SET* Plan Action6 on Energy Efficiency in Industry

“Making EU industry less energy, resource and emissions intensive and more competitive"

INTEGRATED
SET PLAN

SET Plan IWGs / SG meeting
21/10/2021

Updated 6/2022

(*) SET: Strategic Energy Technology

Achievements

Declaration of Intent – initial scope: April 2016

- 1-Iron & Steel
- 2-Chemical & Pharma
- 3-Heat/Cold recovery
- (4-Components)
- 5-Systems integration and symbiosis:

Temporary Working Group: set up in Sept 2016

Implementation Plan: endorsed 27 Sept 2017

- Priorities, targets, activity areas and fiches
  - Inspiration for MS&AC national programmes
  - Structuring sectors, projects description template, visibility

2018 - Workshop: 27-28 June 2018, Brussels

- 140p (70 IND, 43 Research&Aca, 17 EU, 9 Nat. Repr)
- Countries share info on R&I programme and cooperation models
- Parallel sessions: the countries and stakeholders further **develop activities into project ideas** (40 project ideas discussed in roundtables)

Workshop 2018 - outcomes

The Workshop confirmed a wide interest from the attendees in several areas defined by clusters of Project Ideas but not yet a sufficient critical mass of stakeholders in a group of Countries that could justify bi-multi-lateral cooperation

Priority	Activity No	Activity name	Contributing ideas	Countries															
				AT	BE	CH	DE	ES	FI	FR	GR	IT	NL	NO	PT	SE	TR	UK	US
1A-Steel	ST1A.1	CO_2 emission avoidance through direct reduction	25, 34, 41,43	2			3			1						3			
1A-Steel	ST1A.2	Hisarna smelting reduction process	30	1			2			1			1						
1A-Steel	ST1A.3	Top Gas Recycling – Blast Furnace	33, 46		1					3				1					
1B-CHEM	CH1B.1	Process intensification	5, 6,44		1	2	2	2						1					
1B-CHEM	CH1B.3	Power-to-X & unconventional energy	10, 11, 13, 20, 45				2	2					2	1	2		1		
3-Heat &Cold	HE3.2	Heat upgrade	29		4				1			1	1	1				2	
3-Heat &Cold	HE3.3	Heat-to-Power (electrical) recovery	3, 14, 15, 16, 18, 36		3		1		1			4		2				2	
3-Heat &Cold	HE3.4	Poly-generation	7,9, 13, 29,35		2	1	3	3	1	1	1	6	2	3				3	1
5-SYST	SY5.1	Symbiosis and non-conventional energy	17, 38, 39, 40	1	2	1	5	1	1	3			2					2	
5-SYST	SY5.2	Digitisation	1, 21, 26, 37					1		1		2		2					
5-SYST	SY5.3	Knowledge exchange, training and capacity	12, 42, 47									1		1				1	

Colour code: Nb of partners within: 1-2 3-4 5-6

2019

Networking event, 4 Dec. 2019, Brussels

"Cooperation and Funding
on Energy Efficiency in Industry"

Objective: inform on finance opportunities at EU level

- **presentations** on Cross-border cooperation, Innovation Fund, EIB and IPCEI
- **exchange experiences on common barriers** towards project implementation and funding, exchange ideas on possible recommendations to overcome such obstacles
- **one-to-one consultations on funding** with members of the SET Plan Action 6 Secretariat and National and European funding agencies

2019 -2020

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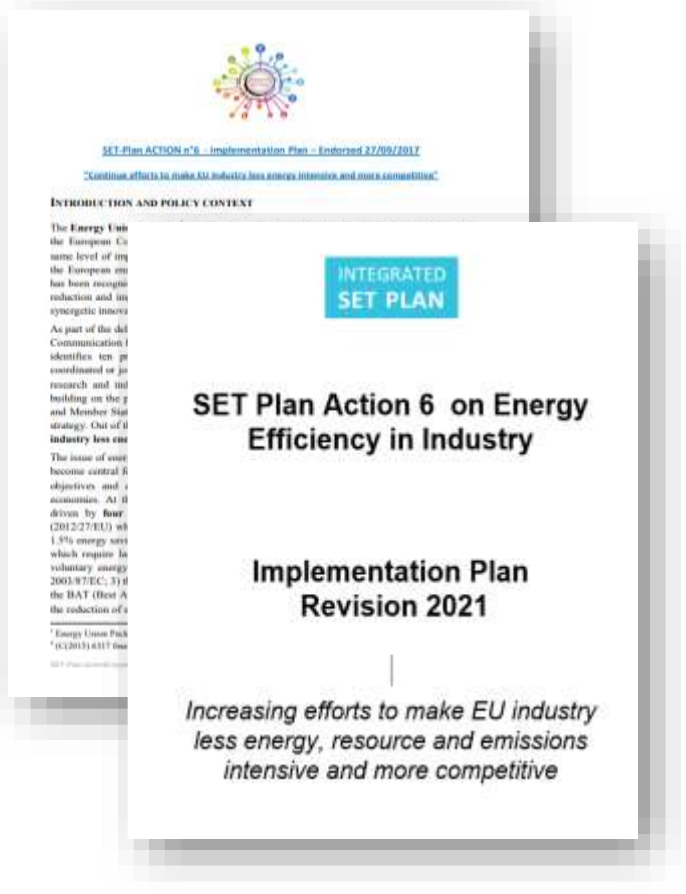
- **H2020 - Topic** on Demonstration of Industr. Heat recovery and conversion-to-Power (CC-09) – Project CO2OLHEAT (sCO_2)
  start June 2021 – end May 2025 - funding €14m
- **Horizon Europe** – WP 2021-2022 – **4 topics** - €48m
  - Demonstration of **heat upgrade** technologies with supply T° 90 - 160°C
  - Development of **heat upgrade** technologies with supply T° 150-250°C
  - Demonstration of Industrial waste **Heat-to-Power conversion** based on organic Rankine cycles
  - Development of **high temperature thermal storage** for industrial applications
- **Tender AIDRES** - **A**dvancing **I**ndustrial **D**ecarbonisation by assessing the future use/needs of **R**enewable **E**nergie**S** in industrial processes
  €0.5m – start Dec 2020 – end Dec 2022

Revised of the Implementation Plan (IP)



- The IP is the **key strategic document** for Action 6
- The IP is currently **being revised** to align Action 6 with recent **R&I developments and policy changes** (e.g. European Green Deal)
- The IP draws on the **expertise of industry and research stakeholders, and MS & associated countries** representatives,
  to set out **priority R&I activities** and collectively agreed **targets**

Lock-down slowed down, but did not stop…

- Lock-down caused problems
- IWG 6 virtual meeting 12/2021
- Virtual workshop, Annual Event 8-10 March 2022 afternoons

- The 3 year contract with consultants stopped in spring 2022
- New contract is under preparations (DG ENER)

Implementation Plan rescoping

Target areas
- Energy (and resource) efficiency

Sector-specific
- Iron & Steel
- Chemicals

Cross-cutting
- Heating & Cooling
- Systems Integration

Rescope
2017 to 2021

- Energy efficiency
- Resource efficiency
- GHG emissions
- Feedstocks and circularity
- Iron & Steel
- Chemicals
- Cement
- Pulp & Paper
- Heating & Cooling
- Systems Integration

Updated R&I priority areas

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Priority	No.	Title
Heat & Cold	1.1	**Heat upgrade** from low to high grade
	1.2	**Waste heat to power** (low and high temperature)
	1.3	**Waste heat to cold** generation
	1.4	**Polygeneration** (heat, cold, electrical power and hybrid plants **integrating renewable heat**
Systems	2.1	**Industrial symbiosis**
	2.2	**Non-conventional energy sources** in process industry including **carbon capture and use**
	2.3	**Digitalisation**
	2.4	Knowledge exchange, training and capacity-building
Cement	3.1	**Resource efficiency***
	3.2	**Energy efficiency***
	3.3	**Carbon Capture Storage and Usage (CCS/U)***
	3.4	**Recarbonation and mineralisation***
Chemicals	4.1	Electrification
	4.2	Integrated **production of Hydrogen** with low carbon footprint*
	4.3	**Plastic waste as an alternative feedstock***
	4.4	**CO_2 / CO as an alternative feedstock***
	4.5	**Biomass as an alternative feedstock*** *(shared activity, see Pulp & Paper 6.6)**
	4.6	Process efficiency
Iron & Steel	5.1	CO_2 emissions avoidance through **direct reduction of iron using Hydrogen**
	5.2	CO_2 emissions avoidance through **direct reduction iron using electricity***
	5.3	**Process integration: HIsarna** smelting reduction process for lowering energy use and CO_2 emissions
	5.4	**Process integration: Top Gas Recycling – Blast Furnace** (TGR-BF) using plasma torch
	5.5	**Carbon Capture and Usage** (CCU)*
	5.6	**Circular economy***
Pulp & Paper	6.1	Integral **drying and heat recovery** processes*
	6.2	**Paper making without water evaporation***
	6.3	**Process optimisation and electrification** (modular approach)*
	6.4	**Mild pulping** processes *
	6.5	Onsite **renewable energy conversion***
	6.6	**Biomass as alternative feedstock** *(shared activity, see Chemicals 4.5)**

New areas are marked with '*'

Changes in cross-cutting targets

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Priority (OLD)	Target (baseline 2015) (OLD)
3. **Maximising the recovery of industrial excess heat/cold** in a cost efficient manner.	**By 2025, develop and demonstrate (to TRL 8) cost effective excess heat/cold recovery solutions** (e.g. heat exchangers, upgrade to higher temperature, storage, distribution, heat-to-power, heat-to-cold, power-to-heat).
4. **Maximising the energy efficiency of cross-sector industrial components** in a cost efficient manner.	By 2025, develop and demonstrate (to TRL 8) industrial components whose losses are reduced by 15% (e.g. boilers, dryers,… all of which systems typically contain motors and drives).
5. **Improving system integration, optimal design, intelligent and flexible operation, including industrial symbiosis**, to increase energy and resource efficiency while striving to reduce GHG emissions.	**By 2025, develop and demonstrate solutions** enabling small and large, industries to **reduce their energy consumption by 20%** while striving to reduce GHG emissions proportionally.

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Changes in cross-cutting targets => More specific

Priority (OLD)	Target (baseline 2015) (OLD)
3. **Maximising the recovery of industrial excess heat/cold** in a cost efficient manner.	**By 2025, develop and demonstrate (to TRL 8) cost effective excess heat/cold recovery solutions** (e.g. heat exchangers, upgrade to higher temperature, storage, distribution, heat-to-power, heat-to-cold, power-to-heat).
4. Maxi **compo**	
5. **Impro** **and flex** increase GHG em	

<table>
<tr><th colspan="4">Heating & cooling</th></tr>
<tr><th>Activity</th><th>2025</th><th>2030</th><th>2050</th></tr>
<tr><td>1.1 Heat or cool upgrade from low to high grade</td><td>Develop and demonstrate (to TRL 7 for temperature up to 200/250°C and to TRL 6 for temperature above 250°C) solutions enabling small and large industries to cost effectively reduce their energy consumption by 5% by cost effectively upgrading excess heat for more valuable application elsewhere in the process.</td><td rowspan="5">Increase efficiency by 5% compared to 2025 level;

Reduce LCOE by 10% compared to 2025 level.

Develop and demonstrate to (TRL 8) hybrid systems (considering e.g. heat storage, high temperature heat pumps, etc.)</td><td rowspan="5">Carbon neutral manufacturing process:

Reduce use of Critical Raw Material;

Reduce emissions at production level;

Extending components operating lifetime + 25%; Increase the re-use of end of life material.</td></tr>
<tr><td>1.2a Low temperature waste heat to power</td><td>Develop and demonstrate (to TRL 7) solutions enabling small and large, industries to cost effectively (€/kW) recover 10% of low temperature waste heat (100-300˚C) while striving to reduce GHG emissions proportionally (tons CO_2 avoided).</td></tr>
<tr><td>1.2b High temperature waste heat recovery to generate electricity</td><td>Develop and demonstrate (to TRL 7) solutions enabling small and large, industries to cost effectively (€/kW) recover 20% of high temperature waste heat (>300˚C) while striving to reduce GHG emissions proportionally (tons CO_2 avoided).</td></tr>
<tr><td>1.3 Waste heat to cold generation</td><td>Develop and demonstrate (to TRL 7) cost effective cooling solutions using recovered and/or renewable heat</td></tr>
<tr><td>1.4 Polygeneration (heat, cold, electricity) and hybrid plants</td><td>Develop and demonstrate (to TRL 7) cost effective polygeneration solutions and integration of renewable heat in the industrial processes.</td></tr>
</table>

Changes in cross-cutting targets => More specific

INTEGRATED SET PLAN

Priority (OLD)	Target (baseline 2015) (OLD)
5. **Improving system integration, optimal design, intelligent and flexible operation, including industrial symbiosis**, to incre… GHG…	**By 2025, develop and demonstrate solutions** enabling small and large, industries to **reduce their energy consumption by 20%** while striving to **reduce GHG** emissions proportionally…

Systems			
Activity	**2025**	**2030**	**2050**
2.1 Industrial (urban) symbiosis	**Develop and demonstrate solutions, including the needed local logistics**, enabling small and large industries to **reduce their common energy consumption by 10 to 20%** while striving to **reduce GHG emissions** proportionally.		
	-	~**15 real industrial symbiosis full scale hubs**.	**> 200** real industrial symbiosis full scale **hubs.**
2.2 Non-conventional energy sources, including CCU	**Develop and demonstrate solutions** enabling small and large industries to **reduce their energy consumption by 20%** while striving to reduce **GHG emissions** proportionally.		
	-	Optimal use of energy from **biomass residues and waste residues reaching 20%** share in the energy resources. Availability of **digital systems to manage energy mix applications** in heating and cooling of energy intensive processes. > **20% less energy use in capture and purification of CO_2**.	-
2.3 Digitalisation	Implementation of **process control and process automation solutions in 10% of plants.**	Implementation of process control and process automation solutions in **20% of plants**.	Implementation of process control and process automation solutions in **100% of plants.**
2.4 Knowledge exchange, training and capacity-building	**Mapping of training and skills needs and setting up of curricula** (based on knowledge exchange).	**New curricula at university/high schools** (capacity building) on innovative skills and education in agreement with the SET-plan technological, advocacy and management needs. **Tailor made training and skills development** for in-company training based on the new needs (technical, advocacy, management) defined in SET-Plan.	-

Changes in sector specific - overall targets

INTEGRATED SET PLAN

Priority (OLD)	Target (baseline 2015) (OLD)
1. **Increasing the energy efficiency** of most energy consuming industries by increasing the cost effectiveness of not yet economically viable technologies (TRL>=7) through technological development, **while striving to reduce GHG emissions proportionally.**	**By 2030, at least 1/3 of the technical potential energy savings** related to sector specific technologies, **become economically viable (Payback <= 3 years).**
2**. Increasing the energy efficiency** of most energy consuming industries by progressing emerging technologies (TRL 4 - 6), **while striving to reduce GHG emissions proportionally**.	**By 2030, 1/3 of the currently promising emerging technologies are successfully demonstrated** at large scale (TRL>=8).

Changes in sector specific - overall targets

INTEGRATED SET PLAN

Priority (OLD)	Target (baseline 2015) (OLD)
1. **Increasing the energy efficiency** of most energy consuming industries by increasing the cost effectiveness of not yet economically viable t technological develo **emissions proporti**	**By 2030, at least 1/3 of the technical potential energy savings** related to sector specific technologies, **become**
2**. Increasing the er** industries by progres **while striving to re**	

NEW	2030	2050
Cement	Reduce gross CO_2 **emissions** by 30% and value chain emission by 40% by 2030.	**Carbon neutrality** along the cement-concrete **value chain** by 2050.
Chemicals	Deployment between 2030 and 2050 of innovative technologies is aiming at a **climate-neutral chemical industry** by 2050 and increased carbon **circularity**.	
Iron & Steel	Reduce **total CO2 emissions** by 30% by 2030 compared to 2018 (which corresponds to a reduction of around **55% by 2030 compared to 1990**.	Reduce CO2 emissions stemming from EU steel production by **80-95%** compared to 1990 levels by 2050, ultimately leading to **climate neutrality**.
Pulp & Paper	-	**Decarbonising by 80% to reach climate neutrality**, while creating 50% more **added value** by 2050.

Changes in sector specific – detailed targets

INTEGRATED SET PLAN

Cement		
Activity	2030	2050
3.1 Resource efficiency		
3.1a Alternative fuels - sourced from a variety of waste streams, including biomass waste)	60% alternative fuel use of which 30% biomass waste.	90% alternative fuel use of which 50% biomass.
3.1b (overall target) Alternative raw materials, clinker substitution, concrete recycling	3.5% reduction of process CO_2 using decarbonated raw materials.	8% reduction of process CO_2 using decarbonated raw materials.
3.1b (i) New types of clinkers[20]	2% reduction in process emissions CO_2.	5% reduction in process emissions CO_2.
3.1b (ii) Reducing clinker content	Reduce ratio to 74% (from 77% in 2021)	Reduce ratio to 65%
3.1b (iii) Concrete: improved mix design, new admixtures	Reduce cement in concrete by 5% in 2030.	Reduce cement in concrete by 15% in 2050.
3.2 Energy efficiency	4% thermal efficiency improvement.	14% thermal efficiency improvement.
3.3 CCS/U	Pilots and demonstrators by 2030 (dependent on infrastructure and a proper accounting framework).	42% reduction in CO_2 emissions through CCS.
3.4 Recarbonation and mineralisation	-	Up to 8% saving in total CO_2 emissions for cement manufactured (assuming a 23% of process emissions of cement used being captured annually)-

Iron & Steel[3]			
Activity	2025	2030	2050
5.1 CO_2 emissions avoidance through direct reduction of iron using Hydrogen	-	Reduction degree of iron oxide: > 90 % (KPI2a) Replacement rate of fossil carbon by hydrogen injection: > 10 % (KPI2b) Replacement rate of natural gas by H2 in the feed of the direct reduction plant: > 50 volume-% (KPI2c)	
5.2 CO2 emissions avoidance through direct reduction iron using electricity*	-	Electric efficiency of the electrolytic cell: > 85% (KPI3)	
5.3 Process integration: Hisarna smelting reduction process for lowering energy consumption and CO2 emissions of steel production	-	Decrease the use of energy per tonne of steel for clean steel making: > 10 % specific energy consumption reduction for a dedicated process (KPI9)	
5.4 Process integration: Top Gas Recycling – Blast Furnace (TGR-BF) using plasma torch	-	Demonstration of a transformative technology for the blast furnace; increase of the re-use of off-gases in the blast furnace, reducing the consumption of coal per tonne of steel produced and cutting CO2e emissions by up to 20%[4].	Develop all relevant technologies at TRL8 to reduce CO2 emissions stemming from EU steel production by 80-95% compared to 1990 levels by 2050, ultimately leading to climate neutrality.[3]
5.5 Carbon Capture and Usage (CCU)*	-	CO2 capture rate from process/off-gases: > 95 % from dedicated gas streams (KPI6)	
5.6 Circular economy*	-	Re-use and recycling of solid residues co-generated during the steel production process and reduction of their landfilling rate: internal and external recycling and re-use rate > 85 % (in total) (KPI10) Low-quality scrap input share over the total scrap input increased by at least 50% or more compared to the usual practice for a specific steel quality (KPI11)	

Chemicals				
Activity	2030		2050	
	At activity level	*Illustrative examples* (These are individual examples and not representative of the broader scope of the Activity)	At activity level	Ambitions
4.1 Electrification		*First pilot project for e-cracker with the objective to reduce up to 90% of related GHG emissions.*		Indirect and direct electrification of chemical processes will be a key contributor to the abatement of GHG emissions in the chemical sector (including combustion emissions that represented 67 Mt CO_2 eq. in 2018 in EU 27)
4.2 Integrated production of Hydrogen with low carbon footprint*		*First demonstration unit for the production of hydrogen with a new technology enabling a reduction of at least 90% of GHG emissions vs current production of hydrogen from SMR.*		Integrated production (using various technologies[1] of hydrogen used as feedstock without GHG emission.
4.3 Plastic waste as an alternative feedstock*	Demonstration projects to be launched by 2030.	*Demonstration of gasification and pyrolysis technologies with improved process yield and the ability to handle a wider range of mixed plastic streams.* *Pilot units for new technologies for plastic types where currently chemical recycling process options only exist at lab scale.*	Deployment of new technologies between 2030 and 2050.	Large-scale deployment of a combination of technologies enabling the utilisation of plastic waste, CO_2 and biomass as feedstock for the production of chemicals and polymers, as a key contributor to carbon circularity and climate neutrality.
4.4 CO_2 / CO as an alternative feedstock*		*Demonstration of robust CO_2 conversion processes with high productivity enabling to improve economics of the conversion of CO_2 to C_1 molecules* *Pilot unit for new processes for direct conversion of CO_2 to C_{2++} molecules*		
4.5 Biomass as an alternative feedstock*		*Pilot / demonstration for lignin pre-treatment and conversion enabling the production of bio-based aromatics.*		
4.6 Process efficiency		*Pilot / demonstration units for alternative (e.g. membrane, adsorption) to distillation technologies enabling a switch from thermal to electricity-driven separation*		Deployment of various advanced separation technologies to contribute to GHG emissions reduction and the competitiveness of the European chemical industry.

Pulp & Paper[5]			
Activity	2025	2030	2050
6.1 Integral drying and heat recovery processes	Develop integral drying and heat recovery innovations.	Demonstration of integral drying and heat recovery innovations in operational industrial environment by 2030.	Market penetration of integral drying and heat recovery system of 40% by 2050.[6]
6.2 Paper making without water evaporation.	-	Demonstration of Process optimisation and electrification in operational industrial setting by 2030.	Demonstration of Paper making without water evaporation technology in operational industrial setting by 2040. Successful demonstration will lead to commercial application, leading to >10 commercial scale plants in 2050.[7]
6.3 Process optimisation and electrification (modular approach)	Development and piloting of modular technologies.	-	Achieve market penetration of modular technology reaching between 10% and 70% in 2050, depending on the specific modular technology.[42]
6.4 Mild pulping technologies	-	First commercial implementation by 2030.	Market penetration of mild pulping technology reaching 50% by 2050
6.5 Onsite renewable energy conversion		Demonstration and implementation of innovative technologies up to 2030.	-
4.5 / 6.6 Biomass as alternative feedstock			Continuous development, demonstration and implementation of various new biobased products from forest biomass. The share of emerging bio-based products (other than pulp and paper) will substantially increase as to contribute to the sectors ambition of 50% more added value in 2050. (Currently 3% of European pulp and paper industry sector turnover)

Cement – detailed targets

INTEGRATED SET PLAN

Cement		
Activity	**2030**	**2050**
3.1 Resource efficiency		
3.1a **Alternative fuels** - sourced from a variety of **waste streams**, including biomass waste)	**60% alternative fuel** use of which **30% biomass waste**.	**90%** alternative fuel use of which **50%** biomass.
3.1b **Alternative raw materials,** clinker substitution, concrete recycling (overall target)	**3.5% reduction of process CO_2** using decarbonated raw materials.	**8% reduction** of process CO_2 using decarbonated raw materials.
3.1b (i) **New types of clinkers**	**2% reduction** in process emissions CO_2.	**5% reduction** in process emissions CO_2.
3.1b (ii) **Reducing clinker** content	Reduce ratio **to 74%** (from 77% in 2021)	Reduce ratio **to 65%**
3.1b (iii) **Concrete**: improved **mix** design, new admixtures	**Reduce cement in concrete by 5%**	Reduce cement in concrete **by 15%**
3.2 Energy efficiency	**4% thermal efficiency improvement.**	**14%** thermal efficiency improvement.
3.3 CCS/U	**Pilots and demonstrators by 2030** (dependent on infrastructure and a proper accounting framework).	**42% reduction in CO_2 emissions** through CCS.
3.4 Recarbonation and mineralisation	-	**Up to 8% saving in total CO_2** emissions for cement manufactured (assuming a 23% of process emissions of cement used being captured annually)

Pulp & Paper – detailed targets

INTEGRATED SET PLAN

Pulp & Paper			
Activity	**2025**	**2030**	**2050**
6.1 Integral drying and heat recovery processes	**Develop** integral drying and heat recovery solutions	**Demonstration** in operational industrial environment	**Market penetration of 40%**
6.2 Paper making without water evaporation.	-	**Demonstration** in operational industrial setting ***by 2040***	Commercial application, leading to **>10 commercial scale plants**
6.3 Process optimisation and electrification	Development and piloting of **modular technologies.**	**Demonstration** in operational industrial setting	Achieve **market penetration between 10% and 70%**, depending on the specific modular technology.[42]
6.4 Mild pulping technologies	-	**First commercial implementation**	**Market penetration** of mild pulping technology **reaching 50%**
6.5 Onsite renewable energy conversion		**Demonstration and implementation** of innovative technologies	-
4.5 / 6.6 Biomass as alternative feedstock for emerging bio-based products	Continuous development, demonstration and implementation of **new biobased products from forest biomass**. The **share of emerging bio-based products** (other than pulp and paper) will substantially increase as to contribute to the **sector's ambition of 50% more added value in 2050**. (Currently 3% of European pulp and paper industry sector turnover)		

Steel – detailed targets

INTEGRATED SET PLAN

Iron & Steel		
Activity	**2030**	**2050**
5.1 CO_2 emissions avoidance through direct reduction of iron using Hydrogen	Reduction degree of iron oxide: > 90 % Replacement rate of fossil carbon by hydrogen injection: > 10 % **Replacement rate of natural gas by H2** in the feed of the direct reduction plant: > 50 volume-%	Develop all relevant technologies at TRL8 to reduce CO2 emissions stemming from EU steel production by 80-95% compared to 1990 levels by 2050, ultimately leading to climate neutrality.
5.2 CO2 emissions avoidance through direct reduction iron using electricity*	Electric **efficiency of the electrolytic cell**: > 85%	
5.3 Process integration: HIsarna smelting reduction process for lowering energy consumption and CO2 emissions	Decrease the use of energy per tonne of steel for clean steel making: **> 10 % specific energy consumption reduction** for a dedicated process	
5.4 Process integration: Top Gas Recycling – Blast Furnace (TGR-BF) using plasma torch	Demonstration of a transformative technology for the blast furnace; increase of the re-use of off-gases in the blast furnace, **reducing the consumption of coal** per tonne of steel produced and **cutting CO2e emissions by up to 20%.**	
5.5 Carbon Capture and Usage (CCU)*	**CO2 capture rate** from process/off-gases: **> 95 %** from dedicated gas streams	
5.6 Circular economy*	Re-use and recycling of **solid residues co-generated** during the steel production process and reduction of their landfilling rate: **internal and external recycling and re-use rate > 85 %** (in total) **Low-quality scrap input share over the total scrap input increased by at least 50%** or more compared to the usual practice for a specific steel quality	

Chemical – detailed targets

INTEGRATED SET PLAN

Chemicals				
Activity	**2030**		**2050**	
	At activity level	***Illustrative examples*** (These are individual examples and not representative of the broader scope of the Activity)	**At activity level**	**Ambitions**
4.1 Electrification	**Demonstration projects** to be launched by 2030.	***First pilot project for e-cracker*** *with the objective to reduce up to 90% of related GHG emissions.*	**Deployment of new technologies** between 2030 and 2050.	**Indirect and direct electrification of chemical processes** will be a key contributor for reducing GHG emissions in the sector
4.2 Integrated production of Hydrogen with low carbon footprint*		***First demonstration*** *unit for the production of hydrogen with a new technology enabling a* ***reduction of at least 90% of GHG emissions vs current production of hydrogen by SMR***		**Integrated production** (using various technologies) of hydrogen used as feedstock without GHG emission.
4.3 Plastic waste as an alternative feedstock*		***Demonstration of gasification and pyrolysis*** *technologies with* ***improved process yield*** *and a* ***wider range of mixed plastic streams****.* ***Pilot units for new technologies*** *for plastic types where currently chemical recycling process options only exist at lab scale.*		**Large-scale deployment** of a combination of technologies enabling the utilisation of plastic waste, CO_2 and biomass as feedstock for the production of chemicals and polymers, as a key contributor to carbon circularity and climate neutrality.
4.4 CO_2 / CO as an alternative feedstock*		***Demonstration of*** *robust CO_2 conversion processes with high productivity enabling to improve economics of the* ***conversion of CO_2 to C_1 molecules****.* ***Pilot unit for*** *new processes for* ***direct conversion of CO_2 to C_{n+1} molecules***		
4.5 Biomass as an alternative feedstock*		***Pilot / demonstration*** *for lignin pre-treatment and conversion enabling the* ***production of bio-based aromatics.***		
4.6 Process efficiency		***Pilot / demonstration*** *units for alternative (e.g. membrane, adsorption) to distillation technologies enabling a* ***switch from thermal to electricity-driven separation***		**Deployment of advanced separation technologies** to contribute to GHG emissions reduction and competitiveness of the EU chemical industry.

NEXT STEPS

- **Heating and Cooling roadmap**
- **Networking event**
- **Cooperation with other IWGs**
- **Contribution to Horizon Europe**
  - Cluster 4 – Destination 4.2 – ‘Industries in energy transition’
  - CETP – Clean Energy Technologies partnership – Co-fund

Thank you very much for your attention!