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# Recent development in scenario analysis

Detlef van Vuuren

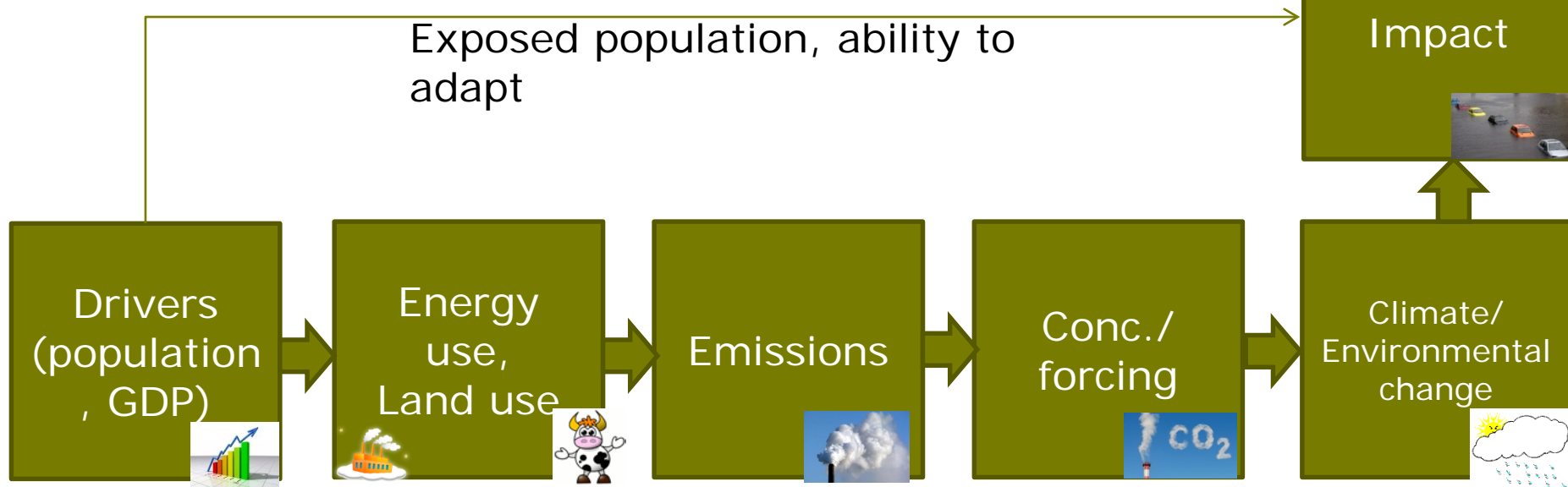
# Scenarios as mean to link communities



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## SSPs

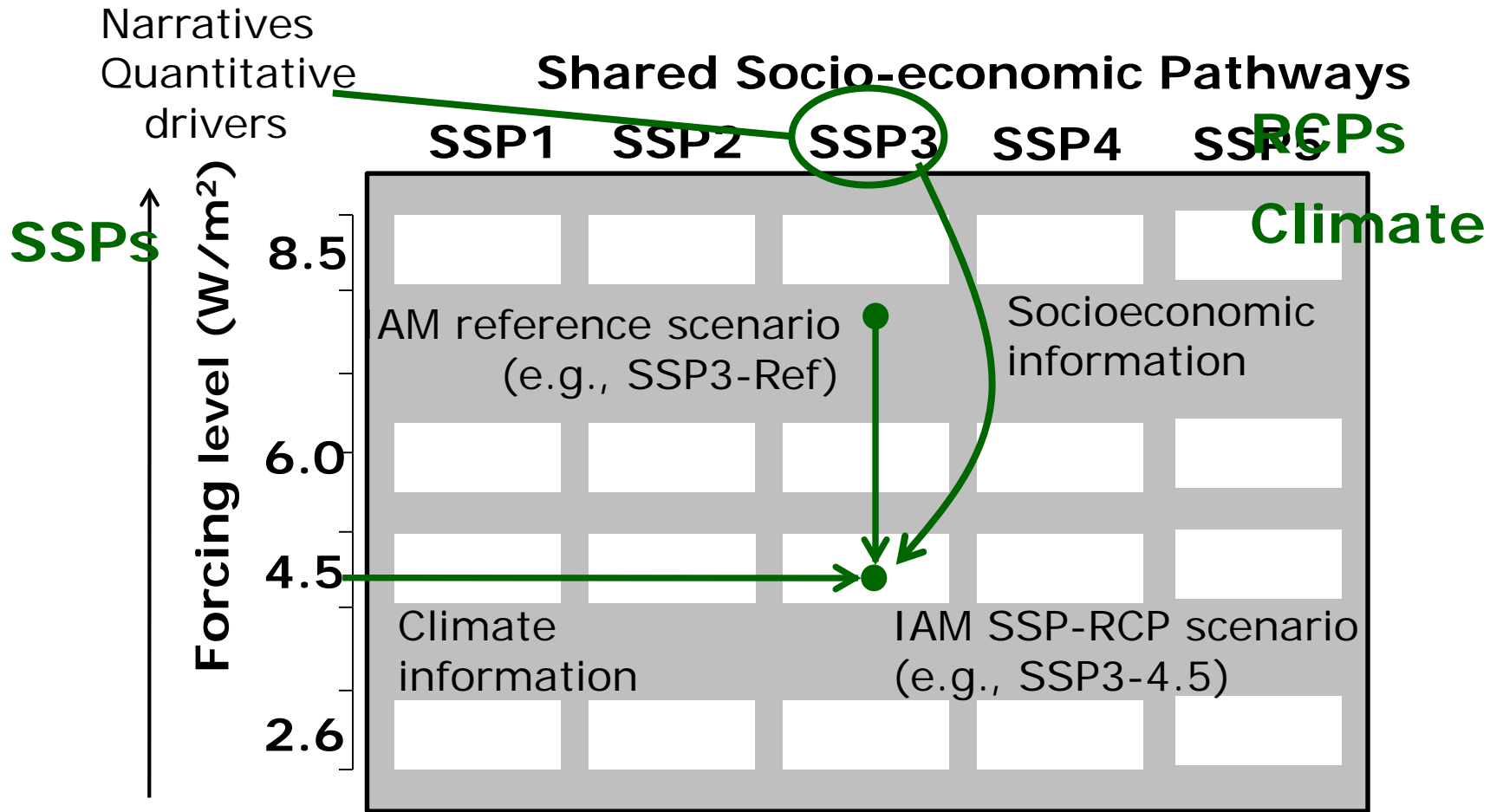
## RCPs Climate



# The Scenario Matrix Architecture



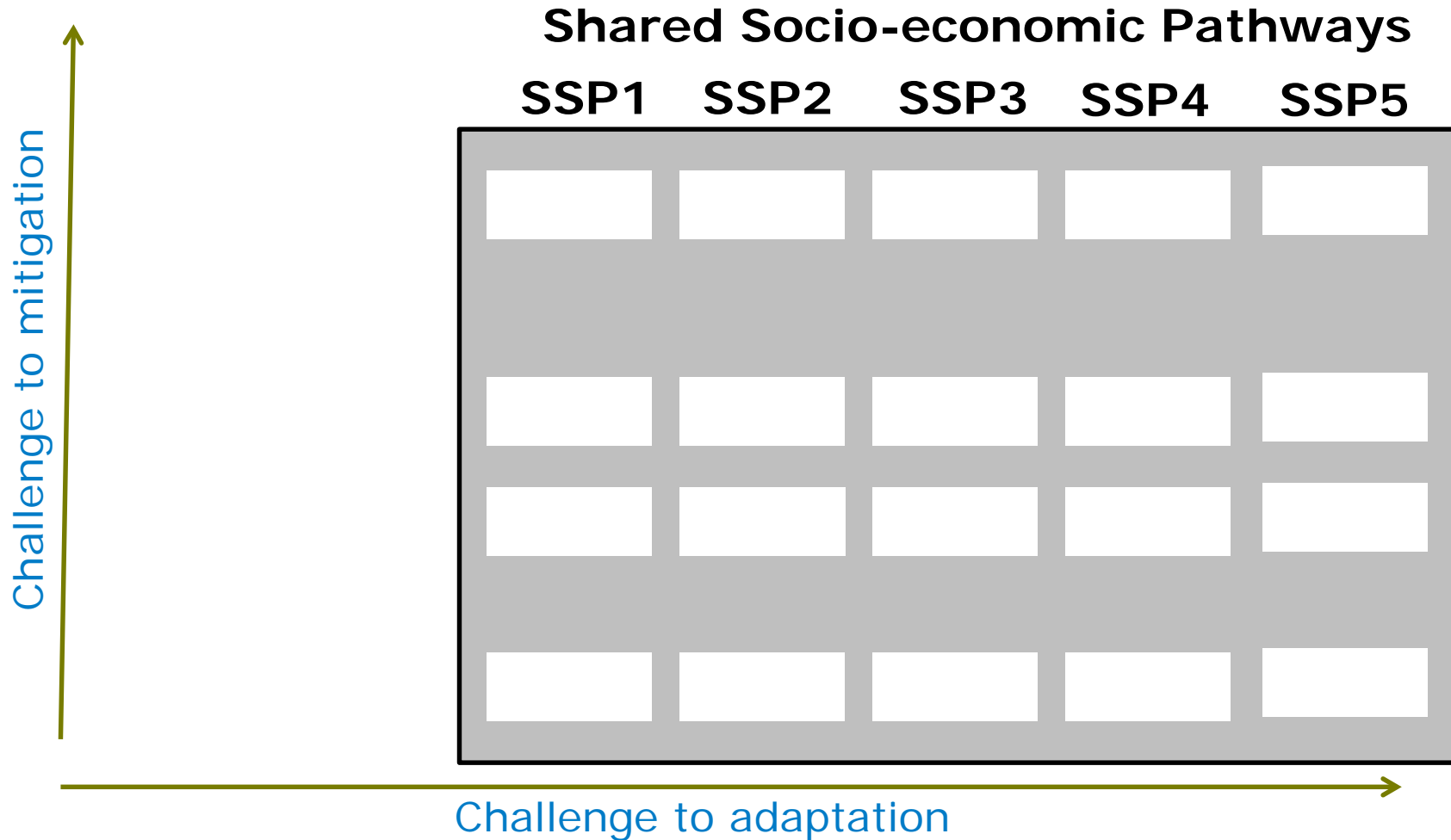
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# The Scenario Matrix Architecture



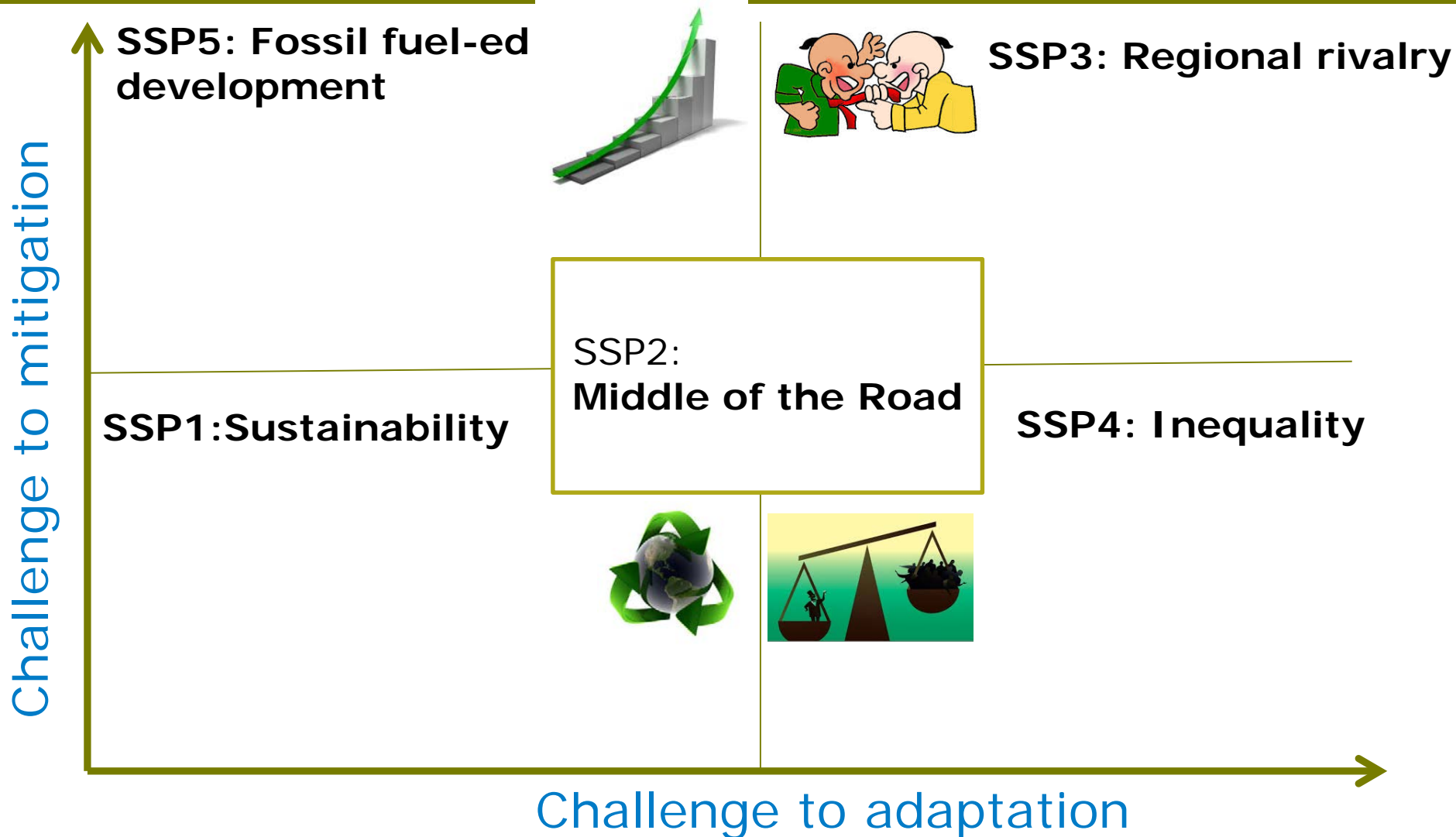
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# The Scenario Matrix Architecture



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# The Scenario Matrix Architecture



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Challenge to mitigation

**SSP5: Fossil fuel-ed development**



**SSP3: Regional rivalry**

**SSP2:  
Middle of the Road**

**SSP1:Sustainability**

- Global cooperation
- Rapid technology dev.
- Strong env. policy
- Low population growth
- Low inequity
- Focus on renewables and efficiency
- Dietary shifts
- Forest protection



UN world

**SSP4: Inequality**



Challenge to adaptation

# The Scenario Matrix Architecture



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Challenge to mitigation

## SSP5: Fossil fuel-ed development



Clash of civilisations

## SSP3: Regional rivalry

- Competition among regions
- Low technology development
- Environment and social goals not a priority
- Focus on domestic resources
- High population growth
- Slow economic growth dev. countries

## SSP2: Middle of the Road

## SSP1: Sustainability

- Global cooperation
- Rapid technology dev.
- Strong env. policy
- Low population growth
- Low inequity
- Focus on renewables and efficiency
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UN world

## SSP4: Inequality



Challenge to adaptation

# The Scenario Matrix Architecture



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Challenge to mitigation

## SSP5: Fossil fuel-ed development

- Rapid growth, free trade
- High technology development,
- Environment and social goals not a priority: adaptive, technology-fix
- Focus on economic growth



Markets first



Clash of civilisations

## SSP3: Regional rivalry

- Competition among regions
- Low technology development
- Environment and social goals not a priority
- Focus on domestic resources
- High population growth
- Slow economic growth dev. countries

## SSP2: Middle of the Road

## SSP4: Inequality

## SSP1: Sustainability

- Global cooperation
- Rapid technology dev.
- Strong env. policy
- Low population growth
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UN world



Challenge to adaptation



# The Scenario Matrix Architecture



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Challenge to mitigation

## SSP5: Fossil fuel-ed development

- Rapid growth, free trade
- High technology development,
- Environment and social goals not a priority: adaptive, technology-fix
- Focus on economic growth



Markets first



Clash of civilisations

## SSP3: Regional rivalry

- Competition among regions
- Low technology development
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- High population growth
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## SSP2: Middle of the Road

## SSP1: Sustainability

- Global cooperation
- Rapid technology dev.
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UN world



Have's and have not's

## SSP4: Inequality

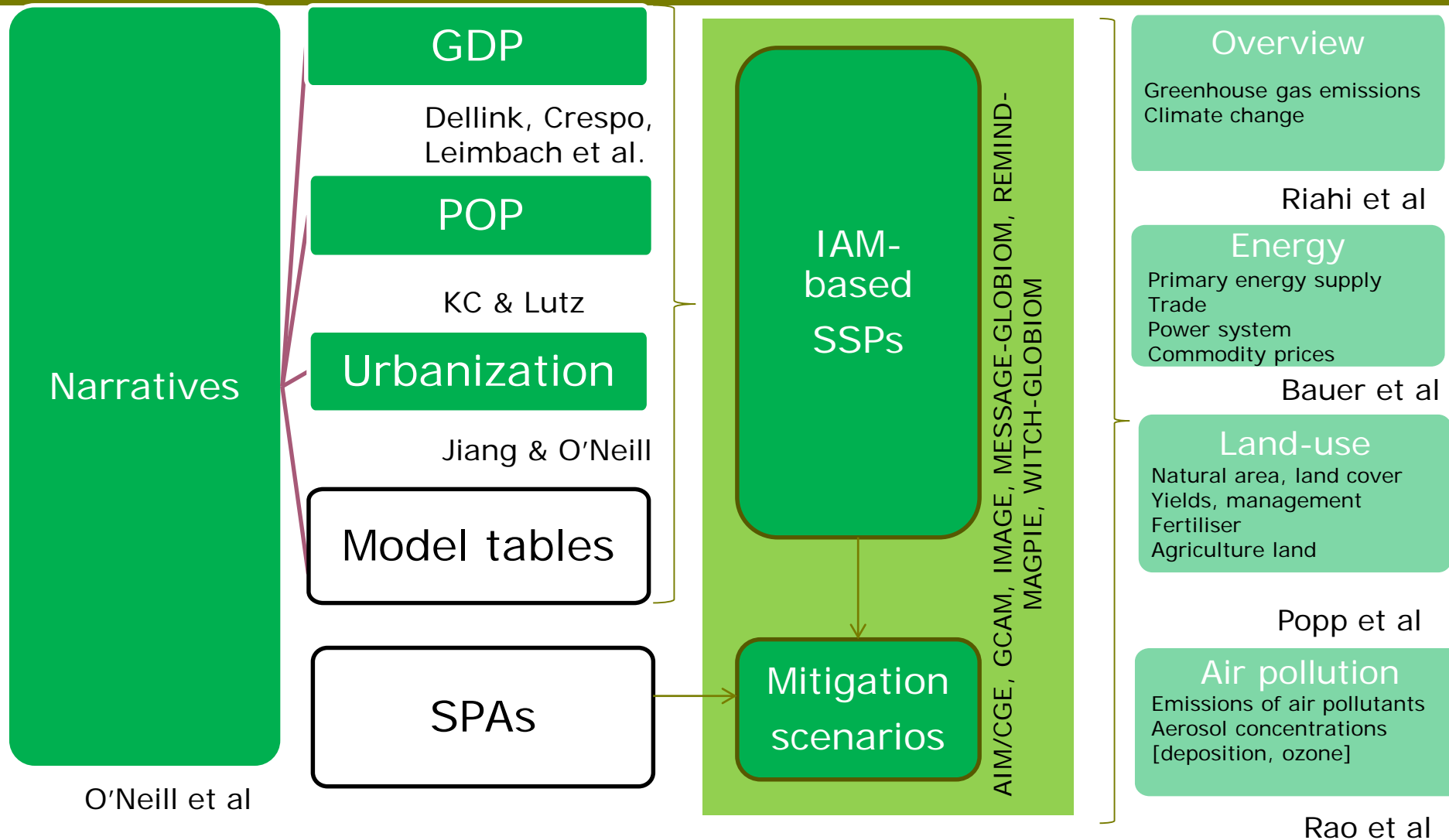
- Inequality across and within regions
- Low technology development
- Environment priority for those that can afford
- Limited trade

Challenge to adaptation

# SSP process

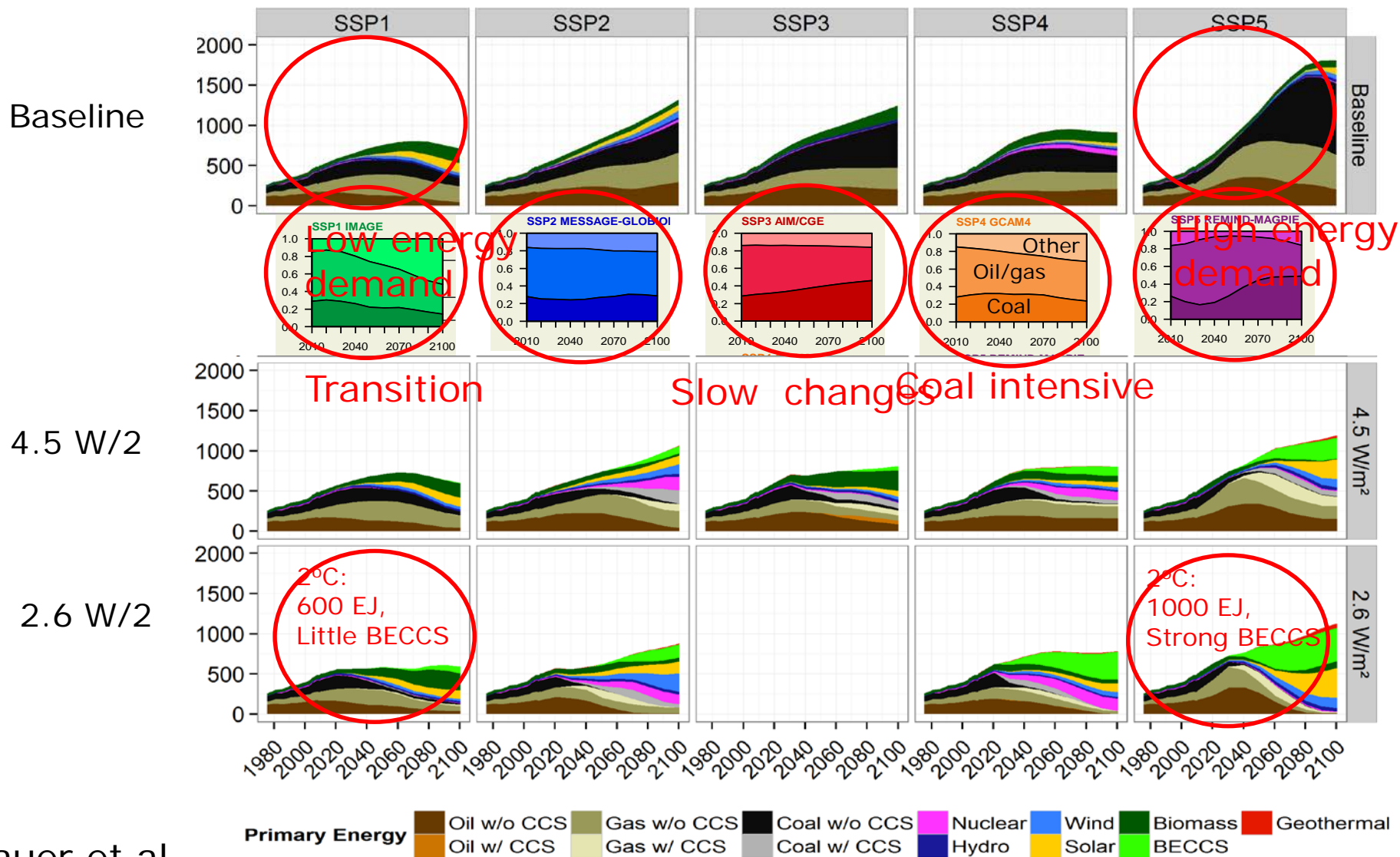


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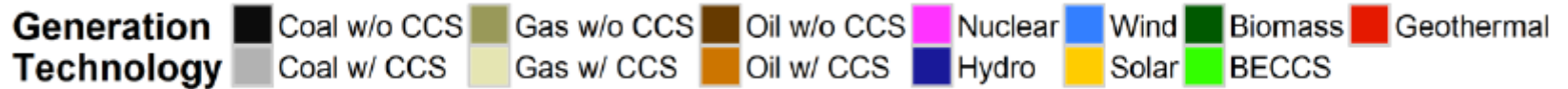
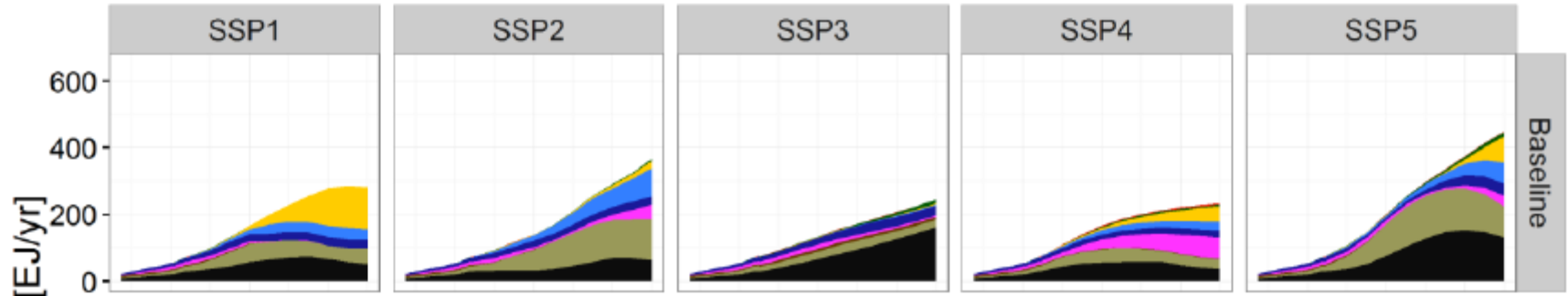
# Primary energy use (EJ)

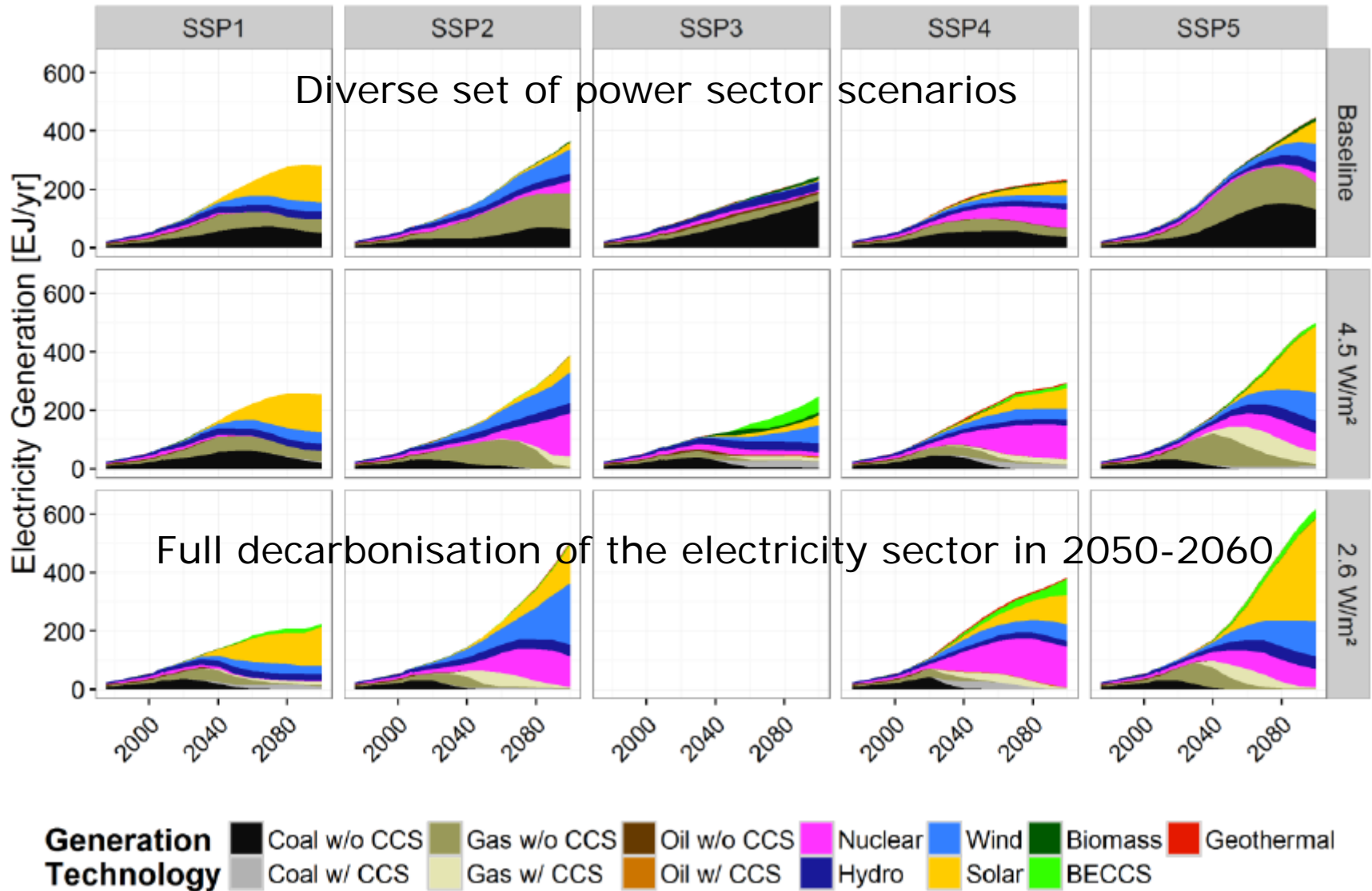


# Power sector



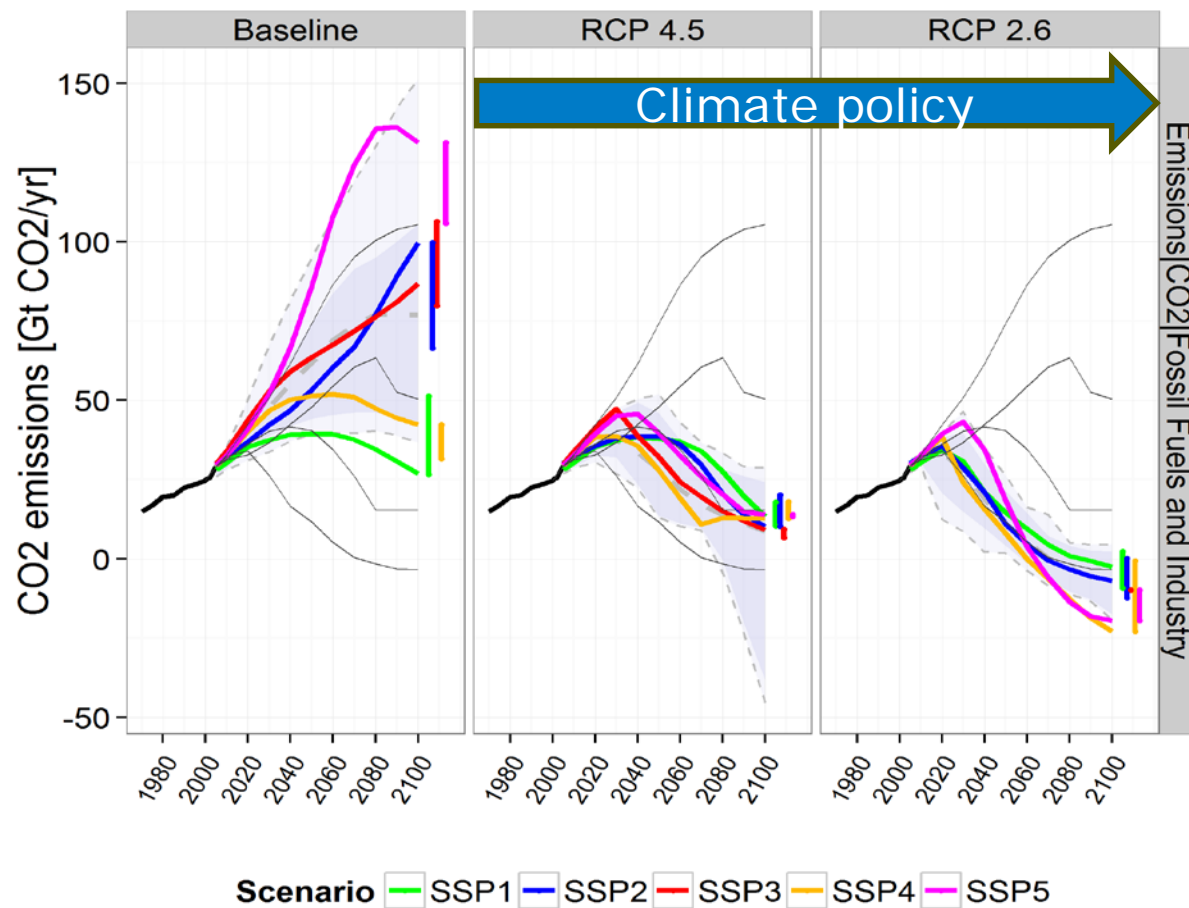
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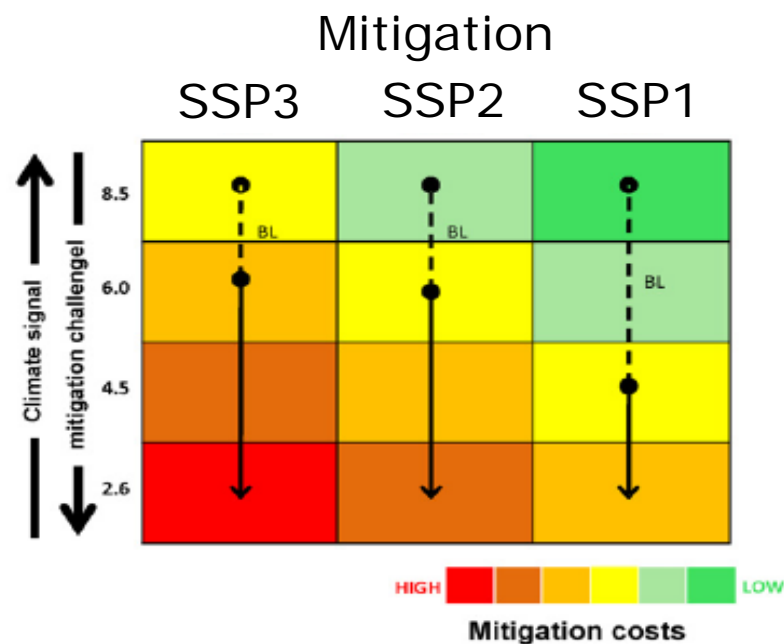
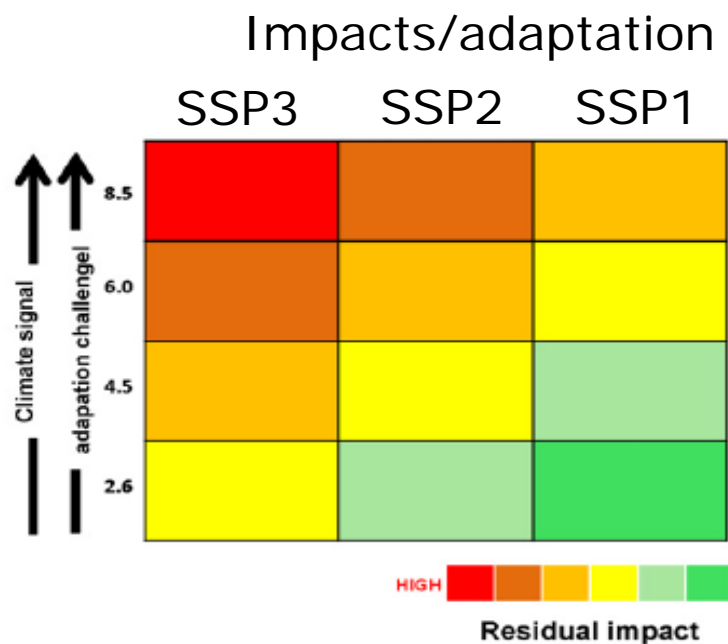


# CO2 emissions





# Scenario matrix architecture forms scenario tool kit

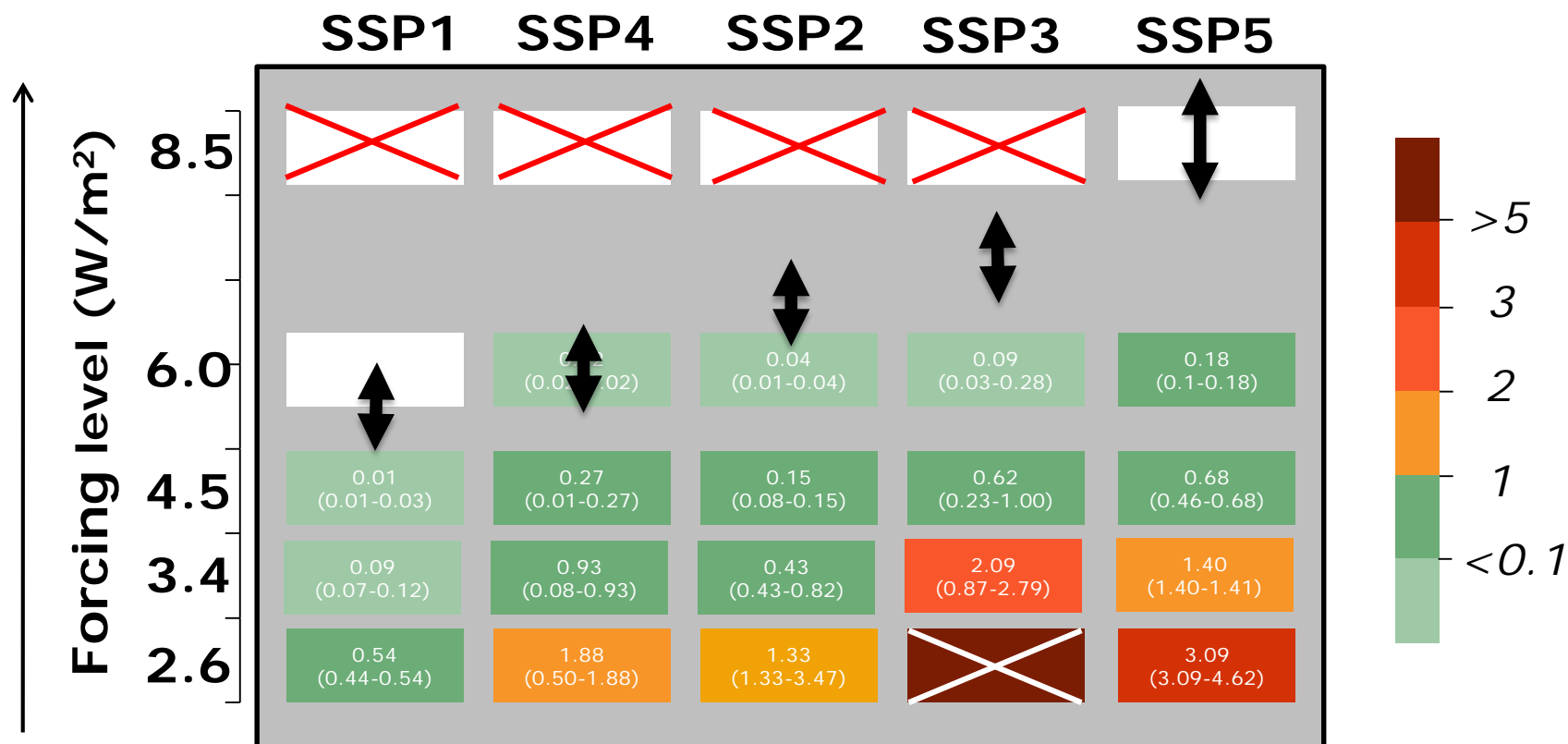


- Provides opportunity for mitigation and impact/adaptation research in one structure



# Feasibility and costs of targets greatly depend on the SSP

(Mitigation costs as % of GDP)



Mitigation costs are given as area under the MAC and percent of total GDP (2010-2100)



## COP21 – agreement on long-term climate objectives



The universal agreement's main aim is to keep a global temperature rise this century well below 2 degrees Celsius and to drive efforts to limit the temperature increase even further to 1.5 degrees Celsius above pre-industrial levels

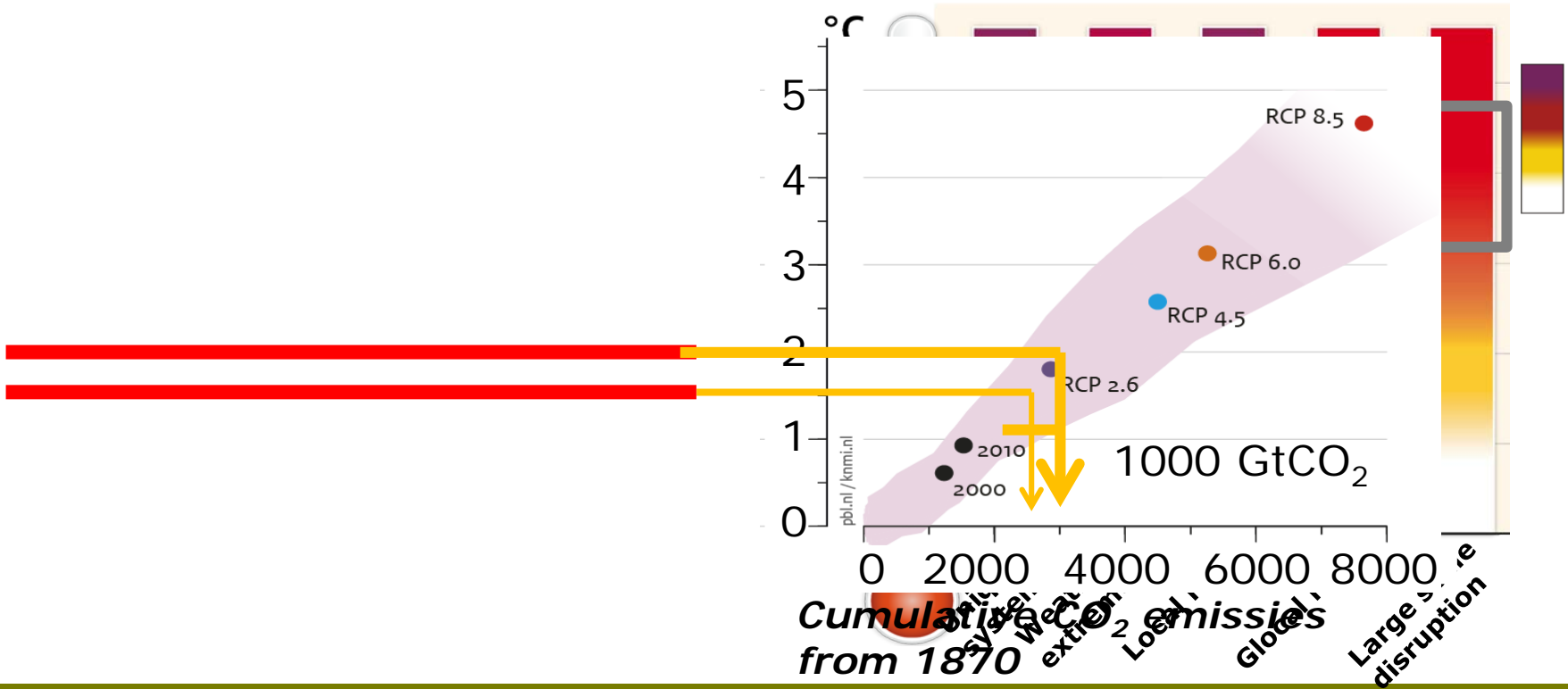
- What do these long-term objectives imply for climate policy (reduction targets)



Paris agreement: ... with the aim to keep temperature rise well below 2 °C (and push for 1.5 °C)

Source: IPCC, 2013/2014

Risks of climate change  
Relationship CO<sub>2</sub> / temperature

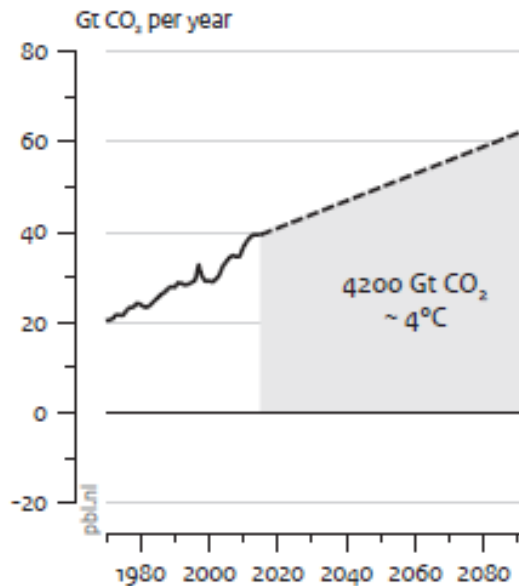


# 1000 GtCO<sub>2</sub> is very tight.

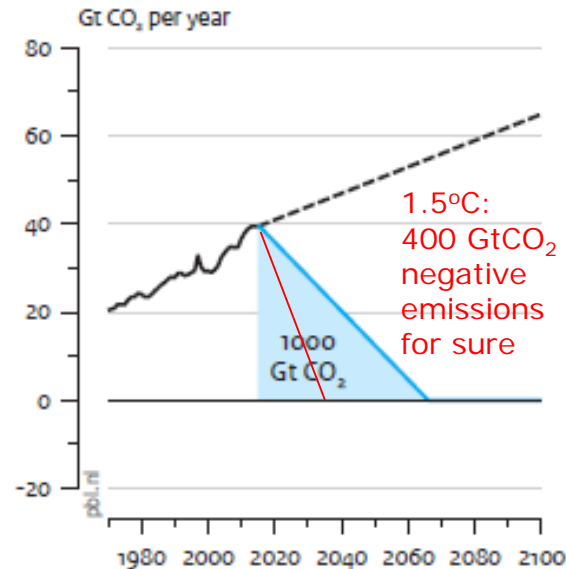
Timing  
Contribution non-CO<sub>2</sub> gasses  
Regional contribution

All factors that play a role in UNFCCC negotiations

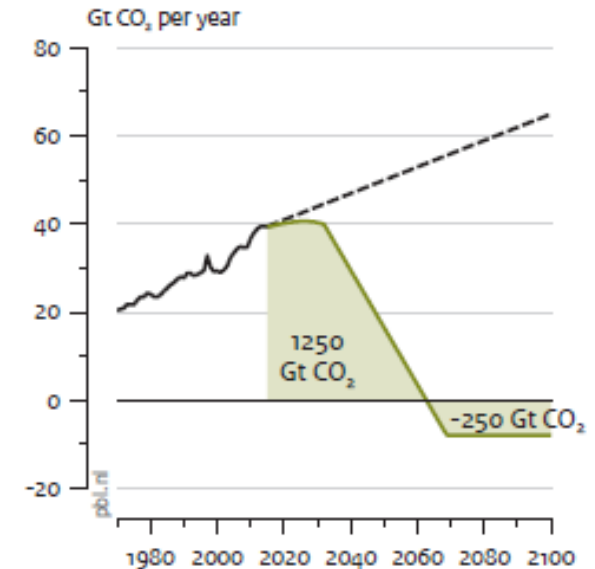
Business as usual projection



Linear reduction over about 50 years



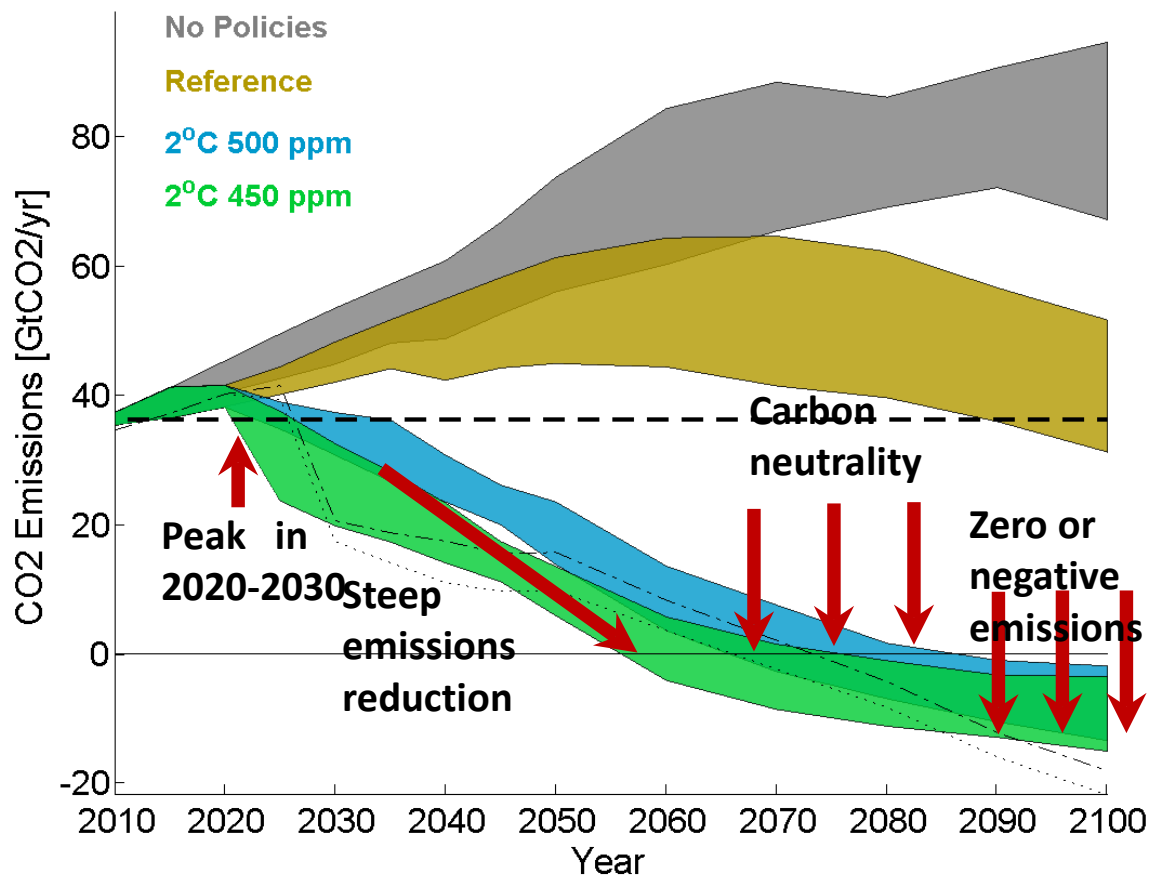
Negative emissions in the long term



Bron: PBL

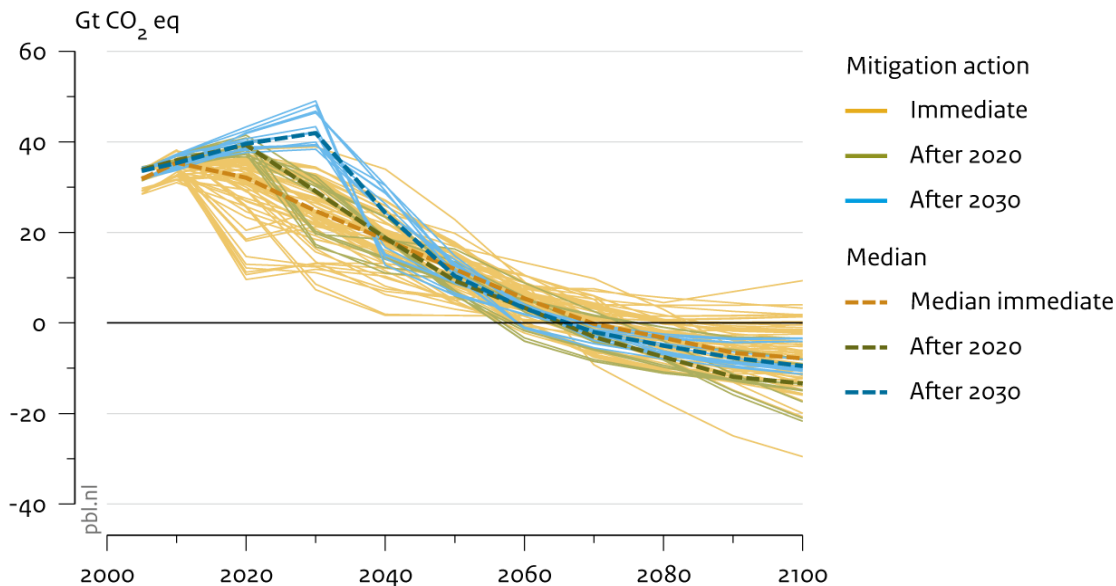
Negative emissions: Bio-energy + CCS / reforestation

## 2°C scenarios have 4 distinct phases



# Delay leads to more rapid decarbonisation after 2030 – and even more stringent reductions

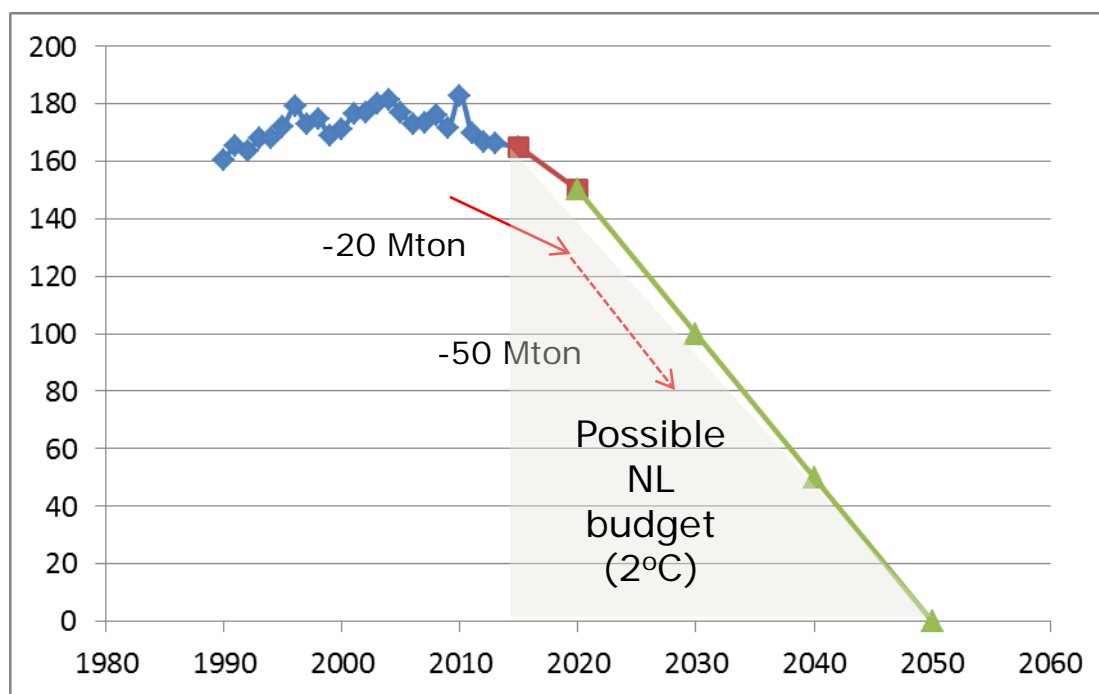
Effect of delay on greenhouse gas emission for 2 °C scenarios



*Not strengthening the INDCs (and EU's 40% goal) make achieving the 2°C target without negative emissions almost unthinkable.*

Source: IPCC AR5 database

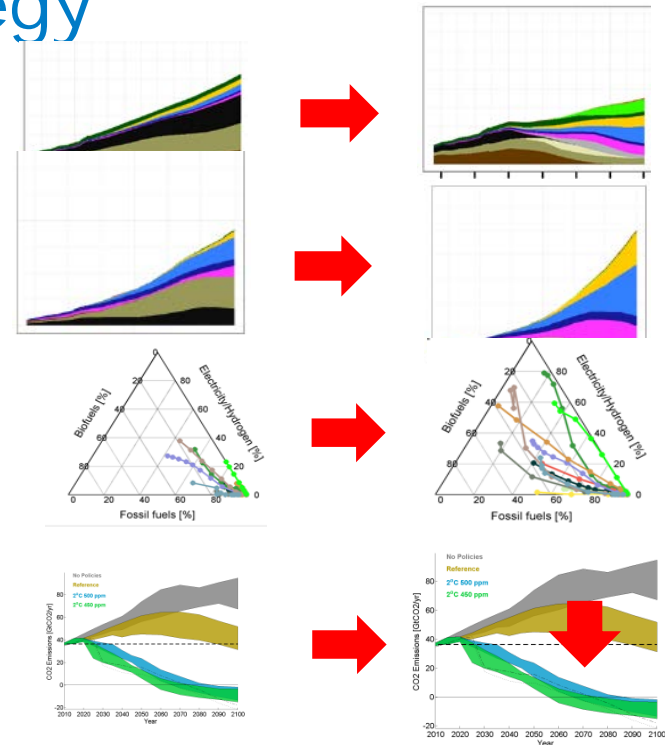
## Netherlands' climate policy would need to increase level of ambition to be consistent with 2°C



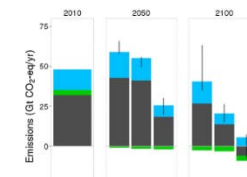
- Prepare in the short-term for acceleration (focus on LT transition)
- International programme on CCS

# 6 step decarbonisation strategy

1. Increase energy efficiency
2. Decarbonize the electricity asap
3. Electrification where feasible
4. Negative emissions
5. Difficult bit: decarbonize the remainder
6. Mitigate non-CO<sub>2</sub>; halt deforestation; reforest

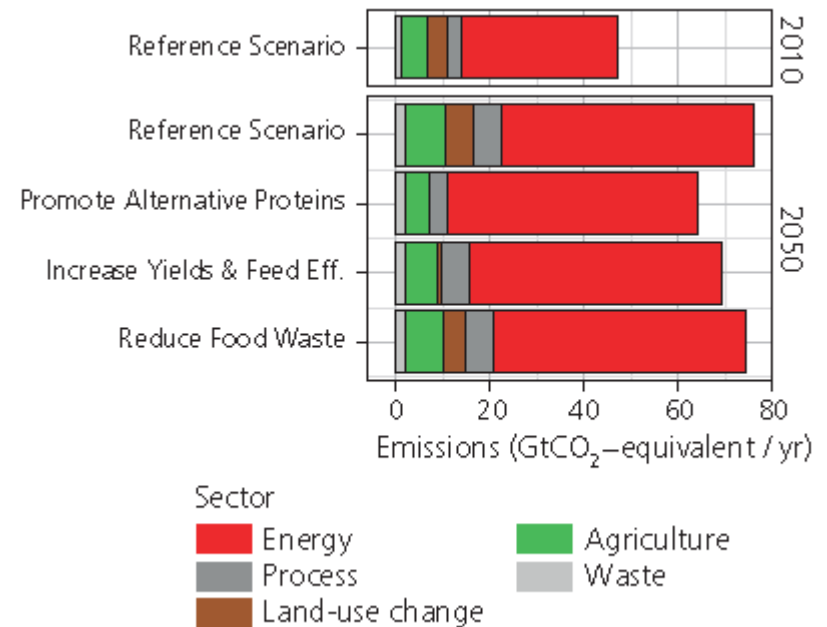
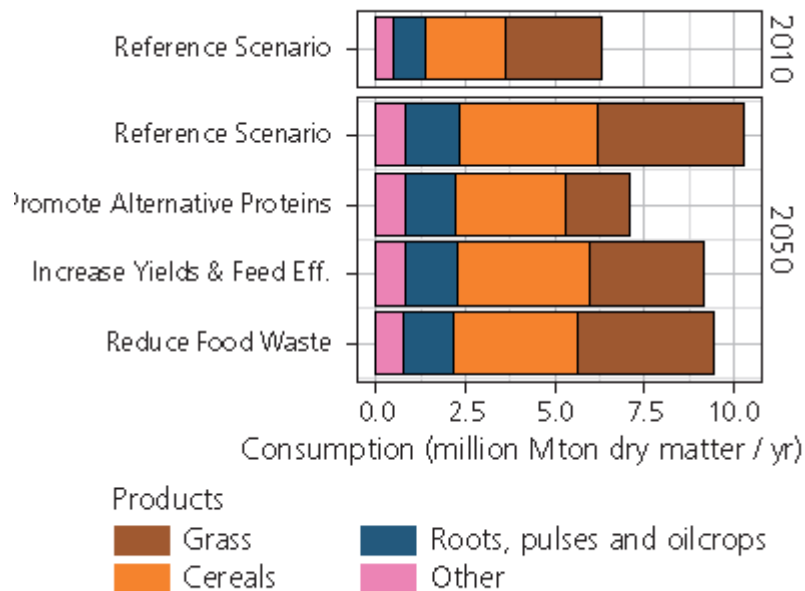


Biofuels, CCS, H<sub>2</sub>



# Alternatives

## Lifestyle change







## Priorities for research agenda

- Join in SSP-based research; elaborate alternative scenarios ('fill the matrices')
- Research feasibility of the "default" mitigation strategy – model analysis – but especially combination with transition sciences → How to achieve enough momentum for change
- 1.5°C scenarios → Comparison to 2°C (how much negative emissions are needed)
- Look into alternative pathways
- Map out infrastructure and investment requirements for mitigation strategies
- Connections between mitigation strategies and SDGs (increase support; trade-off LUC)



# Thank you for your attention

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