## Modelling analysis for the EU's vision for a Long Term Strategy

Energy system modelling and sector integration

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Commissie

## The 2030 Climate



- ➔ Overall GHG emissions to be cut by 40% wrt 1990
- The Emissions Trading System sectors reduce their emissions by 43% compared to 2005 levels.
- In 2019 and 2023, the MSR allowances will double to 24% of the total circulating.
- Total emission allowances will decline at an annual rate of 2.2% from 2021 onwards, compared to 1.74% currently
- Non-ETS sectors to cut emissions by 30% (wrt 2005) translated into individual targets (Effort Sharing Decision)
- ➔ Energy efficiency 2030: 32.5% reduction in Primary Energy Consumption by 2030 (wrt the 2007 Baseline projections)
- The original 2030 target of at least 27% was revised upwards in 2018.
- ➔ A binding RES target for the EU for 2030 of at least 32% in final energy consumption
- The original target of at least 27% was revised upwards in 2018.

➔ MS to ensure that LULUCF GHG emissions are offset by an equivalent removal of CO<sub>2</sub> from the atmosphere over 2021 to 2030.

## 7 Building blocks / Strategic priorities





### Detailed assessment supported by scenario analysis

#### Long Term Strategy Options

	Electrification (ELEC)	Hydrogen (H2)	Power-to-X (P2X)	Energy Efficiency (EE)	Circular Economy (CIRC)	Combination (COMBO)	1.5°C Technical (1.5TECH)	1.5°C Sustainable Lifestyles (1.5LIFE)
Main Drivers	Electrification in all sectors	Hydrogen in industry, transport and buildings	E-fuels in industry, transport and buildings	Pursuing deep energy efficiency in all sectors	Increased resource and material efficiency	Cost-efficient combination of options from 2°C scenarios	Based on COMBO with more BECCS, CCS	Based on COMBO and CIRC with lifestyle changes
GHG target in 2050	-80% GHG (excluding sinks) ["well below 2°C" ambition]				-90% GHG (incl100% GHG (incl. sinks) sinks) ["1.5°C" ambition]			
Major Common Assumptions	<ul> <li>Higher energy efficiency post 2030</li> <li>Deployment of sustainable, advanced biofuels</li> <li>Moderate circular economy measures</li> <li>Digitilisation</li> <li>Market coordinate of the sustainable of the su</li></ul>				dination for infrastructure deployment nt only post-2050 in 2°C scenarios earning by doing for low carbon technologies nprovements in the efficiency of the transport system.			
Power sector	Power is nearly decarbonised by 2050. Strong penetration of RES facilitated by system optimization (demand-side response, storage, interconnections, role of prosumers). Nuclear still plays a role in the power sector and CCS deployment faces limitations.							
Industry	Electrification of processes	Use of H2 in targeted applications	Use of e-gas in targeted applications	Reducing energy demand via Energy Efficiency	Higher recycling rates, material substitution, circular measures	Combination of most Cost- efficient options from "well below 2°C" scenarios	COMBO but stronger	CIRC+COMBO but stronger
Buildings	Increased deployment of heat pumps	Deployment of H2 for heating	Deployment of e-gas for heating	Increased renovation rates and depth	Sustainable buildings			CIRC+COMBO but stronger
Transport sector	Faster electrification for all transport modes	H2 deployment for HDVs and some for LDVs	E-fuels deployment for all modes	Increased modal shift	Mobility as a service	application (excluding CIRC)		<ul> <li>CIRC+COMBO but stronger</li> <li>Alternatives to air travel</li> </ul>
Other Drivers		H2 in gas distribution grid	E-gas in gas distribution grid				Limited enhancement natural sink	<ul> <li>Dietary changes</li> <li>Enhancement natural sink</li> </ul>



## Modelling toolbox for the EU Long Term Strategy



# Changes in final energy consumption (2050 vs. 2005)



# Buildings are key in the reduction of energy demand in the EU

European Commission

 New buildings only 10-25% of 2050 stock: energy demand reduction will have to go through EE-oriented renovation of the building stock



### A clean, safe and connected mobility is developing



### Energy demand in industry is expected to diminish





# As a consequence electricity plays a greater role, along e-fuels and biomass







## **Electrification of demand in all sectors**

Increase in final use of electricity compared to 2015 80% 12 % change compared to 2015 10 60% 8 40% 2015 = 16 20% 4 0% 2 -20% 0 COMBO **1.5LIFE** 2030 Ш CIRC ELEC **1.5TECH** Baseline P2X 2030 CIRC ELEC **1.5LIFE** HZ Ш **1.5TECH** Baseline Н2 P2X COMBO

■ Services ● Industry ● Residential ◆ Total

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▲ Transport

## Electricity and e-fuels demand leads to much higher electricity production needs



#### Gross electricity generation compared to 2015



Renewables more than 80% of total electricity production

# RES represent the bulk of the installed capacity in 2050, and most of the investments



2030 Baseline EE CIRC ELEC H2 P2X COMBO 1.5TECH 1.5LIFE



## The primary energy mix now up to 60% RES





## The new energy system leads to reduced fossil fuel imports



# **Decoupling GDP and GHG Emissions**



From 2% of EU GDP invested in the energy system today to 2.8% (up to € 575 bn per annum) to achieve a netzero greenhouse gas emissions economy

Positive for growth and jobs, with GDP higher by up to 2% in 2050, as well as co-benefits: energy imports down, public health, etc

## Deep decoupling of robust economic growth and emissions is needed



## Investments needs by sector (1.5°C)

European Commission

- Investment builds up significantly to 2030 already in most sectors and peaks around 2040
- All LTS scenarios share a common path to 2030, based on recently adopted and proposed legislation
- Investment needs will be particularly large in the residential sector (energy efficiency) and the power sector (generation and grid)
- Investment needs will be large in transport, though a significant share is the replacement of vehicles



# Policy design influences GDP and ETS impact in EU28

			European Commission			
GDP vs. Baseline, 2050 JRC-GEM-E3	Fragment	ted action	Global action			
	80% reduction	1.5°C	80% reduction	1.5°C		
Profit maximisation Perfect labour market Lump-sum transfers	-0.13%	-0.63%	-0.28%	-1.30%		
Market share maximisation Perfect labour market Lump-sum transfers	-0.10%	-0.59%	-0.25%	-1.26%		
Market share maximisation Imperfect labour market Revenue recycling	0.05%	-0.29%	-0.18%	-1.09%		

Source: JRC-GEM-E3.

Deviation in output vs. baseline maximisation, 2050 JRC-GEM-E3	Fragmented action 80% reduction				
	Ferrous metals	Non-metallic minerals	Chemicals		
Profit maximisation Perfect labour market Lump-sum transfers	-4.4	-1.3	-1.9		
Market share maximisation Perfect labour market Lump-sum transfers	2.4	0.8	-1.2		
Market share maximisation Imperfect labour market Revenue recycling	2.9	1.1	-0.8		

Source: JRC-GEM-E3.

## **Shifting GDP composition**



## Shifting labour composition

				European Commission			
Sector	Share of total jobs in 2015	Range of change in jobs by 2050 compared to baseline	Range				
Construction		N					
Power generation		~					
Agriculture		N					Number of people
Services		⇒			2015 total employment	2015-2030 change (accumulated effect from baseline development and decarbonisation)	expected to retire between 2015 and 2030 (proxy used is labour in the 50+ years age bracket in 2015)
Manufacturing (energy-int)		⇒		Million			
Other manufacturing		⇒		Construction			
Mining &		П		Construction	14.8	0.4	-4.3
extraction				Services	158.5	5.0	-48.2
			]]	Agriculture	9.9	-1.3	-4.3
				Mining & extraction	1.0	-0.5	-0.3
				Power generation	1.6	-0.3	-0.5
				Manufacturing: Energy- intensive industries	4.4	-0.5	-1.4
				Other manufacturing	29.4	-1.2	-8.4

Source 2015 data: Eurostat LFS.

## Modelling-backed EU energy and climate policies





### Thank you Any questions? alban.kitous@ec.europa.eu kimon.keramidas@ec.europa.eu bert.saveyn@ec.europa.eu toon.vandyck@ec.europa.eu antonio.soria@ec.europa.eu ec.europa.eu/jrc/en/geco

