

- The Inevitable Policy Response:
● Policy Forecasts

Executive Summary

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Preparing financial markets for climate-related policy and regulatory risks

September 2019

*A full description of the IPR Policy Forecasts can be found on the Inevitable Policy Response page of the PRI website

Executive Summary



Consortium partners

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This project has been commissioned by the PRI.



Financial markets are underprepared for climate-related policy risks

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A forceful policy response to climate change is not priced into today's markets.

Yet it is inevitable that governments will be forced to act more decisively than they have so far, leaving investor portfolios **exposed to significant risk**.

The longer the delay, the more disorderly, disruptive and abrupt the policy will inevitably be.

In anticipation, PRI, Vivid Economics and ETA are building a landmark forecast of the financial impact of this Inevitable Policy Response (IPR), including a Forecast Policy Scenario:

- How will it affect the economy?
- Which asset classes will be impacted?
- Which sectors are most at risk?

Growing awareness and momentum on climate issues makes a near-term, forceful policy response more likely

Changing weather trends



Impacts on security

The effects of a changing climate are a **national security issue.**



- *US Department of Defense*

Cheaper renewable energy

FINANCIAL TIMES

Europe 'watershed' as green energy set to overpower coal

- 03/06/2019

New climate research

Global warming report, an 'ear-splitting wake-up call' warns UN chief



Civil society action

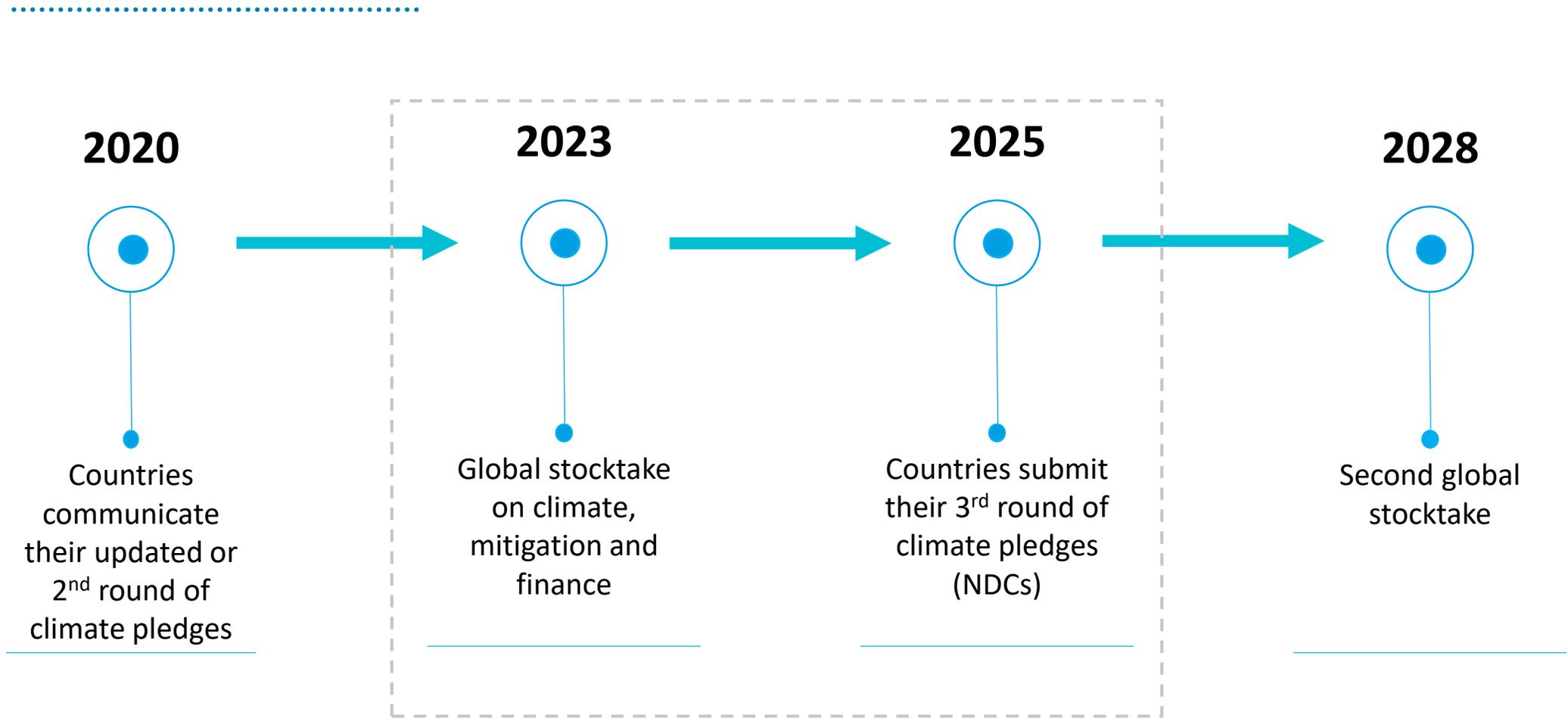


Stakeholders demanding clarity

The catastrophic effects of climate change are already visible around the world. We need collective leadership and action across countries, and we need to be ambitious.



Timing: Paris Ratchet process triggers a cumulating policy response into 2025

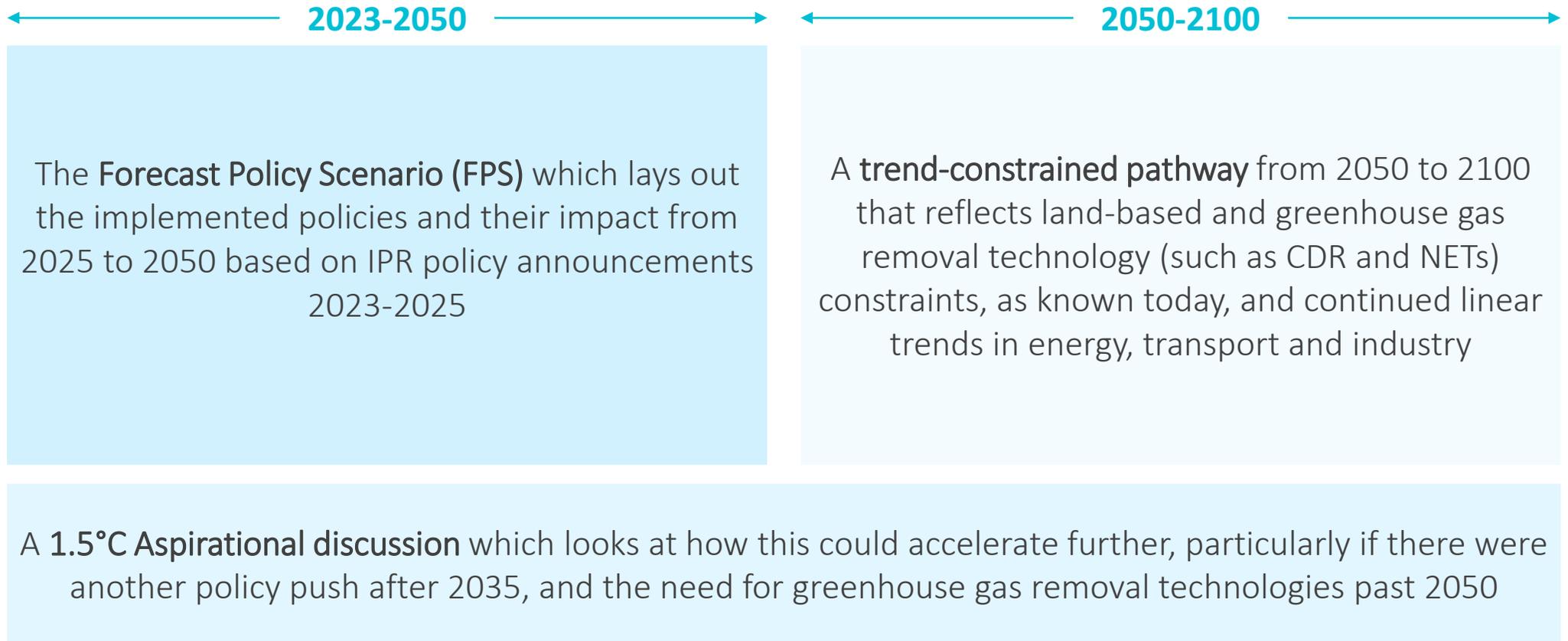


Policy announcements are expected to accelerate in 2023-2025

The Inevitable Policy Response

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The Inevitable Policy Response (IPR) has three parts



Value-add of the Inevitable Policy Response

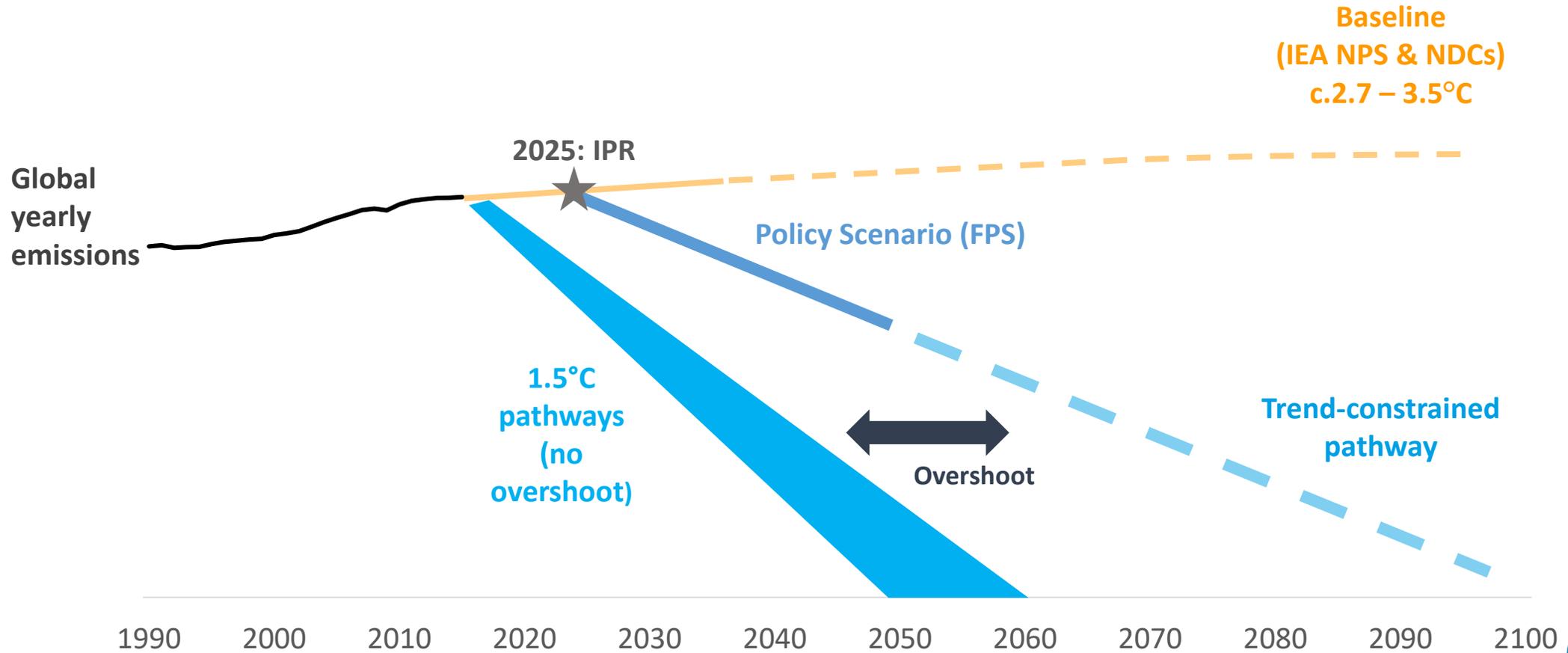
- **A high conviction policy-based forecast**, not a hypothetical scenario that optimizes policy to meet a temperature constraint
- Designed to be an alternative to, for example, the IEA NPS for **business planning** by corporations, investors and governments
- **Covers all regions of the world**, with specific policy forecasts for key countries and regions
- **Sets out the gap to 1.5°C** scenarios and how this might be filled by greater policy aspiration
- **Transparent**: on expectations for policy and deployment of key technologies, such as Negative Emission Technologies
- **Complete**: A set of models that includes macro, energy and land use models linking crucial aspects of climate across the entire economy
- **Fully integrating land-use** to ensure the full system impacts of policies, and highlight the critical role of land use
- **Applicable to TCFD**: aligned forward-looking analyses

Later this year, the IPR will extend from macro and sector level results to portfolio and company level financial impacts to show investors the cost and impacts of this delayed, forceful and disruptive policy response forecast, and to make the case to ACT NOW and aspire to a more orderly transition to 1.5°C

We believe that any forecast will need to contain these elements. We welcome feedback on the forecasted policies and the results to enhance value-add and relevance on an ongoing basis.

The Forecast Policy Scenario (FPS) is meant to facilitate discussion around a business planning case to fully value climate-related policy risk

Illustrative



Forecast Policy Scenario key themes in energy, transport, industry and buildings

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Against the backdrop of falling technology cost in renewable power and transport, supported by enabling policies in the green economy, we forecast:

- Performance standards:
 - ICE sales bans
 - Coal-fired electricity generation bans
 - Energy efficiency standards
- Global action on carbon prices and emerging border carbon adjustments that accelerate the transition across regions
- Steady demonstration and commercialisation of new technologies, but at a realistic pace given stage of development
- Need to incorporate a Just Transition to ensure social and political feasibility
- Limited nuclear expansion due cost differences and political concerns

This results in:

- Early coal phase-outs
- Powerful deployment of renewables
- Rapid scale-up of ultra-low emissions vehicles resulting in decreased oil demand
- Significant increase in energy efficiency throughout the economy, such as in buildings
- Transformative changes to industrial technology

Land-use and greenhouse gas removal

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We forecast:

- Strong policy action against deforestation, such as monitoring and penalties, supported by consumer pressure
- Incentives for reforestation and afforestation via domestic action and carbon markets
- Policy action, particularly investments in agricultural infrastructure such as irrigation and water management, in developing markets to increase agricultural yields
- Just Transition concerns, such as food price rises and small producer rights, constrain competition between agriculture, bioenergy and forestry, and shape land-use change
- Limited greenhouse gas removal (GGR) technologies, which includes Negative Emissions Technologies such as Bioenergy CCS (BECCS), as not demonstrated at scale yet

This results in:

- CCS not deployed at scale to maintain fossil fuels in the power system, but deployed later in industry
- An end to deforestation
- Afforestation and reforestation become an important source and low-cost measure of removing CO₂ emissions
- Yield improvements in agriculture, especially in countries still far behind the leading frontier

The FPS is grounded in credible policy commitments, market-leading views, and emerging trends, accounting for technology, institutional and social readiness

Realistic policy impacts → no carbon or temperature constraint → no hidden assumptions to reach 2°C or below



Covering key economic sectors

- Oil, gas, and coal
- Electricity
- Transport
- Industry
- Buildings
- Agriculture
- Forestry

FPS is split into three tiers of countries: leaders, followers and laggards

- EU, China and US setting the global tone on many policies
- Border carbon adjustments that help to transmit policies across countries
- Realistic but rapid catch-up by less developed countries
- Key markets: Western Europe, the US, Canada, Australia, Japan, China, India, Brazil

Forecast Policy levers: current trends

We drew key policy levers from current trends

Coal phase-out  The UK has committed to phase out unabated coal use by 2025, and support for a just transition is starting to emerge	ICE sales bans  All new cars to be emissions-free in the Netherlands by 2030, and other countries have announced intentions	Carbon pricing  57 carbon pricing initiatives around the world cover 20% of global emissions and discussion of BCAs	CCS and industry decarbonisation  Only two large scale CCS power projects in operation at the end of 2018, and no proven policies ready for ensuring scale-up
Zero-carbon power  Nuclear, hydro, solar PV, wind and other renewables represented 36% of electricity generation globally in 2018	Energy efficiency  A coalition of 8 European cities have pledged to completely decarbonise their existing building stocks by 2050	Land use-based greenhouse gas removal  National and bilateral payment systems trialled and planned to support nature-based solutions, including re/afforestation and bioenergy production	Agriculture  Historic rates of agricultural improvement very high, and large investment in agricultural technologies and infrastructure remains a priority



Enabling a green economy



'Just Transition' lens to ensure social and political feasibility

Key policies we forecast are:



Coal phase-outs

- Early coal phase-out for first mover countries by 2030
- Steady decline of coal-fired power generation after 2030

Germany currently envisages to phase-out coal only by 2038



ICE sales ban

- Early sales ban for first mover countries by 2035
- Very low stock of ICE vehicles globally by 2050

Electric vehicles currently represent less than 1% of all cars globally



Carbon pricing

- US\$40-60/tCO₂ prices by 2030 for first movers
- Global convergence accelerated by BCAs to ≥\$100/tCO₂ by 2050

The price of European Emissions Allowances today is ~€25/tCO₂ – and much lower in other regions



CCS and industry decarbonisation

- Limited CCS uptake to 2050
- CCS primarily for industry and BECCS, with limited ramp-up of hydrogen for industry

The combined capture capacity of CCS power projects in operation at the end of 2018 was 2.4MtCO₂



Zero carbon power

- Significant ramp-up of renewable energy globally
- Nuclear capacity increase in a small set of countries, nuclear fade-out elsewhere



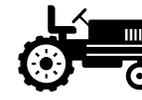
Energy efficiency

- Increase in coverage and stringency
- Performance standards, utility obligation programs, financial and behavioral incentives



Land use-based GHG removal

- Improved forestry and nature-based solutions
- End deforestation and expand re/afforestation
- Limited bioenergy available



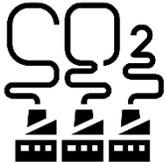
Agriculture

- Continued improvements in agricultural yields
- Steady growth in irrigation and AgTech
- Gradual shift from beef

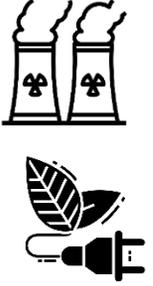
Forecast policy summary (1/4)

Policy Lever	What a forecast would look like	Reasons for Forecast
<p>Coal phase-outs</p> 	<ul style="list-style-type: none"> • Early coal phase-out for first mover countries by 2030 • Steady decline of coal-fired power generation after 2030 	<ul style="list-style-type: none"> • Falling costs of gas-fired and renewable energy generation making coal economically unattractive • Announcements of coal power generation phase-outs in the EU, Canada and Chile • Blacklisting of coal producers by financial institutions, and increasing costs of capital
<p>ICE sales bans</p> 	<ul style="list-style-type: none"> • Early sales ban for first mover countries by 2035 • Very low stock of ICE vehicles globally by 2050 	<ul style="list-style-type: none"> • ICE bans have been announced by national governments in the EU; Asia is following suit • Cities will drive national level ambition: Paris, Madrid, Amsterdam, Athens and Mexico (among others) have announced bans on diesel or ICE vehicles by 2025 or 2030 • Health concerns from air pollution have driven accelerated action in developing countries, following China's lead • Leading countries pushing industrial strategies and support policies for development of EV industries

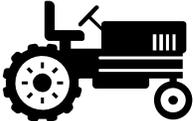
Forecast policy summary (2/4)

Policy Lever	What a forecast would look like	Reasons for Forecast
<p>Carbon pricing</p> 	<ul style="list-style-type: none"> • US\$40-60/tCO₂e prices by 2030 for first movers • Global convergence to carbon prices ≥US\$100/tCO₂e by 2050 • Incentives to accelerate convergence: border carbon adjustments (BCAs), technology transfers, and financial support from climate finance 	<ul style="list-style-type: none"> • 57 carbon initiatives were in operation or scheduled for implementation at the end of 2018 • Jurisdictions have started linking carbon markets – the agreed linking between the Swiss and EU ETS could become operational by January 2020, thus creating a precedent for future linking • Financial institutions (especially project finance) and emissions-intensive industries are starting to apply internal carbon pricing in their investment decisions
<p>CCS and industry decarbonisation</p> 	<ul style="list-style-type: none"> • Limited CCS uptake to 2050 • Industry decarbonisation by (limited) hydrogen deployment and efficiency improvements 	<ul style="list-style-type: none"> • CCS is technically proven but not yet deployed at commercial scale, with no proven policies in place to accelerate scale-up • Even with strong policy support, the large-scale deployment of hydrogen and fuel cells solutions is not expected before the medium term (2035-2050), with the economics of complete plant replacement constraining the pace of change

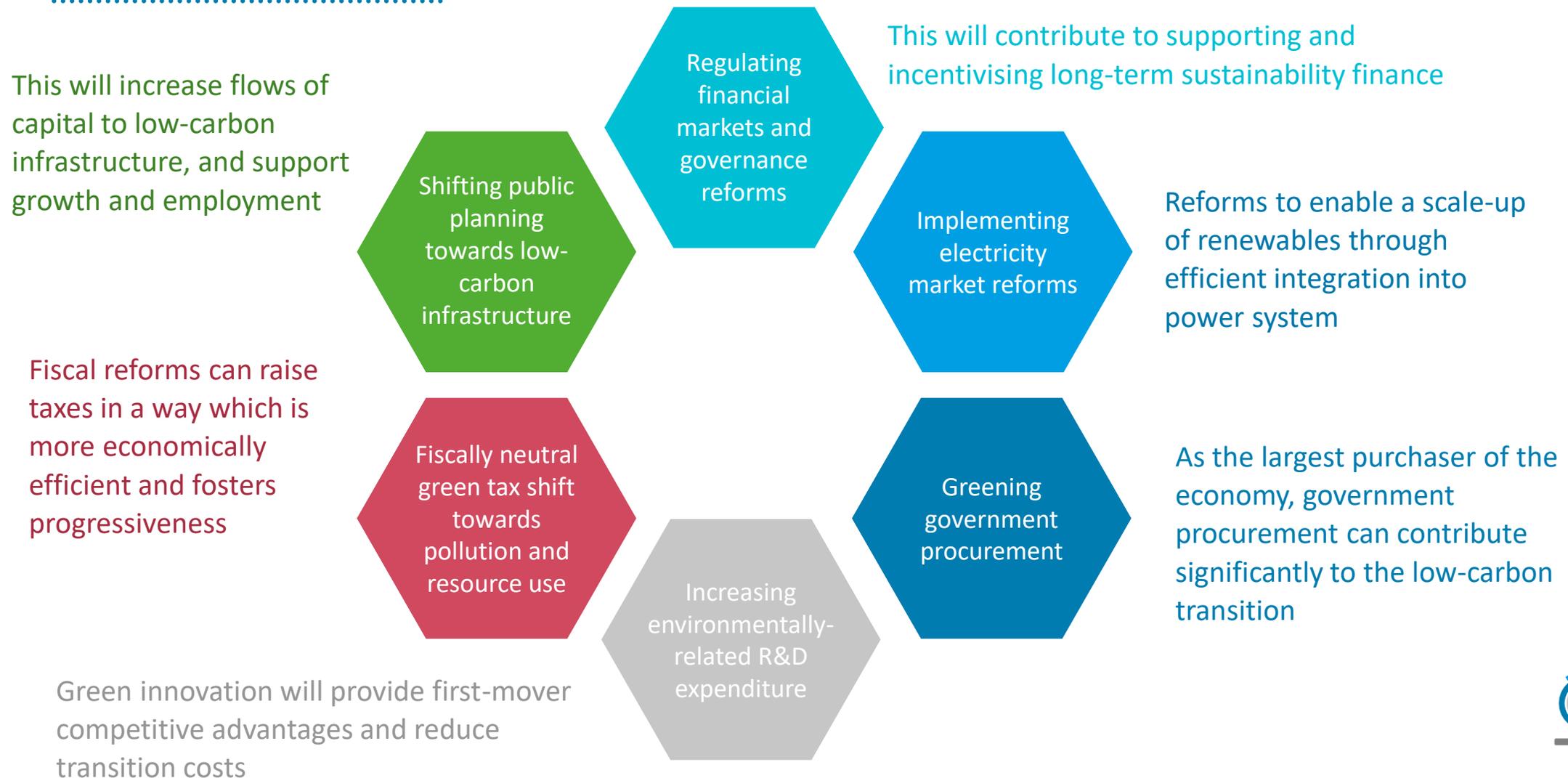
Forecast policy summary (3/4)

Policy Lever	What a forecast would look like	Reasons for Forecast
<p>Zero-carbon power</p> 	<ul style="list-style-type: none"> • Significant ramp-up of renewables, progressively replacing fossil fuels • Increase in absolute nuclear capacity in a small number of countries • Decrease or stabilisation of nuclear capacity elsewhere 	<ul style="list-style-type: none"> • Falling costs of renewable energy due to wider deployment, technological innovation and price competition • Most countries have renewable targets and support policies in place • Both China and India have nuclear plants under construction and development • Due to ageing fleets and low levels of planned investment, nuclear capacity in advanced economies is expected to decrease by 2040: Germany and the US are leading the current fade-out, with France, Spain and Switzerland following suit
<p>Energy efficiency policies</p> 	<ul style="list-style-type: none"> • Increase in coverage and stringency, with significant additional gains possible • Policy suite could include performance standards, energy utility obligation programmes and financial / behavioural incentives 	<ul style="list-style-type: none"> • Economic growth is expected to put upward pressure on energy demand especially in emerging economies • Only one third of final energy use is currently covered by energy efficiency policies globally • Proven, cost-effective policy mechanisms exist, and have been successfully adopted into emerging economies

Forecast policy summary (4/4)

Policy Lever	What a forecast would look like	Reasons for Forecast
<p>Land use-based greenhouse gas removal</p> 	<ul style="list-style-type: none"> • Well-functioning payment systems to support scale-up of nature-based solutions, including re/afforestation and bioenergy production • Slowly emerging payment volumes from international carbon markets • Steady expansion of bioenergy crops, but without major negative impacts on agriculture • Limited BECCS deployment by 2050 	<ul style="list-style-type: none"> • c.50 countries have commitments to the Bonn Challenge which aims to collectively restore 150 Mha of deforested and degraded land by 2020 and 350 Mha by 2030. More have committed to the Aichi targets, which target land protection • 61% of countries included the Land Use, Land Use Change and Forestry (LULUCF) sector in their first-round NDCs • BECCS is the most mature carbon dioxide removal technology but there are few examples to date where bioenergy or biomass combustion has been combined with CCS facilities
<p>Agriculture</p> 	<ul style="list-style-type: none"> • Substantial investment in R&D and global climate finance for maintaining historic rates of improvement in agricultural yields • A gradual shift away from ruminant meats (to 75% of baseline in 2050) due to clean meat technologies and changing preferences 	<ul style="list-style-type: none"> • Substantial global yield enhancement is still possible just from productivity catch up in developing countries • High growth in sustainable consumption preferences (flexitarianism, vegetarianism, etc.) in recent years in developed economies, but starting from a very low base • High growth in clean meat technologies (e.g. Beyond Meats, Impossible Foods) beginning to mass market across the developed world, though still very early in adoption curve

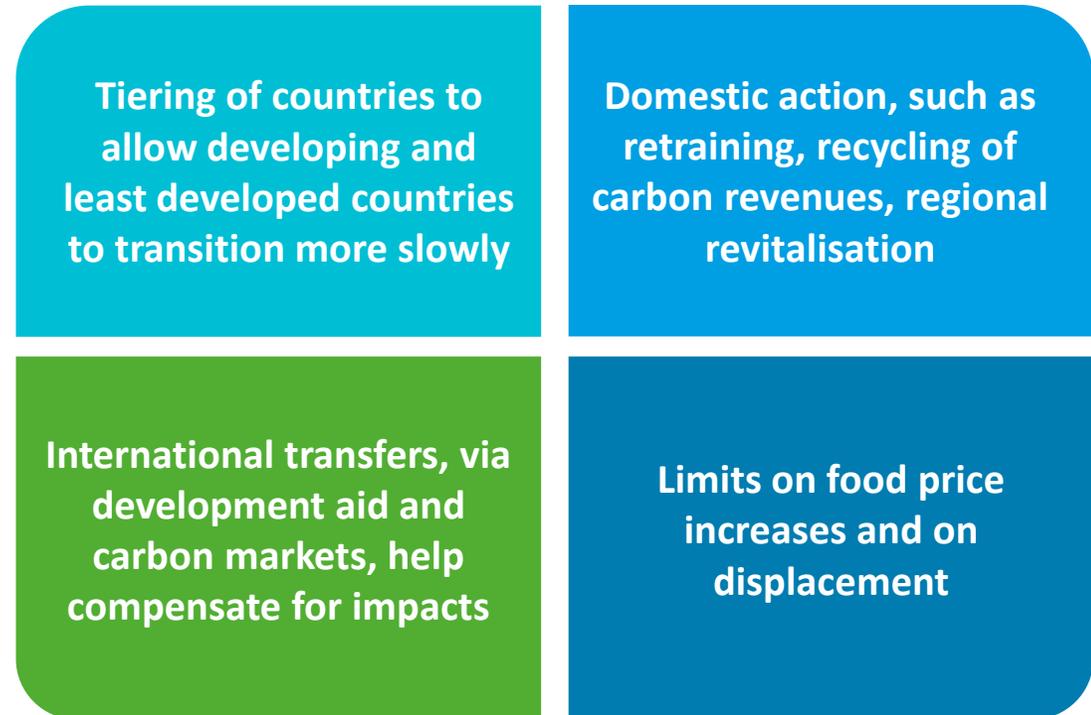
We expect broader action on a green economy to underpin our forecast policies across sectors and lead to strong scale-up of renewable energy



Implementation of the policy forecast incorporate a strong Just Transition dimension to ensure social and political feasibility

- **The Just Transition addresses wider systemic implications** - both positive and negative - for consumers, communities and citizens
- **Key aspects of the Just Transition agenda will be critical to social and political feasibility** – this is a pragmatic consideration critical to a robust policy forecast
- **The Just Transition was included in the Paris Agreement** to focus on the implications of the transition primarily for workers
- These consideration sit across both the decarbonization and the resilience agendas

Our forecasts reflect this in the following ways:



Aspiring to 1.5°C – ACT NOW and/or another policy push after 2035?

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The forecasted policies will not be sufficient to not exceed 1.5°C. To achieve that will require earlier and more forceful policy action as well as accelerated development and scale-up of technologies. It also challenges more fundamental changes in consumer preferences themselves.

Aspirational technologies (currently not deployed at scale)

- Very significant acceleration in carbon capture and storage (CCS)
- Other greenhouse gas removal technologies such as direct air capture (DAC)
- ‘Known unknown’ technologies – Artificial intelligence (AI), low carbon cement, electric aircrafts, etc.

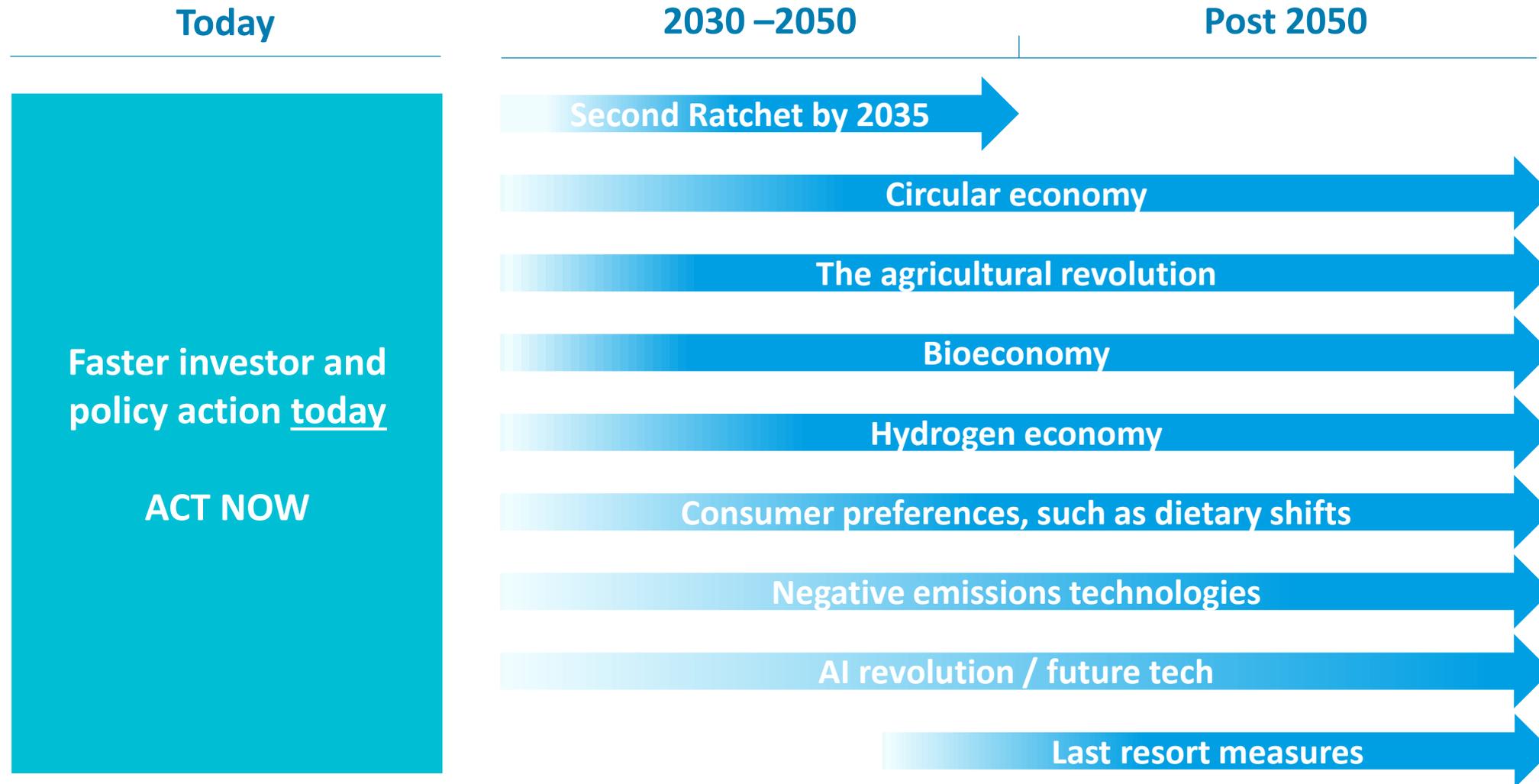
Uncertain societal changes

- Radical dietary shifts
- Air travel shifts

To accelerate these it is possible that further policy action of significant proportions might start by 2035 as climate unease continues to grow.

Achieving the 1.5°C target will require accelerated and substantial effort

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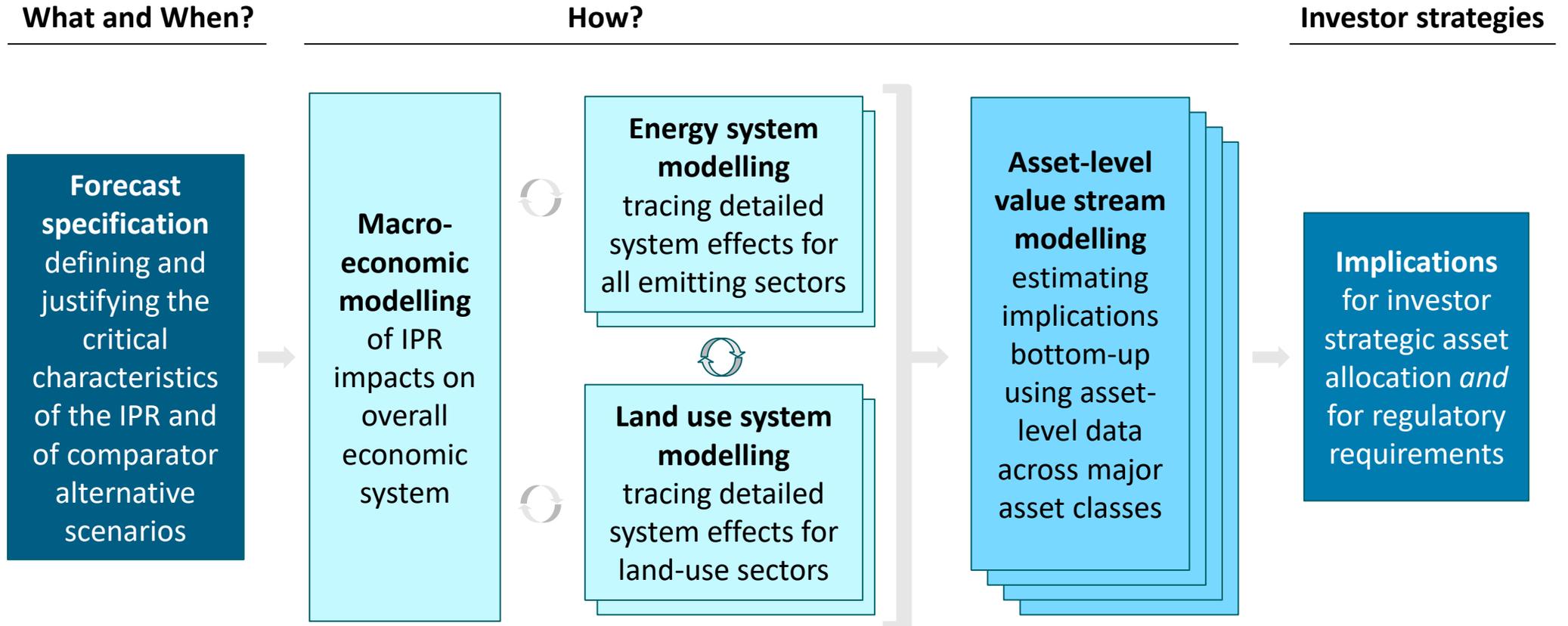


What to expect next



TO BE RELEASED END OF SEPTEMBER

RESULTS TO BE RELEASED LATER IN THE YEAR



Acknowledgements

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This project has received support from:



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