GROWTH-POSITIVE ZERO-EMISSION PATHWAYS TO 2050

Report launch event, 9th April 2021

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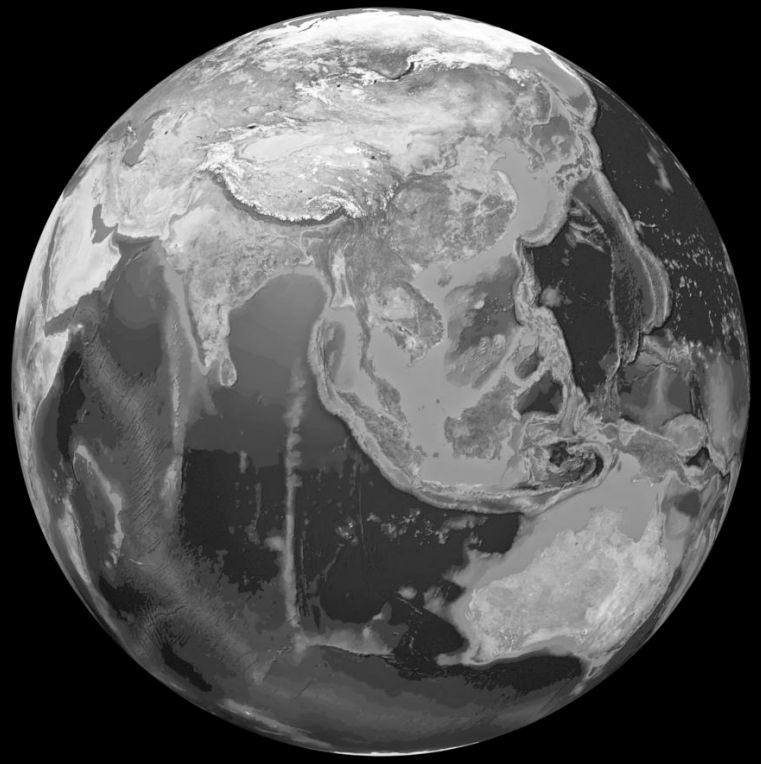

Where are we at?

- Global net emissions need to be decreased to zero by 2050 **to have a chance** to reach 1.5 degrees target (IPCC 2018)
- Global CO2 emissions have tended to increase as the global economy has grown

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Can emissions be decoupled from economic growth?

Aim of the study

Explore with energy system and macroeconomic models:

- Whether net-zero emissions by 2050 is possible? And how?
- Can we combine stringent climate policies with economic growth towards 2100?

This study includes...

1. Summary of main findings so far (on 1.5 °C pathways and emissions decoupling)
2. New modelling on how to meet energy demands until 2100 while seeking to reduce CO_2 emissions to net zero in 2050 and to limit the global temperature increase to 1.5 °C in 2100
3. Explanation of *why* strong emissions reduction does not stop growth in the economy
4. Exploration of key policy requirements at global level

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Summary of main findings so far, 1/2

Emissions decoupling **has been possible** at a national level (e.g. UK and Finland), where energy-related emissions reduction occurred through:

1. Energy efficiency
2. Replacing fossil fuels
3. Structural changes in the economy
4. Public policies driving these developments

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Summary of main findings so far, 2/2

Scenario-based analyses have:

- shown that various pathways of GHG emission reduction are in line with the Paris 1.5 °C target, though usually not without overshooting in the temperature
- all exhibited decoupling of GHG emissions from economic growth

Which models were used? (1/2)

Two global models representing the energy and economic systems:

1. **TIAM – UCL:** energy system model that investigates the decarbonisation of the global energy system and allows to better understand the global costs and benefits of many different decarbonisation options

2. **GEM-E3**: Global economic model that represents all economic agents and how they interact with each other. EU energy system detail provided by **PRIMES**.

Which models were used? (2/2)

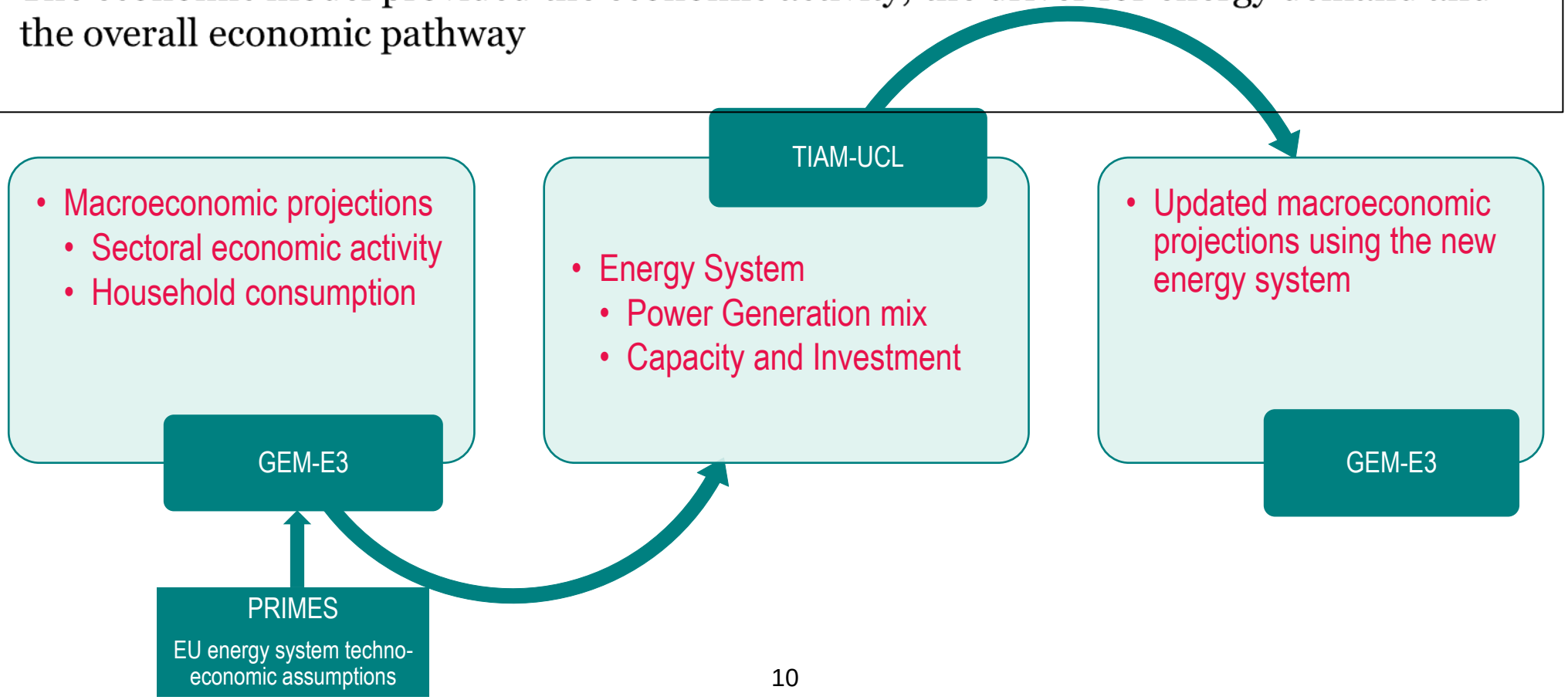
The two models were linked to perform a consistent calculation of a decarbonized energy and economic system.

- TIAM UCL calculated the changes required for the energy system to achieve GHG emissions consistent with a 1.5°C temperature increase in 2100
- GEM-E3 calculated how the changes in energy system impact economic growth

Both models are dynamic and provide projections up until 2050 and 2100

Model linking

- TIAM-UCL and GEM-E3 were used in a complementary way:
  - The bottom-up energy system model provided the exact adjustment of power generation mix and associated investments to the economic model
  - The economic model provided the economic activity, the driver for energy demand and the overall economic pathway



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What was not analysed?

1. Wider environmental issues (e.g. land use for bioenergy)
2. Circular economy
3. Decoupling of other environmental issues from GDP

These should be analysed in other studies!

4. Economic costs from increasing temperatures and other climate damages

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So what does it take to reach the 1.5 degrees target?

Assumptions under which Paris targets are less difficult to reach….(1/2)

1. Global co-operation
2. Rapid technology development
3. Strong environmental policy
4. Low population growth
5. Declining inequality

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Assumptions under which Paris targets are less difficult to reach… (2/2)

6 Dietary shifts

7 Forest protection

Absence of any of these assumptions would make the achievement of the Paris 1.5 °C target more difficult or even impossible!

These assumptions provided the foundation for the new scenarios.

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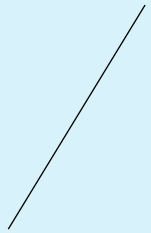
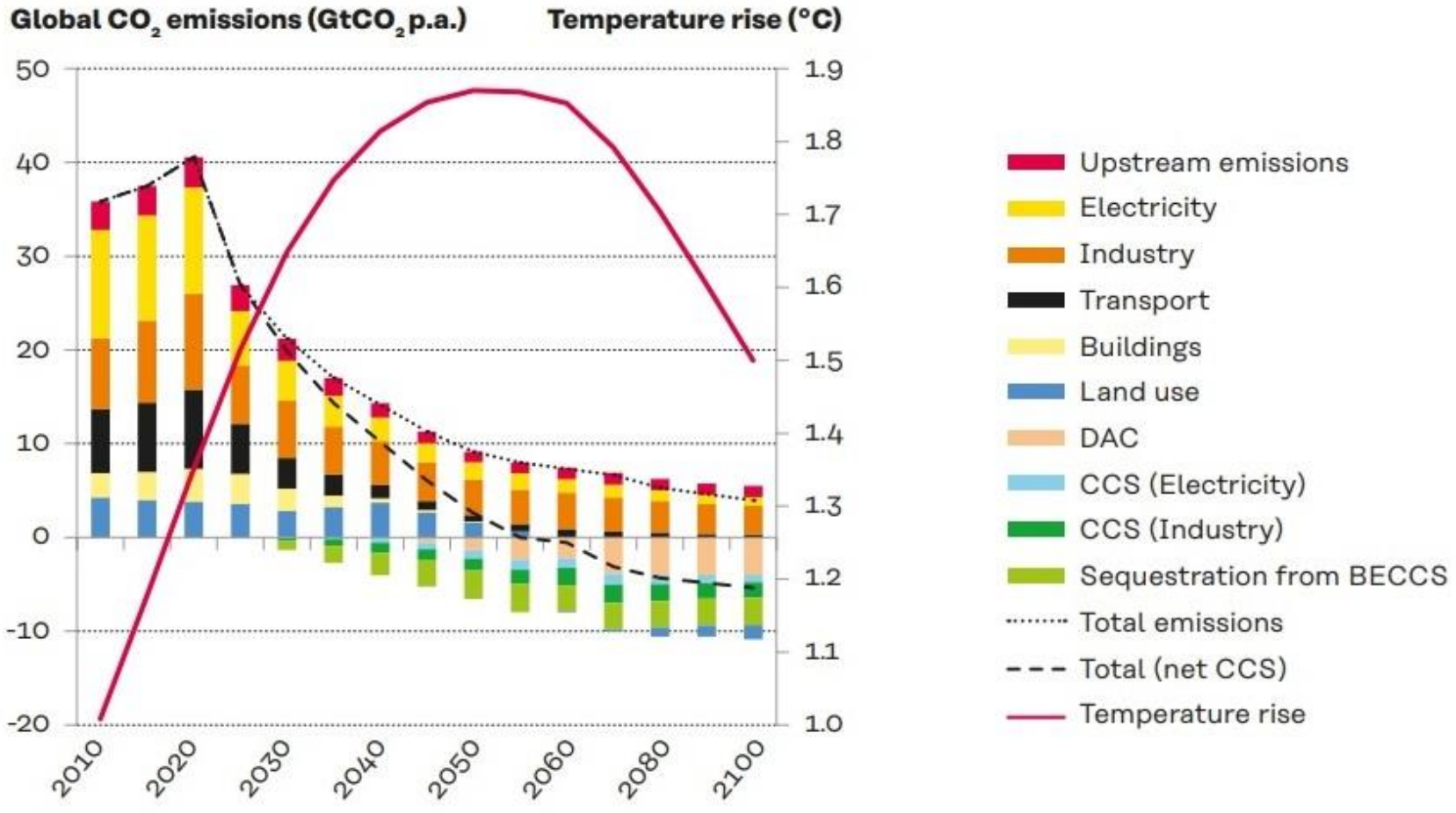
The good news: The 1,5 °C target can be reached – with the economy growing

...but the 1,5 ºC target requires unprecedented action by all countries.

And strong public policies!



Carbon capture technologies seem important in the central scenario



(Authors' note: land use includes all CO_2 emissions from agriculture, forestry, land use and land-use change)

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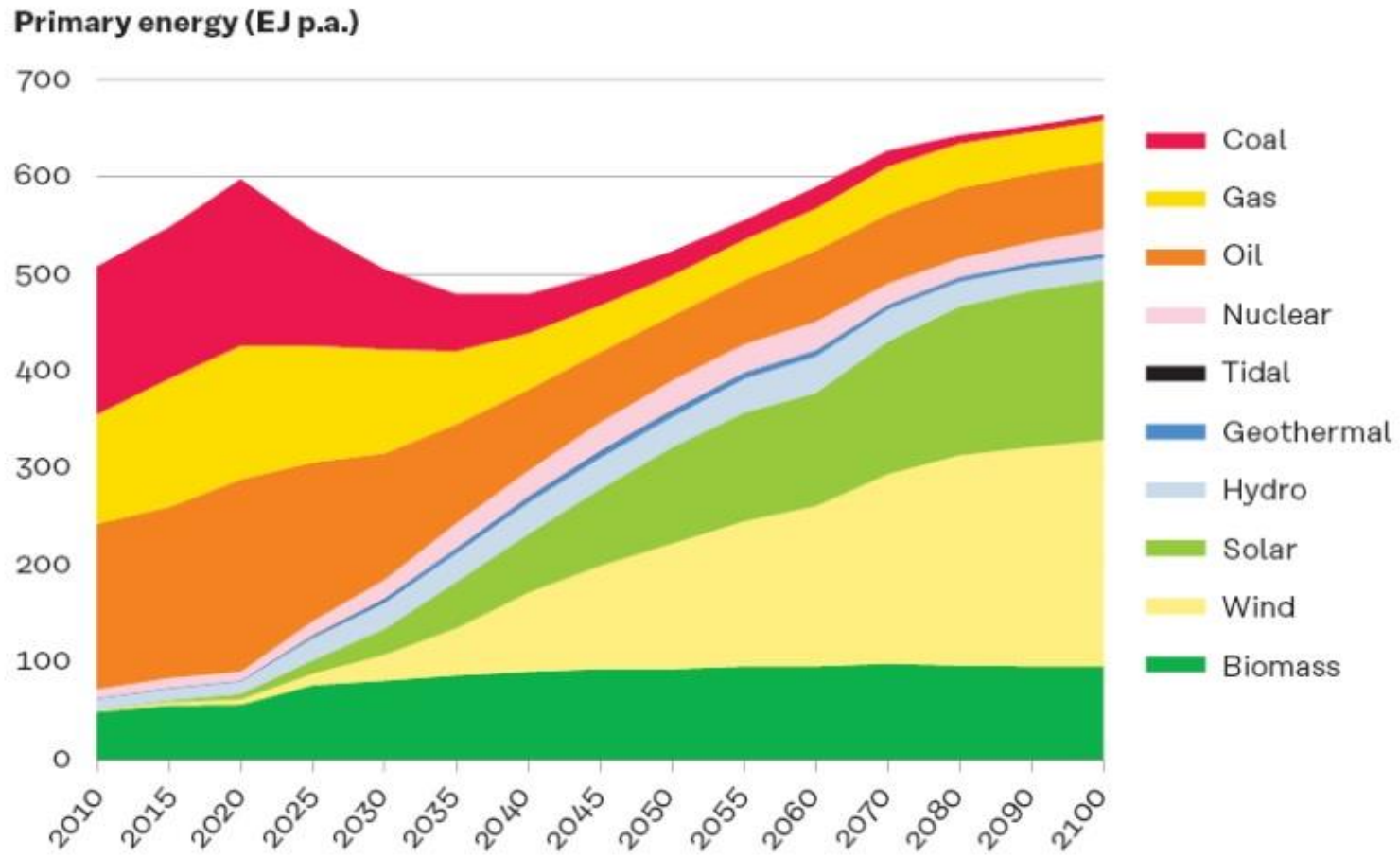
Fast coal reduction also important



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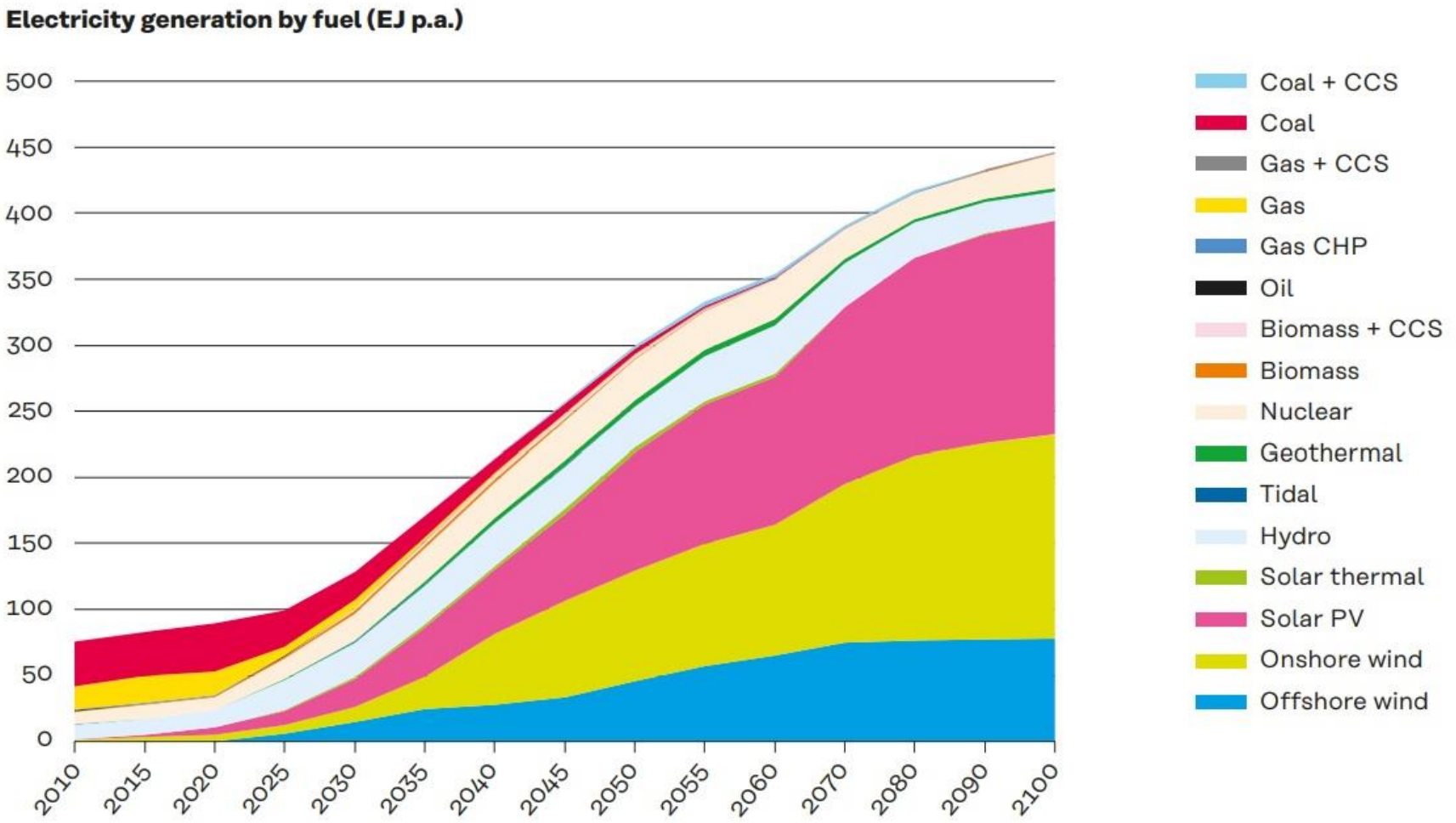
Electrification needed in wide scale...



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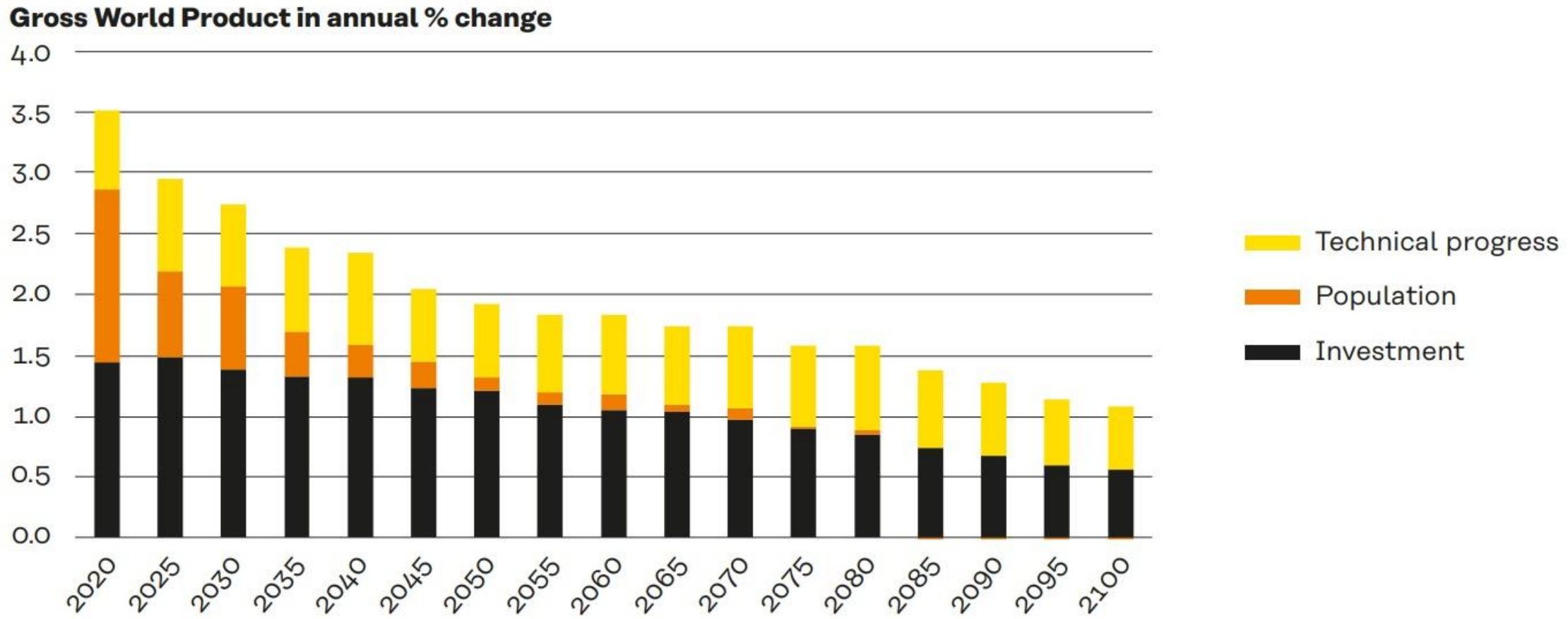
Global economy continues to grow



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Economic growth would be decreased only if...

...it raises the cost of energy or reduces the rates of technical progress (productivity)

There are no compelling reasons why this should be the case.

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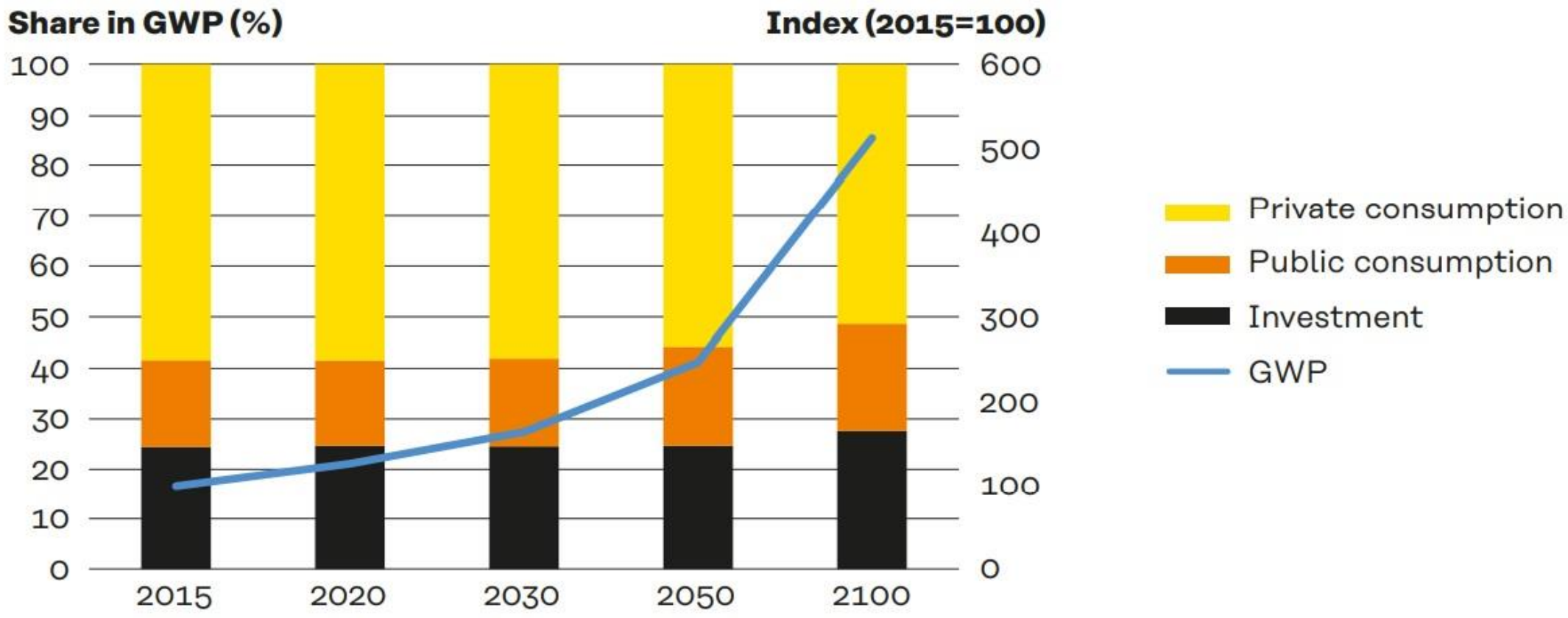
The share of investments in Gross World Product (GWP) increases



What if coal reduction is not that fast or carbon capture tech is not available?

Results of sensitivity scenarios.

Carbon capture seems important to limit temperature growth

	Central scenario	Slow coal phase-out	No CCS or NETs	
Coal phase-out rate	5.4% p.a.	2.7% p.a.	5.4% p.a.	2.7% p.a.
Net-zero date	2055	2055	-	-
Offset emissions from CCS, BECCS and DAC (2020-2100)	583 $GtCO_2$	638 $GtCO_2$	0 $GtCO_2$	0 $GtCO_2$
Peak temperature	1.87 °C	1.89 °C	1.89 °C	1.92 °C
Final temperature by 2100	1.5 °C	1.5 °C	**1.74 °C**	**1.79 °C**

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Key messages for policy makers (1/2)

1. **We need strong public policy** (for energy efficiency, renewables, coal phase-out and carbon capture etc.)
2. Decarbonisation at scale and at speed will require **a mix of different policy instruments and approaches**
3. Most of society's fundamental techno-socio-economic systems **will need to be refashioned**
4. **Avoiding uncertainties** (related to CCS, NETs and tipping points) **would require emissions to be reduced even faster**

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Key messages for policy makers (2/2)

5

Lack of global co-operation, high population growth, high inequality, energy- and resource-intensive consumption and limitations around the ability to control land-use emissions would make it very difficult to reach the 1.5 °C degree target.

6

The policy approaches must be consistent, **coherent**, **credible** and **comprehensive** for decades…

No government in the world is **yet close to a policy architecture** in line with the Paris Agreement goals!

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Three things to remember from the study:

1. **Strict climate targets can be achieved while the global economy grows.**

2. **The 1.5 degree target requires unprecedented action from all countries.**

3. **Technology leap: Countries need to invest heavily in carbon sequestration** to have a better chance of reaching the 1.5 degree target this century. **Coal has to be phased out rapidly.** Similarly, heating, transport and industry need to **switch to clean electricity** as much as possible.

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This decade is crucial to put the world on 1.5 °C pathway

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