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Clean technologies and the Survey of Environmental Goods and Services: A technical reference guide

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Clean technologies and the Survey of Environmental Goods and Services: A technical reference guide

Overview

This reference guide is intended for users of the Survey of Environmental Goods and Services (SEGS). The SEGS measures revenues, employment and exports from the provision of environmental and clean technology goods and services. This guide provides an overview of the goods, services, and technologies that fall within the Government of Canada clean technology priorities, as defined by the clean technology (cleantech) taxonomy, and which were used to develop content for the SEGS.

The Canadian clean technology taxonomy was developed by Natural Resources Canada in conjunction with partners at Innovation, Science and Economic Development Canada; Global Affairs Canada; Agriculture and Agri-Food Canada; Fisheries and Oceans Canada; Environment and Climate Change Canada; and Statistics Canada.

About this product

The taxonomy detailed in the following tables represents the suite of products that are considered to be clean technologies, and which are either currently included or being considered for future inclusion, in Statistics Canada's estimates of economic activity in the environmental and clean technology sector.

The tables indicate which technologies and services were included in SEGS 2012, 2015, 2017, 2018, 2019, 2020, 2021 and 2022. They will be updated for future survey cycles as the scope of what is considered to be an environmental or clean technology good or service evolves.

Clean technology

Clean technologies are defined as follows:

- Any good or service designed with the primary purpose of contributing to remediating or preventing any type of environmental damage;
- Any good or service that is less polluting or more resource-efficient than equivalent normal products which furnish a similar utility. Their primary use, however, is not one of environmental protection.

Table 1 Environmental protection activities

**Table 1.a
Protection of air and climate**

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Air, environment & remediation									
Emission control	Emission control	N	Y	Y	Y	Y	Y	Y	Y
	Clean coal processing technologies	N	Y	Y	Y	Y	Y	Y	Y
	Carbon capture technologies	N	Y	Y	Y	Y	Y	Y	Y
	Carbon storage technologies	N	Y	Y	Y	Y	Y	Y	Y
	Carbon utilization technologies	N	N	N	N	N	N	N	N
Monitoring and compliance	Leak detection technologies (ultrasonic detection and measurement, gas leak detection)	N	Y	Y	Y	Y	Y	Y	Y
	Environmental measurement apparatus	N	Y	Y	Y	Y	Y	Y	Y
Air pollution or flue gas or greenhouse gases management	Software	N	Y	Y	Y	Y	Y	Y	Y
	Platform or system	N	Y	Y	Y	Y	Y	Y	Y
	Sensors	N	Y	Y	Y	Y	Y	Y	Y
	Other	N	Y	Y	Y	Y	Y	Y	Y
Physical/chemical/ biological treatment of air pollution or flue gas	Filters (membrane, baghouse, granular bed), cyclones	Y	Y	Y	Y	Y	Y	Y	Y
	Electrostatic precipitator	Y	Y	Y	Y	Y	Y	Y	Y
	Scrubbers (Venturi, spray tower, mechanical, plate tower, packed tower)	Y	Y	Y	Y	Y	Y	Y	Y
	Waste gas absorber, waste gas flare/incinerator	Y	Y	Y	Y	Y	Y	Y	Y
	Industrial catalytic converter	Y	Y	Y	Y	Y	Y	Y	Y
	Pollutant recovery condenser	Y	Y	Y	Y	Y	Y	Y	Y
	Adsorbers	Y	Y	Y	Y	Y	Y	Y	Y
Industrial air pollution or flue gas or greenhouse gases services	Emissions trading services	N	Y	Y	Y	Y	Y	Y	Y
	Generation of compliance units, surplus allowances, emissions performance credits, offset credits	N	Y	Y	Y	Y	Y	Y	Y
	Preparation of emissions reports and verification services	N	Y	Y	Y	Y	Y	Y	Y
	Allowance auctioning services, exchange platform provision services	N	Y	Y	Y	Y	Y	Y	Y
	Market monitoring services	N	Y	Y	Y	Y	Y	Y	Y
	Offset protocol development and validation services	N	Y	Y	Y	Y	Y	Y	Y
	Development of compliance systems, electronic emissions reporting system	N	Y	Y	Y	Y	Y	Y	Y

Table 1.b
Wastewater treatment and municipal sewage treatment

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Water and wastewater									
Physical/chemical treatment of industrial wastewater	Tanks (including components) for dilution/equalization, neutralization, sedimentation, chemical precipitation	Y	Y	Y	Y	Y	Y	Y	Y
	Oil separator/skimmer	Y	Y	Y	Y	Y	Y	Y	Y
	Ion exchange bed	Y	Y	Y	Y	Y	Y	Y	Y
	Air stripping tank/column	Y	Y	Y	Y	Y	Y	Y	Y
	Liquid extraction column	Y	Y	Y	Y	Y	Y	Y	Y
	Micro-porous membrane adsorber	Y	Y	Y	Y	Y	Y	Y	Y
	Equipment for advanced chemical oxidation/UV radiation	Y	Y	Y	Y	Y	Y	Y	Y
	Pre-treatment filters	Y	Y	Y	Y	Y	Y	Y	Y
	Chemicals used in industrial wastewater treatment	Y	Y	Y	Y	Y	Y	Y	Y
Centralized physical/chemical and biological treatment of sewage	Intake screen	Y	Y	Y	Y	Y	Y	Y	Y
	Air sparging grit chamber	Y	Y	Y	Y	Y	Y	Y	Y
	Oil separator/skimmer	Y	Y	Y	Y	Y	Y	Y	Y
	Tanks (including components) for sedimentation, chemical precipitation/flocculation, aerobic biological treatment, aeration, clarification, disinfection	Y	Y	Y	Y	Y	Y	Y	Y
	Membrane bioreactor	Y	Y	Y	Y	Y	Y	Y	Y
	Trickling filter	Y	Y	Y	Y	Y	Y	Y	Y
	Chemicals used in municipal sewage treatment	Y	Y	Y	Y	Y	Y	Y	Y
Wastewater management system/services	Software	N	N	Y	Y	Y	Y	Y	Y
	Platform or system	N	N	Y	Y	Y	Y	Y	Y
	Sensors	N	N	Y	Y	Y	Y	Y	Y
	Vehicles	N	N	N	N	N	N	N	N
	Other	N	N	Y	Y	Y	Y	Y	Y

Table 1.c
Management of non-hazardous waste

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Waste and recycling									
Collection	Collection vehicles for non-hazardous waste, recycling and organics	Y	Y	Y	Y	Y	Y	Y	Y
	Containers for collection of recycled materials and household organics, backyard composters, yard	Y	Y	Y	Y	Y	Y	Y	Y
Separating and sorting	Air classifier, magnetic separator, eddy current separator	Y	Y	Y	Y	Y	Y	Y	Y
Compaction	Balers, densifiers, compactors, shredders, granulators	Y	Y	Y	Y	Y	Y	Y	Y
Centralized biological reprocessing	Centralized composters (turned-windrow, aerated static pile, mechanically agitated in-vessel)	Y	Y	Y	Y	Y	Y	Y	Y
Disposal	Equipment for landfill leachate collection and containment	Y	Y	Y	Y	Y	Y	Y	Y
	Equipment for landfill gas management	Y	Y	Y	Y	Y	Y	Y	Y
	Equipment for thermal treatment (rotary kiln incinerator, mass burning, starved air incinerator, fluidized bed)	Y	Y	Y	Y	Y	Y	Y	Y
Waste	Software	N	N	N	N	N	N	N	N
	Platform or system	N	N	N	N	N	N	N	N
	Sensors	N	N	N	N	N	N	N	N
	Other	N	N	Y	Y	Y	Y	Y	Y
Recycling	Recycling equipment and related services	N	N	Y	Y	Y	Y	Y	Y

Table 1.d
Protection and remediation of soil, sediment, sludge, groundwater, surface water, and leachate

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Air, environment & remediation									
In situ physical/chemical treatment of soil, sediment, and sludge	Chemical oxidation, fracturing, soil flushing, soil vapour extraction, solidification/stabilization Include sales of chemicals for remediation of soil, sediment and sludge	Y	Y	Y	Y	Y	Y	Y	Y
Ex situ physical/chemical treatment of soil, sediment, and sludge	Chemical extraction, chemical reduction/oxidation, dehalogenation, separation, soil washing, solidification/stabilization Include sales of chemicals for remediation of soil, sediment and sludge	Y	Y	Y	Y	Y	Y	Y	Y
In situ biological treatment of soil, sediment, and sludge	Bioventing, enhanced bioremediation, phytoremediation	Y	Y	Y	Y	Y	Y	Y	Y
Ex situ biological treatment of soil, sediment, and sludge	Biopiles, composting, landfarming, slurry phase biological treatment	Y	Y	Y	Y	Y	Y	Y	Y
In situ thermal treatment of soil, sediment, and sludge	Hot air injection, electrical resistance	Y	Y	Y	Y	Y	Y	Y	Y
Ex situ thermal treatment of soil, sediment, and sludge	Incineration, pyrolysis, thermal desorption	Y	Y	Y	Y	Y	Y	Y	Y
Water and wastewater									
In situ biological treatment of groundwater, surface water, and leachate	Enhanced bioremediation, phytoremediation	Y	Y	Y	Y	Y	Y	Y	Y
Ex situ biological treatment of groundwater, surface water, and leachate	Bioreaction	Y	Y	Y	Y	Y	Y	Y	Y
In situ physical/chemical treatment of groundwater, surface water, and leachate	Air sparging, bioslurping, chemical oxidation, directional wells, dual phase extraction, thermal treatment, hydrofracturing enhancements, in-well air stripping, passive/reactive treatment walls Include sales of chemicals for remediation of ground water, surface water and leachate	Y	Y	Y	Y	Y	Y	Y	Y
Ex situ physical/chemical treatment of groundwater, surface water, and leachate	Adsorption/absorption, advanced oxidation, air stripping, ion exchange, precipitation/flocculation/coagulation, separation, sprinkler irrigation Include sales of chemicals for remediation of ground water, surface water and leachate	Y	Y	Y	Y	Y	Y	Y	Y
Control, containment, and monitoring services (air, water, soil)	Landfill cap, landfill cap enhancements/alternatives, physical barriers, deep well injection	Y	Y	Y	Y	Y	Y	Y	Y
Treatment of air emissions or off-gas	Oxidation, scrubbing, vapour phase	Y	Y	Y	Y	Y	Y	Y	Y
Other	Carbon adsorption	Y	Y	Y	Y	Y	Y	Y	Y

Table 1.d
Protection and remediation of soil, sediment, sludge, groundwater, surface water, and leachate

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Water and wastewater									
Treatment of drinking water / filtration systems	Microscreening	N	N	Y	Y	Y	Y	Y	Y
	Chemicals used in drinking water treatment	N	N	Y	Y	Y	Y	Y	Y
	Equipment for advanced chemical oxidation/UV radiation	N	Y	Y	Y	Y	Y	Y	Y
	Fluoridation	N	N	Y	Y	Y	Y	Y	Y
	Alkalinity adjustment for process control	N	N	Y	Y	Y	Y	Y	Y
	Corrosion control - pH adjustment	N	N	Y	Y	Y	Y	Y	Y
	Coagulant	N	N	Y	Y	Y	Y	Y	Y
	Flocculation	N	Y	Y	Y	Y	Y	Y	Y
	Tanks (including components) for dilution/equalization, neutralization, sedimentation, chemical precipitation	N	Y	Y	Y	Y	Y	Y	Y
	Membrane bioreactor	N	Y	Y	Y	Y	Y	Y	Y
	Air stripping tank/column	N	Y	Y	Y	Y	Y	Y	Y
	Ion exchange bed	N	Y	Y	Y	Y	Y	Y	Y
	Greensand filtration	N	N	Y	Y	Y	Y	Y	Y
	Micro/ultrafiltration	N	N	Y	Y	Y	Y	Y	Y
	Electrodeionization	N	N	Y	Y	Y	Y	Y	Y
Reverse osmosis or nano filtration	N	N	Y	Y	Y	Y	Y	Y	

Table 1.e
Other environmental protection activities

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Air, environment & remediation									
Noise and vibration abatement	Goods and services for noise insulation in buildings	N	N	N	N	N	N	N	N
	Noise insulation works	N	N	N	N	N	N	N	N
Protection of environment	Site remediation services	Y	Y	Y	Y	Y	Y	Y	Y
	Environmental emergency response services	Y	Y	Y	Y	Y	Y	Y	Y
Protection against radiation	Radioactive waste management, decommissioning, and site remediation	N	N	Y	Y	Y	Y	Y	Y
Other environmental protection	Research and development	N	N	N	N	N	N	N	N
	Training	N	N	N	N	Y	Y	Y	Y
	Consulting & administrative services	N	N	N	N	Y	Y	Y	Y

Table 2 Sustainable resource activities - energy

**Table 2.a
Alternative fuel production**

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Biofuels and bioenergy									
Biofuel production	Grain ethanol	N	N	Y	Y	Y	Y	Y	Y
	Cellulosic ethanol	N	N	Y	Y	Y	Y	Y	Y
	Corn ethanol	N	N	N	N	N	N	Y	Y
	Biodiesel	N	N	Y	Y	Y	Y	Y	Y
	Algae biodiesel	N	N	N	N	Y	Y	Y	Y
	Biobutanol	N	N	Y	Y	Y	Y	Y	Y
	Methanol and Dimethyl Ether	N	N	Y	Y	Y	Y	Y	Y
	Syngas biofuels	N	N	Y	Y	Y	Y	Y	Y
	Drop-in synthetic fuels	N	N	Y	Y	Y	Y	Y	Y
	Biofuel oil	N	N	Y	Y	Y	Y	Y	Y
	Biogas	N	N	Y	Y	Y	Y	Y	Y
	Renewable natural gas	N	N	Y	Y	Y	Y	Y	Y
	Hydrogen (produced from non-fossil sources)	N	N	Y	Y	Y	Y	Y	Y
	Renewable diesel	N	N	Y	Y	Y	Y	Y	Y
	Pyrolysis oil	N	N	Y	Y	Y	Y	Y	Y
	Biobased naphtha	N	N	N	N	N	N	N	N
	Low carbon hydrogen	N	N	N	N	N	N	N	N
Sustainable aviation fuel	N	N	N	N	N	N	N	N	
Engineering services	N	N	N	N	Y	Y	Y	Y	
Bioenergy production	Chips, cubes, briquettes, pucks, and pellets from wood residues and grasses, etc.	N	N	Y	Y	Y	Y	Y	Y
	Black pellets	N	N	Y	Y	Y	Y	Y	Y
	Other biomass	N	N	Y	Y	Y	Y	Y	Y
	Biochar	N	N	Y	Y	Y	Y	Y	Y
	Fuel wood and other wood	N	N	Y	Y	Y	Y	Y	Y
	Engineering services	N	N	N	N	Y	Y	Y	Y

Table 2.b
Renewable / non-emitting electricity and heat production

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Renewable / non-emitting energy supply									
Wind energy	Wind turbine equipment, including nacelles, blades, towers	Y	Y	Y	Y	Y	Y	Y	Y
	Wind turbines	Y	Y	Y	Y	Y	Y	Y	Y
	Switchgears, transformers	Y	Y	Y	Y	Y	Y	Y	Y
	Engineering, installation, maintenance, and architectural services	N	N	Y	Y	Y	Y	Y	Y
Bioenergy	Domestic woodstoves, wood pellets, including own use by households and industry	Y	Y	Y	Y	Y	Y	Y	Y
	Biomass-fired industrial boilers	Y	Y	Y	Y	Y	Y	Y	Y
	Anaerobic digesters	Y	Y	Y	Y	Y	Y	Y	Y
	Engineering, installation, maintenance, and architectural services	N	N	Y	Y	Y	Y	Y	Y
Geothermal energy	Heat pumps, heat exchangers, other equipment used in geothermal energy systems	Y	Y	Y	Y	Y	Y	Y	Y
	Hydrothermal equipment	N	N	Y	Y	Y	Y	Y	Y
	Hot dry rock (HDR) equipment	N	N	Y	Y	Y	Y	Y	Y
	Advanced drilling and exploration equipment	N	N	N	N	Y	Y	Y	Y
	Engineering, installation, maintenance, and architectural services	N	N	Y	Y	Y	Y	Y	Y
Hydro energy	Turbines and components for wave/tidal energy	Y	Y	Y	Y	Y	Y	Y	Y
	Turbines and components for run-of-river hydro	Y	Y	Y	Y	Y	Y	Y	Y
	Turbines (Francis, Kaplan, Pelton, propeller) and components for large hydro	Y	Y	Y	Y	Y	Y	Y	Y
	Generators (including components), valves, gates, transformers, switchgear	Y	Y	Y	Y	Y	Y	Y	Y
	Salinity gradient power equipment	N	N	N	N	N	N	N	N
	Engineering, installation, maintenance, and architectural services	N	N	Y	Y	Y	Y	Y	Y
Solar energy	Active (thermal) solar heating & cooling equipment (glazed flat plate collectors, glazed evacuated tubes/collectors, unglazed panels/collectors for heating pools, perforated cladding for solar air heating)	Y	Y	Y	Y	Y	Y	Y	Y
	Active (thermal) solar power generation equipment (concentrating mirrors, receivers)	Y	Y	Y	Y	Y	Y	Y	Y
	Solar photovoltaic energy equipment (photovoltaic cells, modules, panels/arrays, inverters for solar photovoltaic systems)	Y	Y	Y	Y	Y	Y	Y	Y
	Thin film solar PV (nanotechnology)	N	N	N	N	N	N	N	N
	Engineering, installation, maintenance, and architectural services	N	N	Y	Y	Y	Y	Y	Y
Waste to energy	Organic (liquid) waste to energy	N	N	Y	Y	Y	Y	Y	Y
	Organic (solid) waste to energy	N	N	Y	Y	Y	Y	Y	Y
	Landfill gas to energy	N	N	N	N	Y	Y	Y	Y
	Engineering, installation, maintenance, and architectural services	N	N	Y	Y	Y	Y	Y	Y
Nuclear energy	Nuclear reactors, or nuclear island components (primary circuit, steam generators, primary side auxiliaries, nuclear island electrical supply and instrumentation and controls)	N	N	Y	Y	Y	Y	Y	Y
	Nuclear fuel handling, processing, and fabrication equipment	N	N	Y	Y	Y	Y	Y	Y
	Balance of nuclear power plant, or conventional island components	N	N	N	N	Y	Y	Y	Y
	Engineering, installation, maintenance, licensing support, and architectural services	N	N	Y	Y	Y	Y	Y	Y
	Uranium processing, conversion, and nuclear fuel fabrication services	N	N	Y	Y	Y	Y	Y	Y

Table 2.c
Smart grid & energy storage

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Smart grid									
Demand management	Inverters	N	Y	Y	Y	Y	Y	Y	Y
	Smart meters	N	Y	Y	Y	Y	Y	Y	Y
	Phasor measurement units / sensors	N	Y	Y	Y	Y	Y	Y	Y
	Management systems (communication solutions, monitoring and automation, software)	N	Y	Y	Y	Y	Y	Y	Y
	Engineering, installation, and maintenance services	N	N	N	N	Y	Y	Y	Y
Transmission and distribution	Transmission and distribution management	N	N	Y	Y	Y	Y	Y	Y
	Microgrid solutions	N	N	Y	Y	Y	Y	Y	Y
	Local & district heating equipment and related services	N	N	N	N	N	N	N	N
	Other related ICT equipment	N	N	Y	Y	Y	Y	Y	Y
	Engineering, installation, and maintenance services	N	N	N	N	Y	Y	Y	Y
Energy storage									
Mechanical energy storage	Flywheels	N	Y	Y	Y	Y	Y	Y	Y
	Pumped hydro	N	Y	Y	Y	Y	Y	Y	Y
	Compressed air	N	Y	Y	Y	Y	Y	Y	Y
Electrochemical energy storage (advanced batteries)	Nickel cadmium (NiCd)	N	Y	Y	Y	Y	Y	Y	Y
	Nickel metal hydride (NiMH)	N	Y	Y	Y	Y	Y	Y	Y
	Lead acid (LA)	N	Y	Y	Y	Y	Y	Y	Y
	Lithium-ion (Li-ion)	N	Y	Y	Y	Y	Y	Y	Y
	Sodium sulphur (NaS)	N	Y	Y	Y	Y	Y	Y	Y
	Sodium nickel chloride (NaNiCl)	N	Y	Y	Y	Y	Y	Y	Y
	Hybrid flow	N	Y	Y	Y	Y	Y	Y	Y
	Redox flow	N	Y	Y	Y	Y	Y	Y	Y
	Hydrogen storage	N	Y	Y	Y	Y	Y	Y	Y
	Liquid hydrogen storage	N	N	N	N	N	N	N	N
	Gaseous hydrogen storage	N	N	N	N	N	N	N	N
	Fuel cells	N	Y	Y	Y	Y	Y	Y	Y
	Synthetic natural gas	N	Y	Y	Y	Y	Y	Y	Y
Electrical storage	Double-layer and super/ultra capacitors (DLC)	N	Y	Y	Y	Y	Y	Y	Y
	Superconducting magnetic energy storage (SMES)	N	Y	Y	Y	Y	Y	Y	Y
Thermal storage	Thermal storage systems	N	Y	Y	Y	Y	Y	Y	
Hybrid storage	Hybrid storage systems	N	N	N	N	Y	Y	Y	
Energy storage services	Engineering, installation, and maintenance services	N	N	N	N	Y	Y	Y	

Table 2.d
Substitutes for fossil fuels and fossil-fuel-based materials (bioproducts)

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Biofuels and bioproducts									
Equipment for producing biofuels and bioproducts	Mixers/centrifuges	N	Y	Y	Y	Y	Y	Y	Y
	Filtration systems	N	Y	Y	Y	Y	Y	Y	Y
	Biofuel reactors (distillation towers, digesters)	N	Y	Y	Y	Y	Y	Y	Y
	Washers	N	Y	Y	Y	Y	Y	Y	Y
	Dryers	N	Y	Y	Y	Y	Y	Y	Y
	Heaters	N	Y	Y	Y	Y	Y	Y	Y
	Storage systems	N	Y	Y	Y	Y	Y	Y	Y
	Additives/catalysts (e.g., sodium hydroxide, potassium hydroxide)	N	Y	Y	Y	Y	Y	Y	Y
	Shredders, chippers	N	Y	Y	Y	Y	Y	Y	Y
	Dust collectors	N	N	Y	Y	Y	Y	Y	Y
	Conveyors	N	N	Y	Y	Y	Y	Y	Y
Other conversion technologies/equipment	N	Y	Y	Y	Y	Y	Y	Y	
Biochemicals									
Biochemicals	Lubricants, waxes, and grease	N	Y	Y	Y	Y	Y	Y	Y
	Bio-oils & derivatives	N	N	Y	Y	Y	Y	Y	Y
	Resins	N	N	Y	Y	Y	Y	Y	Y
	Bioplastics	N	N	Y	Y	Y	Y	Y	Y
	Biobased packaging	N	N	Y	Y	Y	Y	Y	Y
	Acids	N	Y	Y	Y	Y	Y	Y	Y
	Sugars (C5, C6), cellulose esters, polyols	N	N	Y	Y	Y	Y	Y	Y
	Other building block chemicals	N	N	N	N	Y	Y	Y	Y
	Paints, coatings, solvents, adhesives	N	N	Y	Y	Y	Y	Y	Y
	Other biobased specialty chemicals	N	N	N	N	Y	Y	Y	Y
	Bio-pesticides and bio-stimulants	N	N	Y	Y	Y	Y	Y	Y
	Bio-catalysts and bio-enzymes	N	N	Y	Y	Y	Y	Y	Y
	Biofoam (insulation) and biorubber	N	Y	Y	Y	Y	Y	Y	Y
	Lignin	N	N	Y	Y	Y	Y	Y	Y
Hemicellulose	N	N	Y	Y	Y	Y	Y	Y	
Biomaterials									
Biomaterials	Biocomposites and biofibres	N	Y	Y	Y	Y	Y	Y	Y
	Advanced materials (e.g., nanomaterials, nanocomposites, nanocrystalline cellulose, silk fibres)	N	N	Y	Y	Y	Y	Y	Y
	Cross laminated timber	N	N	Y	Y	Y	Y	Y	Y
	Wood composite	N	N	Y	Y	Y	Y	Y	Y
	Agri-based composite	N	N	Y	Y	Y	Y	Y	Y
	Textile	N	N	N	N	N	N	N	N
	Mats and specialty cellulose products	N	N	Y	Y	Y	Y	Y	Y
	Panels, cement, and other building products	N	N	Y	Y	Y	Y	Y	Y
	Automotive and transportation products	N	N	Y	Y	Y	Y	Y	Y
	Furniture and Consumer Goods	N	N	N	N	N	N	N	N
Other									
Other	Reclaimed rubber or other petro-based materials	N	N	N	N	N	N	N	N

Table 2.e
Technologies to improve energy and resource efficiency / management

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Energy efficiency									
Energy & resource efficient modifications, improvements	In process (ancillary/own use) modifications	N	N	N	N	N	N	N	N
	Combined heat and power and cogeneration	N	N	Y	Y	Y	Y	Y	Y
	Enhanced solvent extraction for oil sands	N	N	N	N	N	N	N	N
	Fuel control systems	N	N	N	N	Y	Y	Y	Y
	Material/waste recovery and related services	N	N	N	N	Y	Y	Y	Y
	Energy recovery and related services	N	N	Y	Y	Y	Y	Y	Y
	Low-energy/passive buildings and related services	N	N	N	N	N	N	N	N
	Energetic refurbishment of existing buildings and related services	N	N	N	N	Y	Y	Y	Y
	Advanced thermostats	N	N	N	N	Y	Y	Y	Y
	Advanced insulation activities	N	N	Y	Y	Y	Y	Y	Y
	Collaborative consumption systems	N	N	N	N	N	N	N	N
Additive manufacturing	N	N	N	N	Y	Y	Y	Y	
Measurement, controls and monitoring	Energy Audit for houses, buildings, industries and fleets	N	Y	Y	Y	Y	Y	Y	Y
	Energy efficiency certification (such as energy star for products, R-2000 for houses, BOMA Best for buildings, ISO 50001 for industry)	N	Y	Y	Y	Y	Y	Y	Y
	Energy management system services	N	N	N	N	Y	Y	Y	Y
	Energy monitoring services	N	N	Y	Y	Y	Y	Y	Y
	Demand control services	N	N	Y	Y	Y	Y	Y	Y
	Process integration services	N	N	Y	Y	Y	Y	Y	Y
	Data analysis and modelling services	N	N	Y	Y	Y	Y	Y	Y
	Automation and control technology	N	N	Y	Y	Y	Y	Y	Y
Uncertified green property investments	N	N	N	N	N	N	N	N	
Green building certification	N	Y	Y	Y	Y	Y	Y	Y	
Industrial design and related services	Aerodynamic design	N	N	Y	Y	Y	Y	Y	Y
	Aerodynamic testing	N	N	Y	Y	Y	Y	Y	Y
	Modelling tools and services	N	N	Y	Y	Y	Y	Y	Y
	Energy efficiency consulting services	N	Y	Y	Y	Y	Y	Y	Y
	Design of emission control technologies	N	N	Y	Y	Y	Y	Y	Y
	Circular design services	N	N	N	N	N	N	N	N

Table 3 Sustainable resource activities - water

Table 3.a
Reduction of water use, losses

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Water and wastewater									
Water efficiency	Planning and design	N	N	Y	Y	Y	Y	Y	Y
	Efficiency consulting	N	N	Y	Y	Y	Y	Y	Y
	Laboratory	N	N	Y	Y	Y	Y	Y	Y
	Piloting, validation and verification	N	N	Y	Y	Y	Y	Y	Y
	Training and plant operation	N	N	Y	Y	Y	Y	Y	Y
	Equipment to reduce water consumption	N	N	Y	Y	Y	Y	Y	Y
	Processes for desalinated water	N	N	Y	Y	Y	Y	Y	Y
	Rainwater collection	N	N	Y	Y	Y	Y	Y	Y
Pipe inspection	N	N	Y	Y	Y	Y	Y	Y	

Table 3.b
Water management

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Water and wastewater									
Measurement and control of water use	Software	N	N	Y	Y	Y	Y	Y	Y
	Platform or system	N	N	Y	Y	Y	Y	Y	Y
	Sensors	N	N	Y	Y	Y	Y	Y	Y
	Information and communication technologies	N	N	Y	Y	Y	Y	Y	Y

Table 3.c
Water recycling

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Water and wastewater									
Recycling	Gray water reuse	N	N	Y	Y	Y	Y	Y	Y
	Water recycling technologies	N	N	Y	Y	Y	Y	Y	Y

Table 4 Sustainable resource activities - agriculture, forestry and biodiversity

**Table 4.a
Agriculture**

Industry and sub-industry	Technology area /type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Precision agriculture, forestry, biodiversity									
Precision inputs	Precision fertilizers and other inputs (e.g., smart seeds)	N	N	Y	Y	Y	Y	Y	Y
Machinery and equipment	Variable rate/precision (GPS enabled) seeders, fertilizer applicators, sprayers, etc.	N	N	Y	Y	Y	Y	Y	Y
	Sensors (crop canopy, yield, etc.)	N	N	Y	Y	Y	Y	Y	Y
	PA decision support software packages for seeding, spraying, fertilizing, irrigating	N	N	Y	Y	Y	Y	Y	Y
	UAV drones with/for agricultural platforms	N	N	Y	Y	Y	Y	Y	Y
	Ionophores for livestock feed	N	N	N	N	N	N	N	N
	Livestock precision feeding technology (RFID sensors, automated feeders)	N	N	Y	Y	Y	Y	Y	Y
	Anaerobic digestors	N	N	N	N	N	N	N	N
	Other	N	N	Y	Y	Y	Y	Y	Y

**Table 4.b
Aquaculture**

Industry and sub-industry	Technology area /type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Precision agriculture, forestry, biodiversity									
Aquaculture	Alternative feeds (plant, algal, yeast-based proteins to replace fish meal consumption)	N	N	N	N	N	N	N	N
	Fish waste reduction/recycling (solid and liquid waste collected/filtered)	N	N	Y	Y	N	N	N	N
	Conversion to land-based culture (e.g., Recirculating Aquaculture System (RAS))	N	N	Y	Y	N	N	N	N
	Energy efficient pumps, filters, processes	N	N	Y	Y	N	N	N	N
	Organic aquaculture products and supporting services	N	N	N	N	N	N	N	N

Table 4.c
Wild flora and fauna

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Precision agriculture, forestry, biodiversity									
Wild flora and fauna management	Minimization of the intake of wild flora and fauna	N	N	N	N	N	N	N	N
	Restoration activities	N	N	N	N	N	N	N	N
	Measurement, control, and laboratories for wild flora and fauna management	N	N	N	N	N	N	N	N
	Training and administrative activities related to flora and fauna management	N	N	N	N	N	N	N	N

Table 4.d
Forestry

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Precision agriculture, forestry, biodiversity									
Sustainable forestry	Management of forest areas (including restoration, replenishment, development of new forest areas, and prevention and control of fires)	N	N	N	N	Y	Y	Y	Y
	Minimization of the intake of forest resources	N	N	N	N	Y	Y	Y	Y
	Measurement, control, and laboratories for forest management	N	N	N	N	Y	Y	Y	Y
	Training and administrative activities related to forest management	N	N	N	N	Y	Y	Y	Y
	Precision sampling and data gathering technologies	N	N	N	N	N	N	N	N

Table 5 Sustainable resource activities - minerals

**Table 5.a
Minerals and metals**

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Mining, processing, materials manufacturing & industry									
Mineral use	In-process modifications to reduce consumption of mineral resources	N	N	N	N	N	N	N	N
	Production of substitutes for minerals-based materials	N	N	N	N	N	N	N	N
	Measurement/control related to the reduction of the use of minerals	N	N	N	N	N	N	N	N
	Recovery of mineral-based materials	N	N	N	N	N	N	N	N
	Machinery for metal recovery	N	N	N	N	N	N	N	N
Green mining and processing	Enhanced solvent extraction	N	N	N	N	N	N	N	N
	Sustainable mineral processing	N	N	N	N	N	N	N	N
Waste management	Recycling and reprocessing	N	N	N	N	N	N	N	N
Energy efficiency	Energy efficient processes and equipment for various applications	N	N	N	N	N	N	N	N
Low carbon energy use	Renewables, non-fossil fuels	N	N	N	N	N	N	N	N
Site reclamation	Cover technologies	N	N	N	N	N	N	N	N
Ecosystems	Dust collectors	N	N	N	N	N	N	N	N

Table 6 Adapted goods

**Table 6.a
Energy efficient equipment & appliances**

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Energy efficiency									
Efficient industrial equipment	High efficiency burners and boilers	N	N	Y	Y	Y	Y	Y	Y
	High efficiency pumps and motors	N	N	Y	Y	Y	Y	Y	Y
	High efficiency industrial HVAC	N	N	Y	Y	Y	Y	Y	Y
	High efficiency industrial lighting system	N	N	Y	Y	Y	Y	Y	Y
	Batteries for portable devices	N	N	Y	Y	Y	Y	Y	Y
Efficient commercial/ residential equipment	High efficiency commercial/residential HVAC	N	N	Y	Y	Y	Y	Y	Y
	High efficiency electric appliances	N	N	N	N	N	N	N	N
	High efficiency lighting system	N	N	Y	Y	Y	Y	Y	Y

**Table 6.b
Sustainable mobility**

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Transportation									
Fuel efficient automotive equipment	Fuel efficient engines and components (including electrification and hybrids)	N	N	Y	Y	Y	Y	Y	Y
	Electric vehicle battery	N	N	Y	Y	Y	Y	Y	Y
	Battery powered electric vehicle other components	N	N	Y	Y	Y	Y	Y	Y
	Fuel cell vehicle FC stack	N	N	Y	Y	Y	Y	Y	Y
	Fuel cell vehicle other components	N	N	Y	Y	Y	Y	Y	Y
	Automobile components using lightweight materials	N	N	Y	Y	Y	Y	Y	Y
	Electric vehicle infrastructure (charging stations)	N	N	Y	Y	Y	Y	Y	Y
	Alternative fuel (including hydrogen & natural gas) refueling infrastructure	N	N	Y	Y	Y	Y	Y	Y
	LNG/CNG engine	N	N	Y	Y	Y	Y	Y	Y
	LNG/CNG tank	N	N	Y	Y	Y	Y	Y	Y
	LNG/CNG control system	N	N	Y	Y	Y	Y	Y	Y
	Aerodynamic device	N	N	Y	Y	Y	Y	Y	Y
	Auxiliary power unit	N	N	Y	Y	Y	Y	Y	Y
	Engine control module	N	N	Y	Y	Y	Y	Y	Y
	Low rolling resistance tire	N	N	Y	Y	Y	Y	Y	Y
	Vehicle emission monitoring	N	N	Y	Y	Y	Y	Y	Y
	Alternative fuel retrofits	N	N	Y	Y	Y	Y	Y	Y
Technical inspection services related to air emissions	N	N	Y	Y	Y	Y	Y	Y	

Table 6.b
Sustainable mobility

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Transportation									
Fuel efficient aerospace equipment	Efficient turbine	N	N	Y	Y	Y	Y	Y	Y
	Fuel efficient engines (including electrification and other alternative fuels)	N	N	Y	Y	Y	Y	Y	Y
	Additive composite	N	N	Y	Y	Y	Y	Y	Y
	Aircraft components using lightweight materials	N	N	Y	Y	Y	Y	Y	Y
	Powder metallurgy, coatings, polishing, anodizing for fuel efficiency	N	N	Y	Y	Y	Y	Y	Y
Infrastructure and traffic control	Intelligent traffic control	N	N	Y	Y	Y	Y	Y	Y
	Integrated traffic infrastructure	N	N	Y	Y	Y	Y	Y	Y
	Traffic management	N	N	Y	Y	Y	Y	Y	Y
Other	Car sharing	N	N	N	N	N	N	N	N
	Electric and more resource efficient transport equipment	N	N	Y	Y	Y	Y	Y	Y
	Vehicle fleet management & logistics	N	N	Y	Y	Y	Y	Y	Y

Table 6.c
Advanced materials

Industry and sub-industry	Technology area / type of service	SEGS							
		2012	2015	2017	2018	2019	2020	2021	2022
Materials, manufacturing & industry									
Advanced/lightweight materials	Products developed using additive manufacturing or low-impact processes	N	N	N	N	N	N	N	N
	Nanotechnology	N	N	Y	Y	Y	Y	Y	Y
	Compound materials	N	N	Y	Y	Y	Y	Y	Y
	Advanced packaging	N	N	Y	Y	Y	Y	Y	Y
	Other lightweight materials	N	N	Y	Y	Y	Y	Y	Y