in 2009-2010 identified financing and costs recovery as a major issue.

The current GEAP does not address the ongoing management of mining, processing and heavy-industry wastes but the introduction of BAT in the mining, processing and heavy-industry sectors and its enforcement in the near-medium term future may remedy this (see Chapter 3).

Management of MSW and End-of-Life Products

The Green Economy Concept 2013 noted that MSW generation was forecast to grow by over 50% from 3.6 million tons in 2011 to 5.6 million tons in 2025, but gave no information on the volumes of ELP (End-of-Life Product) waste generated in the Republic or on how these waste streams are managed. It is probable that many ELPs such as textiles and small batteries are disposed of with collected MSW. How the many other ELPs are disposed of – such as vehicles, vehicle tyres, batteries embedded in vehicles and electronic equipment, freezers and refrigerators, computers, printers, scanners, televisions, washing machines, light fittings, and other waste electronic equipment collectively referred to as WEE – is unclear.

In a circular economy, the materials embedded in the ELPs noted are recovered to a maximal extent and returned to the production sectors for processing and the manufacture of new products. Many of the materials concerned have significant economic value and/or are hazardous to some extent. Regarding ELPs as waste to be disposed of ignores this economic value and the depletion of Natural Capital[43], epitomising a linear, 'use-throw away' economy. Adoption of an SCP and a Circular Economy approach to stimulate at-source waste separation, material recovery and recycling is an essential aspect of a modern system for managing MSW and end-of-life products (ELP).

Similarly, food wastes and other wet wastes generated in production and consumption at present are mostly disposed of untreated to land as waste, ignoring their potential economic value and the GHG emissions arising from their disposal. Strengthening of the enabling environment, enabling SCP to flourish, is needed to transform current practice.

Minimising Solid Waste Generation Rates

A goal of producers, importers and suppliers should be to minimise the quantity of materials used to make and package products for supply to retailers and consumers, while retaining product quality. Producers ought to do this for financial reasons, in any case, though it might be necessary to raise their awareness of the potential for cost savings and higher profits.

Extended Producer Responsibility policies could strengthen the obligations placed on producers, importers and suppliers by, for instance, requiring that products placed on the market are repairable, thus extending their useful product lives. And by requiring that products must be capable of being dismantled once they have reached the end of their useful lives. Both requirements would reduce waste generation and enable material recovery.

By a change in their behaviour – stimulated through effective communication – consumers also may exert direct and indirect influence on the rates of waste generation. For instance:

Directly, by

- Ensuring effective maintenance and repair of products, so extending their useful lives
- Not throwing away products that remain fit for purpose
- Passing on unwanted, but still-serviceable, products to others
- Making full use of consumable items, e.g. using both sides of printing paper
- Changing their behaviour – food buying and hospitality –- to avoid excessive food waste

Indirectly, by

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

43 A generic introduction to the concept of Natural Capital, providing links to many authoritative sources, is given by Frost, R.C. and Faircloth, P.L. (October 2021), FWR Publication FR/G0012, Natural Capital and its Relevance to Improving Freshwater and Wetland Habitats. Available to download from Library/Guides at http://www.fwr.org.

Strengthening of Waste Collection and Resource Recovery

Target Waste Components

To minimise the contamination and maximise the economic value of recoverable materials from MSW, dry MSW waste components – waste paper, cardboard, plastics, textiles, miscellaneous metal items, and glass – should ideally be collected as separate, segregated waste streams. [44] Additionally, facilities should be provided to segregate (i) ELPs such as electrical and electronic appliances including batteries, refrigerators, freezers and other so-called 'white-goods'; (ii) biodegradable 'wet wastes'[45] including food, 'soil' from babies' nappies etc., and green wastes; and (iii) clinical wastes[46].

If cost and practicability considerations rule out separate collection arrangements for MSW components – dry waste components and wet wastes - materials recovery requires waste sorting prior to disposal of residual wastes to landfill. Inevitably, though, the quality of the recovered materials, and their market value, will be lower than it might. If waste-to-energy strategy is in place, some metals may be retrieved from the bottom ashes but if the incinerated waste includes wet components, this reduces the recoverable surplus energy. Wet wastes should be segregated and collected separately to enable effective processing by anaerobic digestion or composting and to ensure that processed material may be utilised on the land.

Hence, municipal solid waste collection systems need to be configured to allow all consumers to dispose of their solid wastes in ways that are compatible with the local resource recovery and waste management strategy. Collection arrangements will depend on whether household waste collection is communal or property-based. Consideration may also be given to making use of larger-scale communal facilities where households (and small businesses) may deposit multiple segregated wastes in assigned containers.

Whatever the degree of waste segregation expected of the public, it is important that households and businesses are able to fulfil these expectations in practice. Otherwise, wastes cross-contamination will reduce the recovery of useable material resources, and increasing the quantity of residual waste sent to landfill. Consultation with the public on practicable collection arrangements is desirable, therefore, and should be supported through effective communication.

Strengthening the Markets

Markets exist in Kazakhstan for some recovered waste streams, such as paper, cardboard, plastics and glass. However, relatively resource-rich waste streams such as end-of-life electrical and electronic equipment (WEE) are typically disposed of to landfill. While the markets for recovered material resources such as composted or digested waste solids and recovered energy – whether biogas, electricity and heat – are immature at best. SCP adoption in practice demands that all these markets are developed as far as it is reasonable to do so. The existence of effective market outlets is an essential aspect of an enabling environment for SCP and solid wastes management (see Chapter 5). Two issues are the most significant:

- ***Processed 'wet waste'***: The biodegradable components of collected 'wet' waste are amenable to treatment by composting and/or anaerobic digestion – subject to the resolution of climate-related practicability issues affecting collection and treatment. And the treated solids may be used beneficially in a number of land-based applications. But other potential constituents of the collected waste, may interfere with the treatment processes or the quality of the treated solids. Hence, effective communication to maximise good consumer waste deposition is recommended.

  After a period of storage, treated bio-solids may be applied beneficially to arable land, communal parkland, and forested land; as cover for landfill sites and in land reclamation. Quality requirements will be important for the higher value applications. Hence a system of quality assurance should be adopted, forming part of a marketing and outreach strategy for using the treated biosolids. Such a strategy should be underpinned by a testing regime and communication on the benefits of using the treated biosolids, while realism will be needed when assigning a financial 'value' to what the recipients will pay.

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44 A strategy that includes one or more waste-to-energy plants contains an in-built conflict of interest regarding paper, cardboard, plastics and textile wastes. As the combustible components of MSW, a waste-to-energy-plant will be designed for a relatively narrow range of these arisings. Once designed and built there is no or limited incentive to minimise the generation of such wastes.

45 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.

46 Clinical wastes should be segregated at source adopting a risk-based approach. More hazardous wastes such as infectious matter, body parts and fluids, and pharmaceutical waste arisings in households and dispensaries may be incinerated in high-temperature incineration units. Less hazardous wastes may be autoclaved prior to disposal to landfill.

Energy may be recovered from MSW as either biogas from the anaerobic digestion of 'wet' waste, or by the incineration of the combustible fraction of 'dry' waste. Outlets for any surplus heat energy generated by such plants are likely to be local and will need to be cultivated. Electricity generation, whether in waste-to-energy or digestion plants, will require that grid connections be made.

- ***Waste electrical and electronic equipment and end-of-life vehicles***: Since most vehicles and electrical and electronic equipment in use in Kazakhstan is imported, there is no ready local market for the materials that might be recovered from ELPs. Given the size of Kazakhstan's population and its distribution, and the present status of its manufacturing sector, it is hard to envisage this situation changing significantly in the short-to-medium term. However, given the right regulatory push and infrastructural development – and the cooperation of neighbouring countries - the creation of an enabling environment in which materials recovery from WEE becomes established, and recovered materials is exported as feedstock to neighbouring countries having the necessary manufacturing capacity and demand, may be possible. A strengthening of the EPR obligations and expanding the role of the existing EPR operator would be helpful. Complementary actions to 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 Kazakhstan or in neighbouring countries. This strategy and plan would have to consider the characteristics and proximity to resource markets of major cities (Nur-Sultan, Almaty and Shymkent especially) and regions.
  - Amendment of legislation prohibiting the disposal of WEE to landfill sites (perhaps phased-in over, say, 10 years); requiring City and Regional authorities to provide separate containers for the deposition and collection of WEE – 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.
  - National and regional budget provisions for investment in necessary infrastructure and development/setup costs.

4.4 Climate Change: Mitigating GHG Emissions

Background

Kazakhstan signed the Paris Agreement in 2016, and has committed itself to reduce greenhouse gas (GHG) emissions by 15% from the 1990 level (386.3 million tons) by 2030. From 2009 to 2018, however, GHG emissions grew substantially to about 402 million tons (see Figure 18) and may have grown since. Moreover, GHG emissions per capita have also shown an increase of 21.6% over the past 10 years. Significant efforts therefore need to be made to change the trajectory in line with meeting the above 2030 commitment, focusing on reducing GHG emissions in the leading emission sectors, i.e. energy, agriculture, and industrial processes.

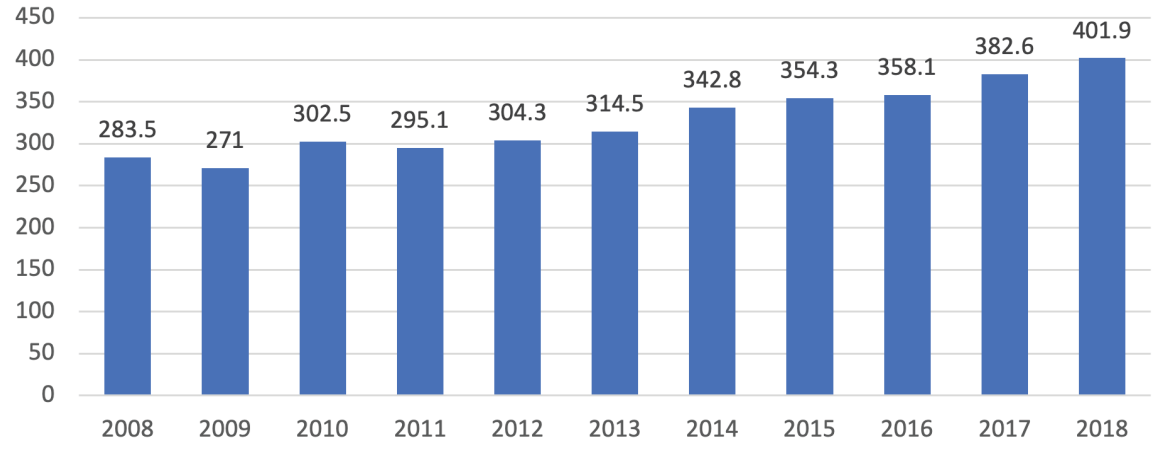


Figure 18: Kazakhstan's Annual GHG Emissions Growth (million tonnes) 2008-18

Under the obligations in the Paris Agreement, Kazakhstan is expected to introduce additional measures for carbon regulation. Updated plans for Kazakhstan's Nationally Determined Contributions (NDCs) propose strengthening the Emissions Trading System (ETS-KZ) and the introduction of a carbon tax – both positive measures fully consistent with an SCP approach. However, introducing such measures must ensure that consumers and producers are not faced with sudden steep cost and price increases. Carbon taxes are also fully in line with the adoption of an SCP approach, but care will be needed to communicate their introduction in advance, and to ensure that their scale is increased gradually to avoid unexpectedly steep cost hikes. It can also be suggested that the tax should be revenue neutral, i.e. there should be compensating reductions in other taxes, to ensure that the effect of the tax will be to 'nudge' enterprises and people to behave differently – in ways to bring about reductions in GHG emissions – without the carbon tax becoming a burden on the national economy. Such policy initiatives should help stimulate an energy efficiency drive, the more efficient use of inorganic fertilisers and their partial substitution with treated biowastes, and a greater uptake of renewable energy.

A twin-track cross-sectoral approach to reduce GHG emissions is presented here. One seeks to improve energy efficiency in all major demand centres, while the other intends to strengthen the uptake of renewable energy resources..

Energy Efficiency

There are boundless opportunities for improving energy efficiency in the economy. Many are being pursued already in industry, which collectively accounts for about 50% of energy consumption. Energy efficiency auditing is a major plank of those efforts, stimulated by the activities of organisations on the State Energy Register (GER) and the Institute for the Development of Electricity and Energy Saving. In addition to the process and manufacturing sectors, other major energy consumer sectors include:

- Buildings – residential, institutional, offices, retail etc. – where energy is used for heating, lighting, cooking, and powering a panoply of electrical and electronic appliances
- Transport – by cars, airplanes and railroads

The GEAP targets action on energy use in industrial production (monitoring, audits, enterprise action plans), systems to provide household heating (centralised heat production and distribution networks), and energy efficiency in the housing stock and road transport sector. Apart from action No. 27 concerning a national 'Roadmap for Energy Conservation and Efficiency, 2022–2026', the GEAP measures focus on hardware and not on the behavioural aspects that play a major role in determining how energy is used in practice. The draft Roadmap will likely be absorbed into and superseded by Zhasyl Kazakhstan. All the proposed measures would make useful contributions to reducing the energy footprint of Kazakhstan and are fully compatible with the SCP approach. Several measures in the proposed Roadmap could be undertaken by, or in partnership with, an SCP Support Mechanism – see Chapter 6 – especially those noted below:

1.1	Conducting a comparative analysis (benchmarking) of energy efficiency of energy-producing and energy transmission enterprises of the Republic of Kazakhstan benchmarking
2.1	Conducting a comparative analysis of the specific consumption for the production of products of industrial enterprises of the Republic of Kazakhstan (benchmarking)
2.9	Development of support programs to improve energy efficiency in the industrial sector
2.11	Development of a brochure on energy saving, within the framework of a technical and economic assessment on the feasibility of implementing energy-saving measures, considering any company restructuring or production modernisation
4.11	Information campaigns and consulting services
4.12	Identification and awarding of energy-efficient institutions
5.2	Creation of an interregional competence centre on the basis of the National Institute for Development in the field of energy saving and energy efficiency
5.4	Training (training) of 10 domestic (national) specialists of large enterprises in the energy management system
5.5	Elaboration of the issue of promotion of energy saving
5.6	Various conferences on energy saving and energy efficiency

The cross-sectoral energy efficiency theme of the SCP Action Plan in Chapter 7 is framed with this in mind. Other financial incentives to stimulate the uptake of renewable energy and energy efficiency measures in buildings – residential and others – might also be introduced. Also worth considering are:

- Regulatory instruments such as prohibiting the placement on the market of energy-consuming appliances that do not comply with minimum performance standards - taking inspiration from the EU's Eco-Design Regulation
- Voluntary adoption of Eco-Label standards for energy efficiency, enabling consumers to take energy efficiency into account when purchasing energy products
- Keeping abreast of developments in the EU's Circular Economy Action Plan and its implementation is also advised

Renewable Energy

Strengthening the uptake of renewable energy resources should, ideally, mean substituting renewable energy resources for fossil-fuel based resources – rather than using renewables to increase energy consumption. The policies noted in the background section should help nudge the public and private sectors towards adopting renewable energy. Further actions that may be taken include:

- Collating and reviewing published benchmark information, good practice documentation, and case studies on the implementation of renewable energy resources, including food wastes
- Establishing and maintaining contact with organisations active in this field in other countries and keeping abreast of ongoing developments in the EU's Green Deal
- Preparing and implementing a priority-driven thematic strategy to promote the use of renewable energy resources where available and appropriate, drawing on the knowledge gained in the above two activities and complementary to Zhasyl Kazakhstan 2021–2025
- Building on recent capacity strengthening initiatives, and preparing regular updated national GHG emissions inventories and GHG emission projections (to 2030 and beyond). The latter should analyse defined scenarios that include at least (i) existing policies and measures and (ii) assume additional policies and measures

4.5 Ambient Air Quality

Ambient air pollution is a problem in urban areas of Kazakhstan, especially in the industrial zones developed as production centres in industrialised Oblasts. The third UNECE Environmental Performance Review of Kazakhstan, reporting that in many cities in 2017, for instance, annual mean and daily mean PM concentrations were higher than both EU air quality standards and WHO (World Health Organization) guideline values. Hence, SDG targets concerning air pollution and human health are relevant issues for Kazakhstan.

In combination, the SCP approaches noted in the value chains and other cross-sectoral areas should reduce air pollutant emissions and thus improve ambient air quality regarding $PM_{2.5}$, PM_{10}, SO_2, NOx and other parameters. Many factors though combine to determine the ambient concentrations of air pollutants. Consequently, near-ground, diffuse emission sources can also be major contributors to air pollution, not only emissions from major point-sources released via high stacks.

European countries adopt a common approach in addressing the issue of ambient air quality, the EU's Clean Air Package comprising a raft of several interlocking policy instruments that form part of the environmental *acquis*.[47] National Air Pollution Control Programme (NAPCP) is one such component, requiring Member States to show how they will achieve their emission reduction commitments. Key building blocks in preparing a NAPCP are a historic national emissions inventory for major air pollutants, and the capability to project future emissions (to 2030). The latter provides a powerful policy tool, helping to inform the potential effects of policy measures. Action on this front is included in the Action Plan in Chapter 6.

47 The EGD assumes the environmental *acquis* as a given. While the Clean Air Package, National Air Pollution Control Programme, emissions inventories and projections underpin and contribute to their delivery, they are not mentioned in the EGD.

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 (Chapter 1) 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, Figure 19. Sections 5.2 to 5.7 introduce the significance of each.

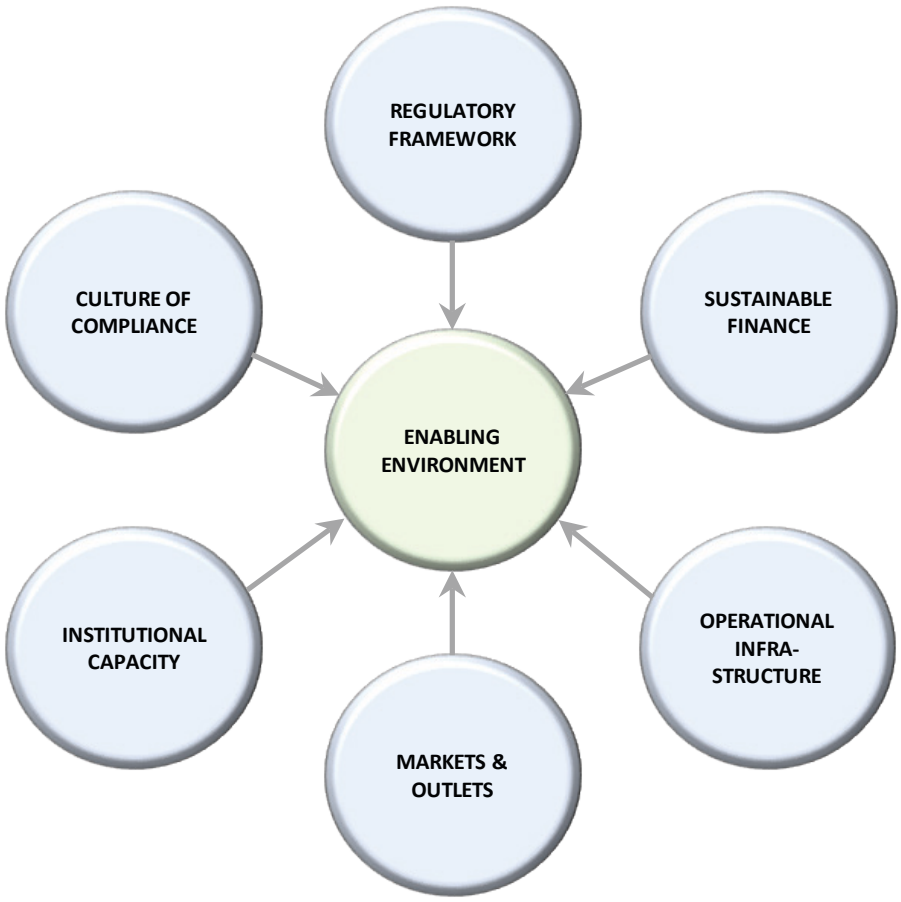


Figure 19: Building Blocks of an SCP Enabling Environment, e.g. for Resource Recovery from Municipal Waste

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, that is, 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. Such issues are summarised separately.[48] As far as possible, the 'hard-wiring' of technological solutions for waste management 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, to allow operators the 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.

48 Yerbol Orazbekov (November 2022), Biodegradable Waste in the Republic of Kazakhstan, Regulatory Framework and Infrastructure Assessment for Municipal Waste Management.

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 (Tenge/tonne) 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 brief case study of the imposition of a landfill tax in the UK since 1996. This shows that the landfill tax, accompanied also by other regulatory measures, was highly effective in diverting MSW (non-inert solid wastes) away from landfill while not causing a significant increase in illegal dumping of waste ('fly-tipping'). 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:

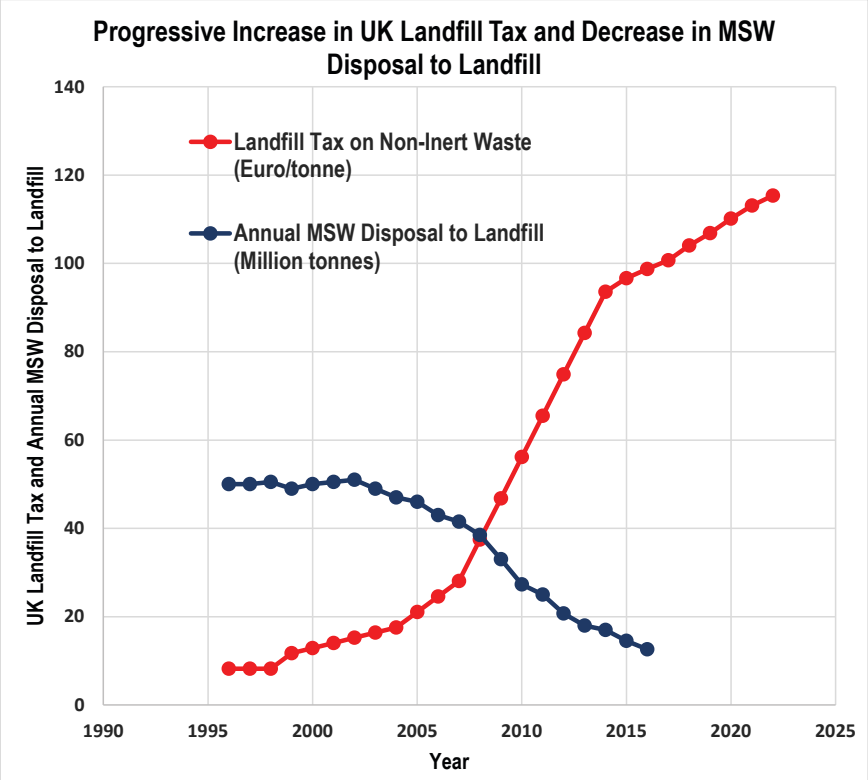
- Cost-recovery from the users of the waste management service, to cover operational and maintenance costs, and debt service charges
- Government (national, regional, city) partial grant-funding of infrastructure investments
- Taking on debt to finance infrastructure investments
- Environmental Funds (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 status of waste collection and disposal as indicated in the Green Economy Concept suggests that sustainable finance remains a critical issue in much of Kazakhstan, as was observed a few years earlier in an EU Technical Assistance project and a follow-on project.[49] 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.

49 Technical Assistance Project, EuropeAid/127636/C/SER/KZ, 'Development and Improvement of Policy Instruments for Environmental Protection', undertaken by Euroconsult Mott MacDonald, CSPC, FCG International and GFA (2009-2010). And FWC BENEFICIARIES 2009 - LOT 6 : Environment EuropeAid/127054/C/SER/multi, 'Developing a national waste management strategy and action plan in the Republic of Kazakhstan', undertaken 2010-2011.

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.[50]



Following the introduction of the landfill tax on non-inert wastes (MSW) the quantity of MSW disposed of to landfill in the UK s 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.

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 with energy recovery plants.

50 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

5.5 Operational Infrastructure

Infrastructural requirements depend on the waste management system adopted. They comprise the methods used to dispose of residual waste; 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 C indicates the needs and significant issues concerning two representative 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
- 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.[51]

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. 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. Most significantly perhaps the low population density nationally (6.9 persons per km^2 in 2019[52]). A dispersed population limits the opportunities for achieving economies of scale in materials recovery and recycling operations. Table 7 considers market outlet and demand issues for materials and energy that typically may be recovered from MSW and end-of-life products.

51 World Bank Group (2018). Decision Maker's Guides for Solid Waste Management Technologies.
52 https://data.worldbank.org/indicator/EN.POP.DNST?locations=KZ

Table 7: 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.
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 Kazakhstan. Consequently the opportunity to recover materials from end-of-life vehicles and to reintroduce them into Kazakhstan's productive sectors as feedstock may be limited. The substantial development of capacity in Kazakhstan'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 Kazakhstan (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	stablished 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

An effective, modern system of waste management requires a range of planning and operational skills. And 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 and environmental protection is respected, should not be underestimated. Waste management organisations need to have adequate capacity in terms of staff numbers, skills and experience.

Those cities that already have functioning segregated waste collection and recovery operations are likely to be better positioned than those that do not. It may be beneficial, therefore, to make an appraisal of existing institutional capacities nationally, and in the regions and large cities, and to determine the specific needs for capacity strengthening across the Republic.

More generally, however, the sustainable adoption of SCP requires that producers and consumers – whether in Government, productive and service sectors, or households – 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 the thought further and argues that an SCP Support Mechanism (SCP-SM) will be needed to establish this aspect of the 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, as a result of the Government's application of BAT to large combustion plants, stricter pollutant emission limit values may be set, to be complied with by a specific date; requiring that existing installations make appropriate investments. Table 8 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 20 represents the twin-track approach of the SCP Action Plan to national policy development and its application, including an SCP support mechanism.

Table 8: ''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 may depend on sector-specific characteristics.

Common to all sectors and cross-sectors, however, 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.

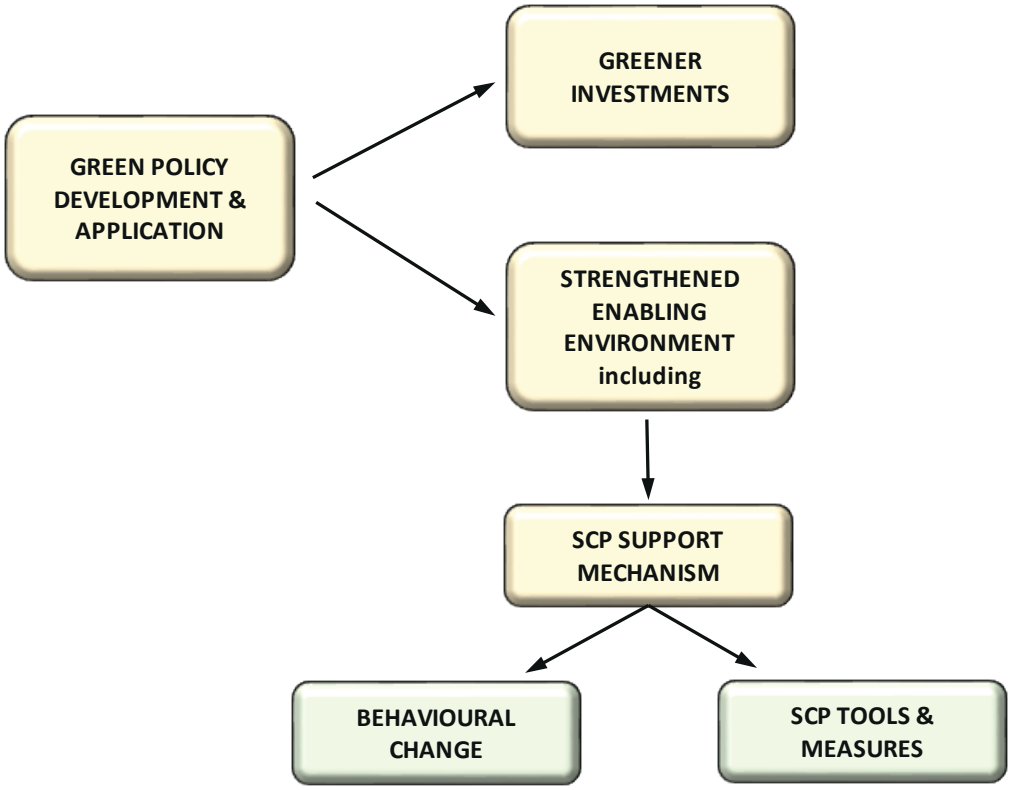


Figure 20: Twin-track representation of the SCP Action Plan, indicating the role of an SCP Support Mechanism

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 21. 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 that 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 in section 6.2 below. The national Government should apply these when considering their options in determining an appropriate mechanism and its institutional 'home'.

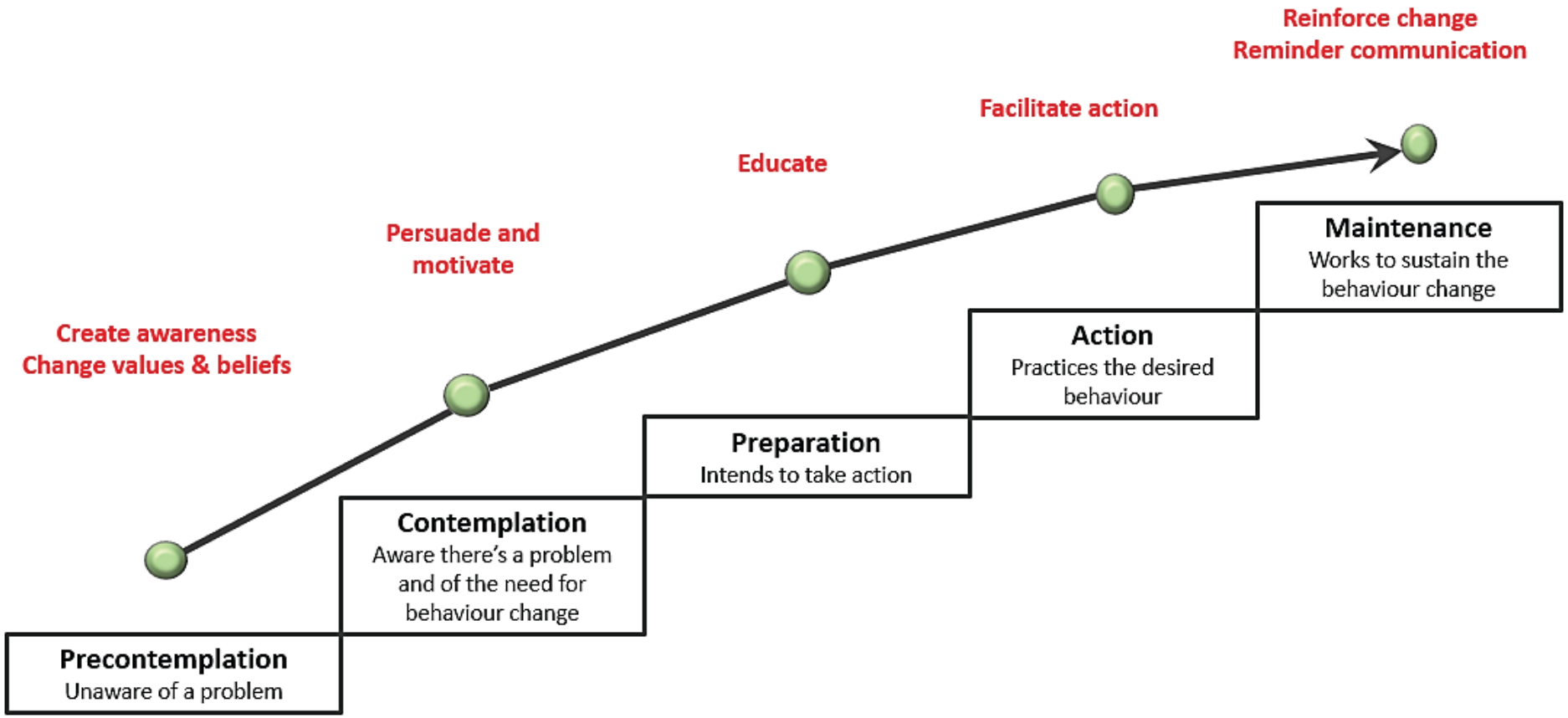


Figure 21: A model for promoting behavioural change that may be adopted to stimulate SCP action

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, to enable 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, energy, and metals value chains; and (ii) the cross sectoral areas of freshwater conservation and efficiency of water use, reducing GHG emissions, ambient air quality, and the recovery of resources from municipal solid wastes.

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 termination of the current Green Economy Action Plan – 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 B 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.

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 22, and elaborated in Sections 7.1, 7.2 and 7.3, comprises three components:

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

Figure 22 shows also the International Green Technologies and Investment Projects Centre's activity in preparing BAT documentation. This is referred to in the SCP Actions addressed below and in chapters 3 and 4.

Also shown in Figure 22 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 9, comprising 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 revised Green Economy Concept (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 among 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 8 in Chapter 6 and Table 9 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, respectively. The thematic activities of the SCP-SM would be one way to identify 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)

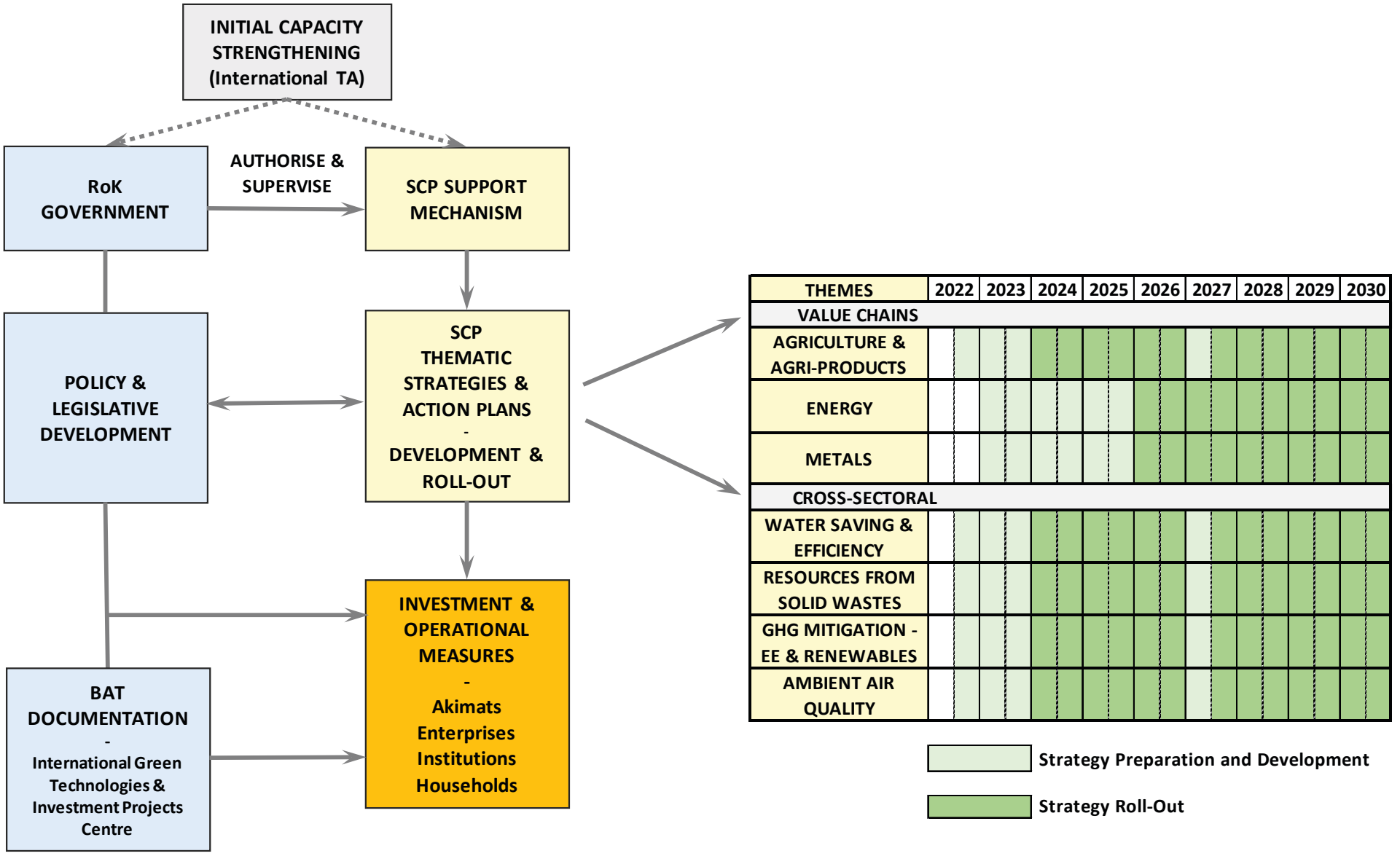


Figure 22: Scope and Structure of the SCP Action Plan

Table 9: 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.	Ministry of Economy (with the support of other relevant Ministries)	2022
0.2	Integrate the SCP approach into a revised, updated version of the Green Economy Concept.	Ministry of Economy (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 themes 1 to 5 inclusive, and to ensure its funding over the period 2023 to 2030 inclusive, subject to a performance review midway (2026/27) through the period.	Ministry of Economy (with the support of other relevant Ministries)	2022
0.4	Secure international assistance to: (i) help prepare detailed Terms of Reference for an SCP-SM that reflect international good practice, (ii) identify the detailed staffing and budget needs of the SCP-SM, and (iii) provide targeted capacity building for staff in relevant Ministries and the SCP-SM.	Ministry of Economy (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 Kazakhstan, the Central Asia region, and worldwide.	Ministry of Economy (with the support of other relevant Ministries)	2023
0.6	Provide regular strategic supervision of the SCP-SM's operation and progress.	Ministry of Economy (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.	Ministry of Economy (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.	Ministry of Economy (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.	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
	- 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 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. - 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 Kazakhstan or by exporting to third-party countries where they may be used as feedstock in the productive sectors. - Measures that could be taken to further develop and promote the work of the Extended Producer Responsibility (EPR) Operator in Kazakhstan. - 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 the successful introduction of those instruments having the potential 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. The analysis should include a consideration of the vision expressed in a revised Green Economy Concept (action 0.2). - 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). - Ministry responsibilities for preparing national air pollutant and GHG emissions inventories and emission projections.		
LEGISLATIVE DEVELOMENT			
0.10	Amend legislation as required: (i) to enable the implementation of agreed actions in themes 1 to 5 inclusive, (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 why resource efficient agriculture, efficient water use, waste minimisation, energy conservation, efficient energy use, and environmental protection in mining areas is needed; and what individual people can do to contribute.	RoK Ministry of Education and Science	2025-2030

7.2 Value-Chain Actions

Value-Chain actions are presented in Table 10. 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 E.1 to E.4 in the energy value chain
- Actions M.1 to M.7 in the metals value chain

7.3 Cross-Sectoral Actions

Cross-Sectoral actions are presented in Table 11. 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.11 concerning water use efficiency and conservation
- Actions RW.1 to RW.13 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
- Actions AAQ.1 and AAQ.2 concerning ambient air quality improvement

Table 10: 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 Kazakhstan. Also establish contact with organisations active in this field in other countries.	SCP-SM (with international assistance)	2022–2023
A.2	Develop the value chain in a quantitative sense based on the prepared qualitative description and on information held by the Ministries of Agriculture and others. Use this analysis, together with the material collated in action 1.1, 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 Kazakhstan'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 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 Kazakh centres of knowledge, and international assistance Ministries of Economy, Agriculture, Environment, 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 1.2). 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 Ministry of Agriculture, other Ministries 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 RoK Ministry of Economy, Ministry of Ecology, Geology and Natural Resources (MEGNR) with the Ministry of Agriculture	2026–2027

No.	VALUE-CHAIN ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
A.6	Implement the second-stage strategy, disseminating outputs through a communication programme (as in action 1.3), 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
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 (Akimats)	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 priority issues in the value chain. (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 Support Unit, 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 (international assistance)	2024–2030
ENERGY			
IMPLEMENTING BAT			
E.1	Develop BAT documentation for the energy value chain (mineral oil and natural gas, coal and lignite), their coverage to include: (i) resource extraction; the management of rock waste, spoil and muds arising, and site aftercare, considering water pollution, solid waste and emissions to air; (ii) the refining and storage of oil and natural gas; (iii) the preparation, storage and transport of coal; (iv) coke production; and (v) coal and natural-gas fuelled large-scale combustion plants for the generation of power, combined heat and power, and heat.	International Green Technologies & Investment Projects Centre	2022–2027

No.	VALUE-CHAIN ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
E.2	Issue permits to operate to activities subject to BAT regulation subject to the requirements laid out in action E.1.	MENR (permitting department)	2023–2030
E.3	Operate, maintain and self-monitor activities subject to BAT regulation in accord with permit conditions (laid down in action E.2), making investments to implement BAT in accordance with the set timescales.	Enterprises - engaged in extraction and refining/processing operations, and large combustion plants	2024–2030
E.4	Monitor and inspect enterprises subject to BAT regulation, enforcement actions to be taken in the event of non-compliance.	MENR (inspection & enforcement department)	2024–2030
METALS			
IMPLEMENTING BAT			
M.1	Develop BAT documentation for the metals value chain, coverage to include: resource extraction and the management of rock waste and spoil arisings; the storage, processing and refining of metal ores; steel production; forging of ferrous and non-ferrous metals; and the post-mining management and aftercare of mining and rock storage sites, tailing ponds etc. It may consider water pollution, solid wastes and emissions to air. In preparing this documentation, consideration should be given to the ongoing developments in the EU's Green Deal, in particular the objective to 'mobilise industry to achieve a clean, climate neutral and circular economy'.	International Green Technologies & Investment Projects Centre	2022–2027
M.2	Issue permits to operate to activities subject to BAT regulation subject to the requirements laid out in action M.1.	MENR (permitting department)	2023–2030
M.3	Operate, maintain and self-monitor activities subject to BAT regulation in accord with permit conditions (laid down in action M.2), making investments to implement BAT in accordance with the set timescales.	Enterprises in the ore mining, ore processing & refining, and foundries & smitheries sectors	2024–2030
M.4	Monitor and inspect enterprises subject to BAT regulation, enforcement actions to be taken in the event of non-compliance.	MENR (inspection & enforcement department)	2024–2030
THEMATIC STRATEGY ACTIONS			
M.5	Prepare and implement a priority-driven thematic strategy to promote resource efficiency (materials and energy) in the processing and refining of metal ores and alloys, and in the manufacture of metal goods. This must take into consideration the current status and planned growth in the metals refining and metal goods manufacturing sectors and should acknowledge ongoing developments in the EU's Green Deal, in particular the Circular Economy Action Plan and its implementation. SCP-SM to disseminate outputs from the thematic strategy via a communications programme.	SCP-SM – calling on Kazakh centres of knowledge Ministries of Economy, Industry, and MENR – to review and approve the thematic programme.	2024–2030
M.6	Enterprises engaged in the metals processing and manufacturing industries to: (i) raise their awareness of the need to make efficient use of material and energy resources, (ii) adopt SCP tools to help identify efficiency measures in the value chain, and (iii) make investments in the identified 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	2024–2030

No.	VALUE-CHAIN ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
M.7	Provide training and capacity strengthening on why and how to improve resource efficiency and incorporate cleaner design and other SCP techniques integral to a circular economy. Training and capacity strengthening to be targeted at enterprises in the metals processing and metal good manufacturing sectors.	SCP-SM, NGOs and Training Institutions (international assistance)	2024–2030

Table 11: 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 for growing crops to be considered as part of the agriculture value chain. Establish contact with organisations active in this field elsewhere.	SCP-SM (with international assistance)	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 wisely (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 growing agricultural crops may be handled within the appropriate value chain strategy.)	SCP-SM – calling on Kazakh centres of knowledge, and international assistance Ministries of Economy, Industry and MENR – 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 Ministry of Economy, MENR, and Ministry of Industry	2026–2027
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

No.	CROSS-SECTORAL ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
WE.8	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.9	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.10	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.11	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 (international assistance)	2024–2030
RESOURCE RECOVERY FROM MUNICIPAL SOLID WASTES			
THEMATIC STRATEGY ACTIONS			
RW.1	Develop Best Available Techniques (BAT) documentation for new waste incineration plants (including waste to energy) – BAT provisions to apply in full to any such plants planned in 2022 and beyond.	International Green Technologies & Investment Projects Centre	2022–2023
RW.2	Review Kazakh and international practice for the collection and processing of the ‘wet waste’ component of MSW in regions where winters are extremely cold, e.g. Canada, Russia, and northern Scandinavia. And make appropriate recommendations for consideration in the context of regional approaches to MSW management and resource recovery in Kazakhstan.	MENR	2022–2023
RW.3	Collate and review published benchmark information, good practice documentation, guides, and case studies relevant to SCP and the management of MSW and End of Life Products (vehicles, electronic appliances, etc.). Also, 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 (with international assistance)	2023

No.	CROSS-SECTORAL ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
RW.4	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 to a minimum, and other measures to minimise MSW generation. This strategy will need to take into consideration potential proposals to build waste-to-energy installations at cities in Kazakhstan; and the outcome of a review of 'wet waste' collection and management (action RW.2). Paralleling the Agricultural value chain and Water thematic strategies, it should cross-reference to, and be consistent with these: a coordinated approach will be necessary. The initial strategy might need to be amended depending on the outcome of policy analyses undertaken as suggested in action 0.9; alternatively, the results of policy analysis might be incorporated in a second-stage strategy, 2026-2030 (action RW.6). 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 Kazakh centres of knowledge, and international assistance Ministries of Economy, Industry, MENR – to review and approve the thematic strategy	2023–2024
RW.5	Implement the strategy and undertake independent impact assessments (analogous to actions WE.3 and WE.4)	SCP-SM External institutions (draft outputs, impact assessments)	2023–2026
RW.6	Prepare and implement a second-stage thematic strategy, incorporating independent assessments of the impacts of key outputs - as in the initial strategy (actions RW.4 and RW.5).	SCP-SM Ministry of Economy, MENR, Ministry of Industry External institutions (draft outputs, impact assessments)	2026–2030
OTHER ACTIONS			
RW.7	Provide the necessary resources and infrastructure to enable: (i) the separate collection of wet wastes, dry wastes and end-of-life appliances 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 (Akimats)	2023–2030
RW.8	Provide regulatory and other market support, as required, to enable enterprises engaged in waste recycling to operate sustainably (environmentally, supply and demand, and profitably).	Government – National, City and Regional (Akimats)	2023–2030
RW.9	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 Support Unit, the media, and the voices of citizens and citizen organisations.)	Enterprises	2023–2030

No.	CROSS-SECTORAL ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
RW.10	Tertiary sector businesses, and institutions, to respond positively to Governmental, SCP Support Unit, the media, and NGO messaging on the need to reduce MSW arisings, how this can be done, and the changes in behaviour that can be made to achieve it. Take necessary practical steps, including investments where appropriate, to reduce waste and to collect efficiently such wastes that do arise.	Tertiary Enterprises, Institutions & City/Regional Governments	2023–2030
RW.11	Households to respond positively to Governmental, SCP-SM, the media and NGO messaging on the need to reduce solid waste arisings, how this can be done, the separation of wastes at source, and the changes in behaviour that can help achieve this.	Consumers	2023–2030
RW.12	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 the generated wastes..	NGOs and the Media	2023–2030
RW.13	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 (with international assistance)	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, 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.	Ministry of Energy - supported by the Institute for the Development of Electricity and Energy Saving, and SCP-SM (together with international assistance)	2024–2025
GHG.2	Prepare and implement a priority-driven thematic strategy to promote energy efficiency and energy conservation to all consumers. The strategy must draw on the energy efficiency road map being developed under the national project Zhasyl Kazakhstan 2021-2025. It must also reflect the law 'On Amendments and Additions to Certain Legislative Acts of the Republic of Kazakhstan on Energy Saving and Energy Efficiency Improvement', issued as a draft in March 2021. The thematic strategy should also consider ongoing developments in the EU's Green Deal and its implementation. It may also consider the earlier proposed 'National Roadmap for Energy Conservation and Efficiency 2022-2026' prepared with Technical Assistance from the World Bank and German Energy Agency DENA (action 27 of Kazakhstan's Green Economy Action Plan).	SCP-SM – partnering as appropriate with the Institute for the Development of Electricity and Energy Saving, and other Kazakh centres of knowledge Ministries of Economy, Industry, Environment – to review and approve the thematic programme	2024–2030
GHG.3	Enterprises engaged in the processing and manufacturing industries (secondary production) to: (i) raise their awareness of the need to use energy wisely and efficiently, (ii) adopt available SCP tools to help identify energy saving and efficiency measures, and (iii) make investments in the identified measures. This action may be stimulated by national and city/regional Governments, the SCP-SM, media, and the voices of citizens and citizen organisations.	Enterprises	2024–2030

No.	CROSS-SECTORAL ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
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. This messaging to focus on the need to improve energy conservation and efficiency, how this can be done in practice, and the changes in behaviour that can achieve it. 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 (international assistance)	2024–2030
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.	Ministry of Energy - supported by the Institute for the Development of Electricity and Energy Saving, and SCP-SM (together with international assistance)	2024–2025
GHG.8	Prepare and implement a priority-driven thematic strategy to promote the use of renewable energy resources where available and appropriate. The strategy must draw on the energy efficiency road map being developed under the national project Zhasyl Kazakhstan 2021-2025. It must also reflect the law 'On Amendments and Additions to Certain Legislative Acts of the Republic of Kazakhstan on Energy Saving and Energy Efficiency Improvement', issued as a draft in March 2021. The thematic strategy should also consider ongoing developments in the EU's Green Deal and its implementation. It may also consider the earlier proposed 'National Roadmap for Energy Conservation and Efficiency 2022-2026' prepared with Technical Assistance from the World Bank and German Energy Agency DENA (action 27 of Kazakhstan's Green Economy Action Plan.	SCP-SM – partnering as appropriate with the Institute for the Development of Electricity and Energy Saving, and other Kazakh centres of knowledge Ministries of Economy, Industry, Environment – to review and approve the thematic programme	2024–2030
OTHER ACTIONS: GHG EMISSION INVENTORIES AND PROJECTIONS			
GHG.9	Building on a recent capacity strengthening initiative (2019-2020) and the preparation of a national emissions inventory report to CLRTAP for 2019, prepare updated annual national inventories for GHG emissions. In addition to their annual updating, a policy of continuous improvement should be adopted, the inventories incorporating planned methodological improvements. Seek further capacity strengthening support from international sources for undertaking this activity, if appropriate.	MENR in partnership with other Ministries Kazhydromet	2023–2030

No.	CROSS-SECTORAL ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
GHG.10	Building on action 4.7, prepare national emissions projections to 2030 and beyond for GHGs . Prepare these biannually (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 goals and objectives. Preparing emission projections, enables the impacts of proposed policies and measures on emissions to be assessed – independently and in combination. Projections are valuable tools that aid policy design and development. It also serves as a valuable opportunity to develop inter-Ministry cooperation and collaboration. If appropriate, seek further capacity strengthening support from international sources for undertaking this activity initially.	MENR in partnership with other Ministries Kazhydromet (with international assistance)	2024–2030
IMPROVING AMBIENT AIR QUALITY			
AIR POLLUTANT EMISSION INVENTORIES AND PROJECTIONS			
AAQ.1	Building on a recent capacity strengthening initiative (2019-2020) and the preparation of a national emissions inventory report to CLRTAP for 2019, prepare updated annual national inventories for air pollutants ($PM_{2.5}$, SO_2, NOx, NMVOCs, NH_3). Also, prepare separate emissions inventories for major city regions that experience air pollution or might do so in future e.g. Nur-Sultan, Almaty, Shymkent. In addition to their annual updating, a policy of continuous improvement should be adopted, the inventories incorporating planned methodological improvements. Seek further capacity strengthening support from international sources for undertaking this activity, if appropriate.	MENR in partnership with other Ministries Kazhydromet	2023–2030
AAQ.2	Building on action AAQ.1, prepare national emissions projections to 2030 and beyond for air quality pollutants. Also, prepare biannual national air pollutant emission projections (e.g. 2024, 2026, etc.) and projections for the major city regions. Prepare these for defined scenarios including at least (1) assuming existing policies and measures and (2) assuming additional policies and measures to meet goals and objectives. Preparing emission projections, enables the impacts of proposed policies and measures on emissions to be assessed – independently and in combination. Projections are valuable tools that aid policy design and development. It also serves as a valuable opportunity to develop inter-Ministry cooperation and collaboration. If appropriate, seek further capacity strengthening support from international sources for undertaking this activity initially.	MENR in partnership with other Ministries Kazhydromet (with international assistance)	2024–2030

ANNEX A: Glossary of SCP Tools, Measures and Terminology

Developed and proven internationally, an array of SCP tools is available – see Table 12. Their application helps to identify measures whose implementation contributes to putting Green Economy policies into effect.[53] In practice, many SCP tools may be used at several stages in the product life cycle and may apply one, two or all three cornerstone principles; and may be policy focused, application focused, or can be applied in both roles.

Table 12: SCP Tools and Measures and their Application of Cornerstone Principles

SCP Tool/Measure	Resource Efficiency	Substitution	Circularity
Policy Focused			
BAT Reference/Conclusions	✓	✓	
Benchmarking - external	✓	✓	
Carbon Pricing/Taxes	✓	✓	✓
Communication	✓	✓	✓
Consumer Awareness, Interest, Motivation & Behaviour	✓	✓	✓
Consumption and Procurement	✓	✓	✓
Eco-Design Product Standards	✓		✓
Education	✓	✓	✓
Emission Projection			✓
Financial Incentives	✓	✓	✓
Forestry Stewardship			✓
Green Purchasing Criteria/Code	✓	✓	✓
Mapping the Sectoral Value Chain	✓	✓	✓
Pricing of Publicly Delivered Goods	✓	✓	✓
Producer Responsibility			✓
SCP Support Unit	✓	✓	✓
Waste Management Hierarchy	✓	✓	✓
Application Focused			
Baseline Assessment	✓		
Benchmarking - internal	✓	✓	
Carbon Footprinting	✓	✓	✓
Champions	✓	✓	✓
Cleaner Design	✓	✓	✓
Communication	✓	✓	✓
Counter-current washing/heat-exchange	✓		
Dematerialisation	✓	✓	✓
Energy Audits	✓	✓	✓
Environmental Management System	✓	✓	

53 The practical measures identified through using SCP tools are sector-specific and too varied to mention here, but some that may be relevant in the agricultural and downstream agri-production sectors, and in consumption, are noted in Table 3.

SCP Tool/Measure	Resource Efficiency	Substitution	Circularity
Fishbone Analysis	✓	✓	
Good Practice Guides and Case Studies	✓	✓	✓
Green Purchasing Criteria/Code	✓	✓	✓
Heat Exchanger Network	✓		
Innovation			✓
Life-Cycle-Analysis		✓	✓
Mapping the Sectoral Value Chain	✓	✓	✓
Mass and Energy Balances	✓		
Metering, Monitoring and Sampling	✓	✓	✓
Product-as-a-Service			✓
Reformulation		✓	
Resource Efficiency & Waste Minimisation Club	✓		
Separation of Wastes at Source	✓		✓
Walk-through Audit	✓		

The glossary below provides a brief introduction to the tools and measures listed above.

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 other 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. This method requires metering of the resources being consumed. Typically, comparisons are made with the 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, organisation, service, place or product, expressed as carbon dioxide equivalent (abbreviated as CO_2-eq). 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 CO_2-eq 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 so that actions may be 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 conducted 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 among all stakeholder interests of the need to take action, and to stimulate their interest in and motivation to contribute to the creation of a Green Economy, for which SCP is such a significant component. 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 that 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 elementary 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): In places 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 also **Carbon footprinting**.

Energy Audits: Defined by the Energy Law of the Republic of Kazakhstan dated 13 January 2012 No. 541-IV (as amended) as 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 organisation 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 in the form of a skeletal fish – 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, while 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[54]: Requiring that all products purchased by an entity meet minimum environmental criteria is a tool the widespread adoption of which encourages increased procurement of green goods and services while discouraging the supply of goods and services failing 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**.

54 Also known as Green Procurement.

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 along with the emissions to air, discharges to water, and solid wastes that are 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 product production to final consumption and end of life, It also helps identify the cross-links to other sectoral activities. It may be used to help focus concerted action to minimise waste throughout the value-chain and help recognise minimised waste streams that can be recovered and reused in other sectors.

Mass and Energy Balances: A standard technique which relies on the principles of conservation of mass and 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 Unit: 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[55] that operated at arms-length from the Government in the energy sector (*Energy Technology Support Unit, ETSU*)

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

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, among other things, market intelligence reports on secondary materials. Action on food waste has been a major focus of its activities. SCP Support Units 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 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 EUR 957 million (1990 prices[56]) – 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 EUR 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
- 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[57], 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 EUR 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, including Canada, South Africa, New Zealand, and Australia. By 2004, responsibility for the EEBPP in the UK transferred to the Energy Saving Trust[58] (for housing issues) and the Carbon Trust[59] (for all other areas).

56 Adopting a GB Pound to Euro exchange rate of EUR 1 to £0.83605 (17 January 2022)
57 https://www.cibse.org/knowledge/knowledge-items-(1)/knowledge-archive/energy-efficiency-best-practice-programme-archive
58 https://energysavingtrust.org.uk/
59 https://www.carbontrust.com/

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 in 1994, later rebranded as 'Envirowise'. Its initial remit was to achieve the goal of delivering annual savings of EUR 191 million for industry within six years. Total funding for the period 1994–2000 was set at about EUR 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'.[60] 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[61] 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.

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 13 provides a profile of WRAP's current activities, sectors, services, and the resources it makes available.[62] 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 – a contribution to meeting Target 12.3 of the UN's Sustainable Development Goals (Annex C). Figure 23 indicates the systematic, cyclical approach.

60 https://wrap.org.uk

61 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.

62 The WRAP website provides full details: https://wrap.org.uk/

Figure 23: Five-stage process for WCPs and developing a culture of continuous approval – food waste

Table 13: 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	

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

The national SCP Support Mechanism should promote the SCP approach and stimulate SCP action in Action Plan themes 1 to 5 inclusive. 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 Kazakhstan, 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 Kazakhstan (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 Kazakhstan 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, namely the number of themes covered and whether materials are developed in-house or externally. Table 14 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 14: 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 the 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 Support Mechanism operation in two. The areas of responsibility might then be sub-divided as shown in Table 15: 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.

Table 15: Potential future sub-division of an SCP Support Unit

Themes Covered	Government Sponsoring Ministries
Agriculture and Agri-products value chain Water Use Efficiency & Conservation Use Waste Management	Ministries of: Economy; Ecology, Geology and Natural Resources; Agriculture; Industry
Energy value chain GHG emissions reduction – cross-sectoral Air quality - cross-sectoral Metals value chain	Ministries: Economy; Ecology, Geology and Natural Resources; Energy; Industry; Transport

ANNEX C: 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[a] Wet waste[b]	Containers for collection of waste: Dry waste[a] Wet waste[b]
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[c] Biogas recovery & use (digestion)	Process wet waste: Anaerobic digestion or composting[c] Biogas recovery & use (digestion)
Storage and the beneficial use of the processed wet waste[d]	Storage and the beneficial use of the processed wet waste[d], or its disposal to landfill
Sorting of mixed dry waste[e] to recover materials for which recycling markets may exist: Paper Cardboard Plastics Metals Glass	Sorting of mixed dry waste[e] to remove recyclable non-combustible materials, for which markets may exist: Metals Glass An alternative is to recover metals from the bottom ashes (note j)
Storage and transfer of recovered materials to recycling plants, in Kazakhstan or other countries[f], for their reintroduction to the productive sectors	Storage and transfer of recovered materials to recycling plants, in Kazakhstan or other countries[f], for their reintroduction to the productive sectors
Transfer and disposal of residual solid waste stream to an engineered landfill site equipped with: Impermeable lining[g] 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[h] Monitoring of the site during its operation and after cell closures, reporting on environmental performance	Incineration of sorted dry waste[c], with: Energy recovery (as steam, electricity and hot watery) and its beneficial use[g] Bottom ash removal Flue gas treatment system to remove particulate matter (PM)[h] (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[i]
-	Bottom ash removal and putting to beneficial use.[j] Alternatively, disposal to landfill.
Notes	
a. 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.	a. As note a, 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.
b. 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.	b. As note b, opposite.

Materials Recovery and Landfill	Waste-to-Energy
c. The anaerobic digestion and composting of waste is a subject of the EC BAT Reference Document on Waste Treatment (2018).	c. As note c, opposite. In EU Member States, the BAT Reference Document on Waste Incineration (2019) also applies.[63]
d. 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.	d. As note d, opposite.
e. 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.	e. 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 i).
f. 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.	f. As note f, opposite.
g. 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.	g. 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.
h. 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.	h. 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.
-	i. 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.
-	j. Metals may be recovered from bottom ash for transfer to recycling plants in Kazakhstan 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.[64] Otherwise, disposal to landfill.

63 https://eippcb.jrc.ec.europa.eu/reference/
64 CEWEP Bottom Ash Fact Sheet. https://www.cewep.eu/wp-content/uploads/2017/09/FINAL-Bottom-Ash-factsheet.pdf

ANNEX D: UN Sustainable Development Goals Relevant to SCP

The principal SDG relevant to an SCP Action Plan is Goal 12, '*Ensure sustainable consumption and production patterns*', though there are others also, as indicated in Table 16. To facilitate the monitoring of progress in implementing national measures and achieving the goals and objectives of the SDGs at the national level, each UN Member State may establish national indicators in addition to the global indicators.

Kazakhstan has nationalised the global SDG indicators, and the monitoring system includes 280 indicators, of which 205 are global and 75 are national indicators.

Table 16: Sustainable Development Goals and Targets Relevant to the GEAP and SCP

Sustainable Development Goal 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
6.3	By 2030, improve water quality by reducing pollution, eliminating dumping and minimising 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 industrialisation 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 acting 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
SDG.11	Make cities and human settlements inclusive, safe, resilient and sustainable

Sustainable Development Goal and Selected Targets	
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 acting, with developed countries taking the lead, considering 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 minimise 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	Rationalise 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 minimising 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; halt and reverse land degradation, and halt biodiversity loss

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