Long term energy scenarios for the Netherlands and strategies to drastically reduce CO_2 emissions

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ECN Policy Studies

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Content

- How are Dutch CO_2 emissions currently developing?
- Concept of long term energy transitions
- Four new energy and CO_2 scenarios towards 2040
- Conclusions and recommendations

Characteristics of Dutch energy system

- Small country and high population density
- Large energy intensive industry
  - Rotterdam harbour favourable location

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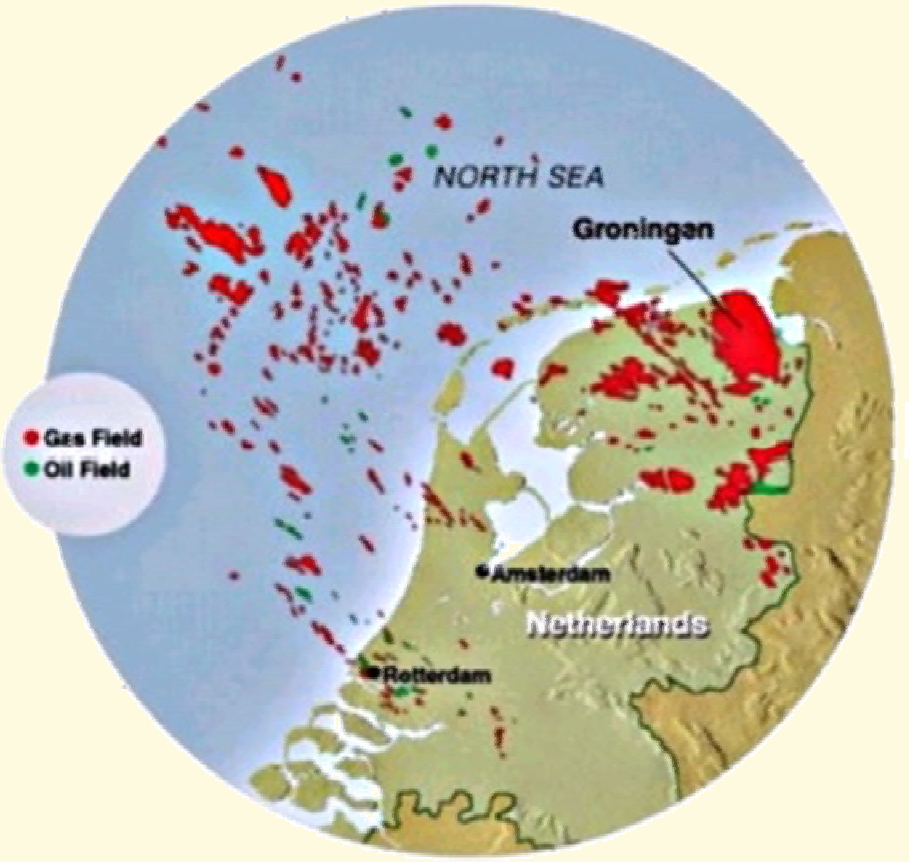
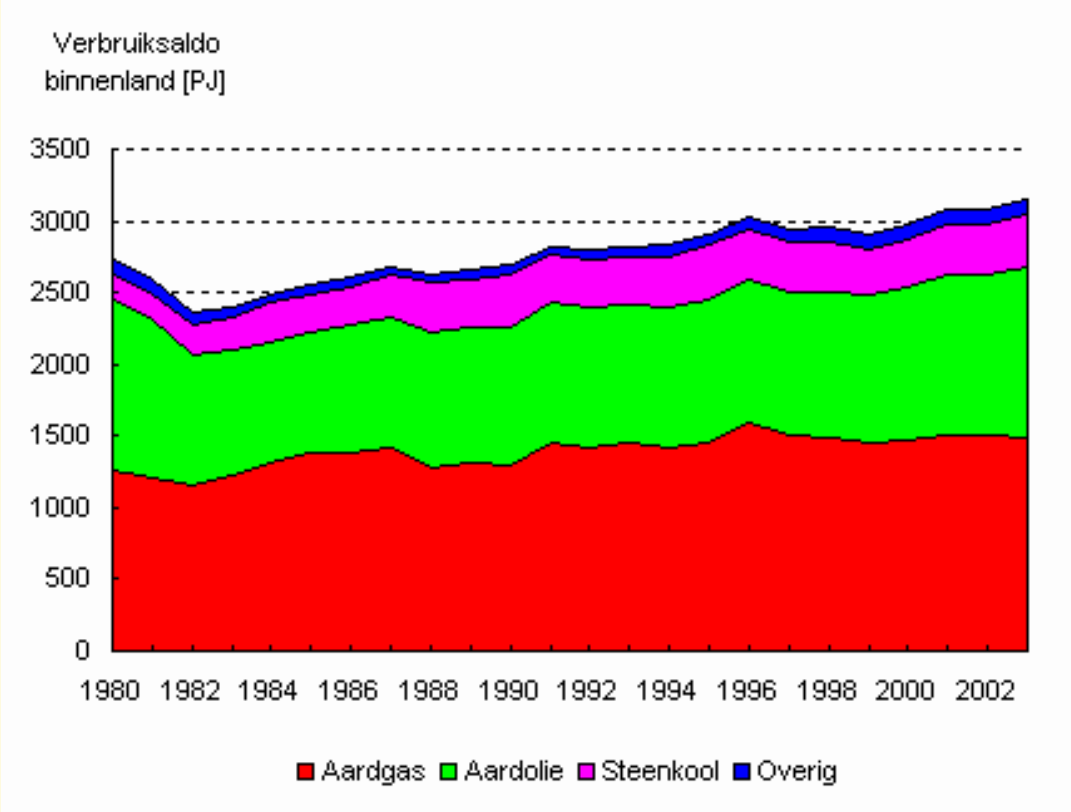


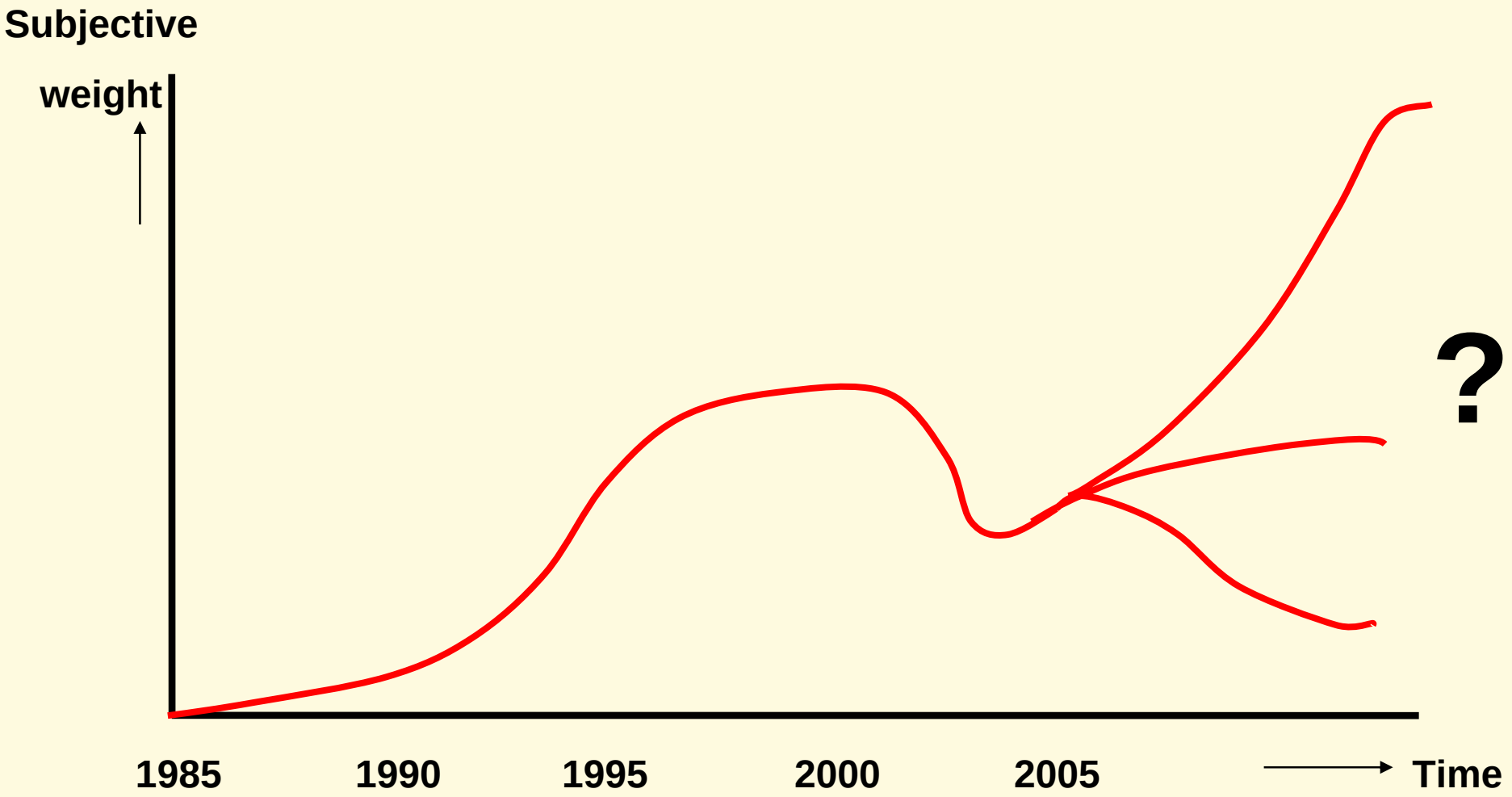
Characteristics of Dutch energy system

- Small country and high population density
- Large energy intensive industry
  - Rotterdam harbour favourable location
- Significant natural gas reserves
- Fossil fuels dominant, one nuclear power plant

Development of fuel mix 1980-2003



Mitigation of greenhouse gas emissions on policy agenda



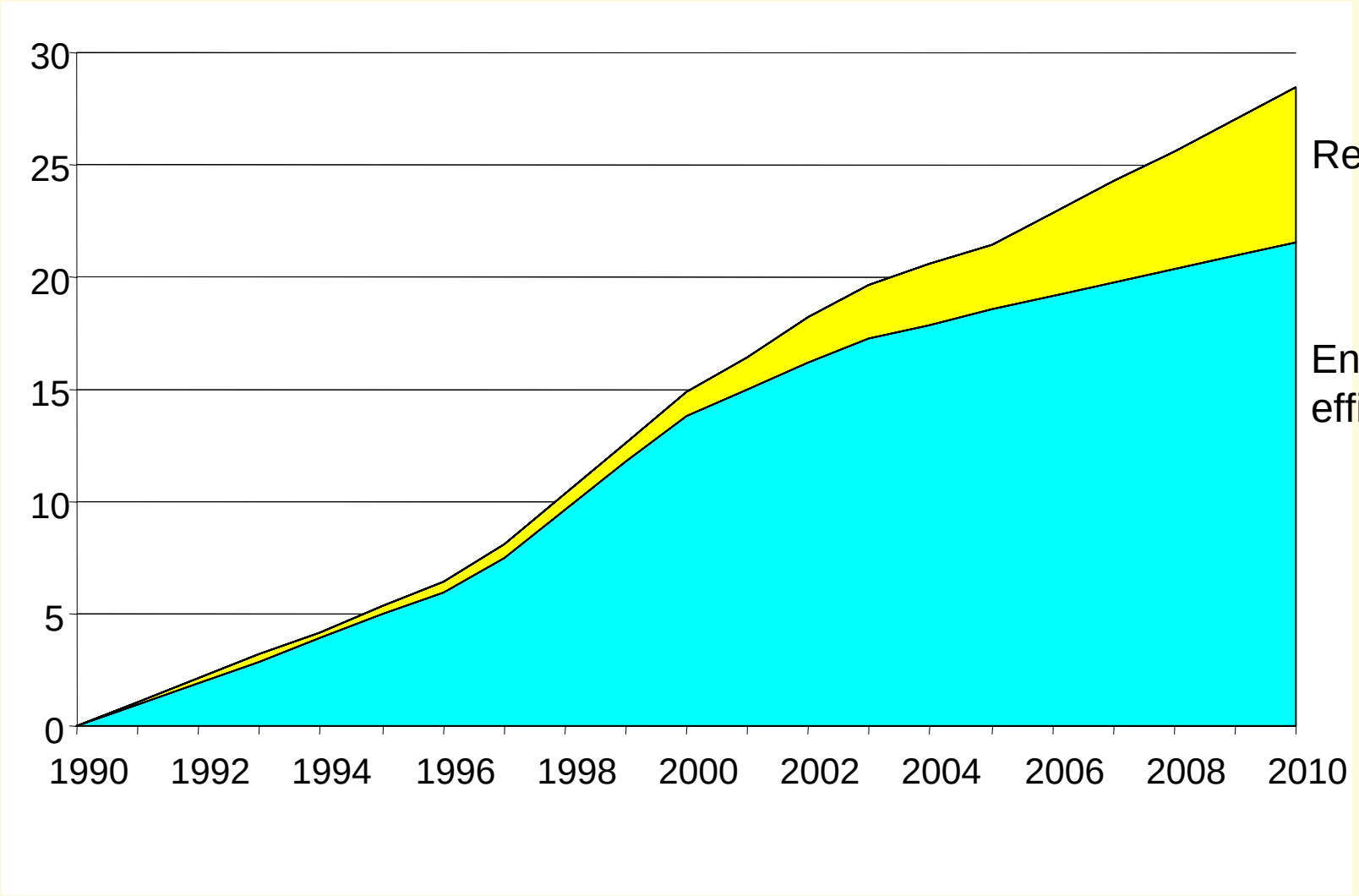
Chronology Dutch climate policy

- First budget period (2008-2012)
  - 1997/1998: Target setting
  - 1998: Overview of options + consultation with sectors
  - 1999: Start of Policy Implementation
  - 2002: 1st Evaluation
  - 2005: 2nd Evaluation
- Second budget period and beyond (2015, 2020)
  - 2005: New overview of options
  - 2005: Ambitions for 2020
  - 2007/2008: Target setting ?
- Long term targets (2030 and beyond)
  - 2001: Indicative targets set (40-60% reduction in 2030)
  - 2002: Start of energy transition approach
  - 2005: New long term scenarios

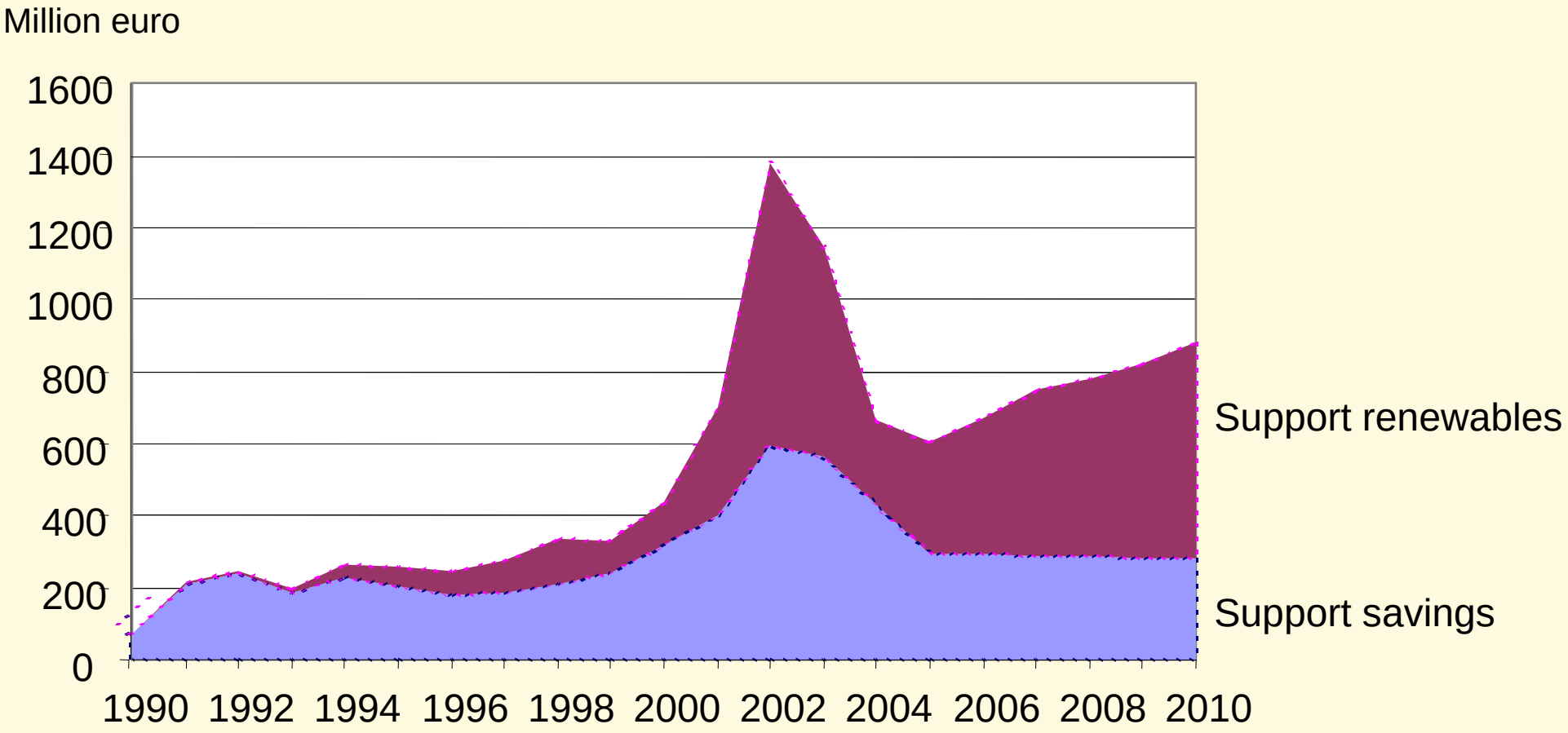
Criteria used for selection of options in 1999

- Cost
  - Cost for stakeholders, social cost
- Ease to implement measures
- Social acceptance
- Other relevant consequences
  - Security of Supply
  - Other emissions
  - Innovation
- Equal distribution over sectors

Estimated avoided CO_2 emissions due to climate policy 1990-2010



Financial support from Dutch government for domestic CO_2 mitigation 1990-2010



Conclusions from Dutch CO_2 mitigation policy until 2010

- Implementation of new policy started promptly
- Mix of criteria to select options
- CO_2 emissions continue to grow (0.7%/year)
- Average cost for government amount to 30 euro/tCO_2
- Dutch Kyoto target is expected to be met:
  - Limited growth CO_2 emissions
  - Decrease non-CO_2 GHG emissions
  - >20 Mton/year via JI/CDM/ETS

Transition approach: rationale

- Awareness that current society is far from sustainable:
  - imbalance between economic, social-cultural and ecological dimensions
  - persistent problem due to system failures
  - drastic CO_2 reduction will not be realized via system optimisation
- System changes are needed: transitions
- Changing role of government, companies and citizens
  - new modes of governance needed
- Look beyond the current energy system
- Anticipate a more sustainable but uncertain future

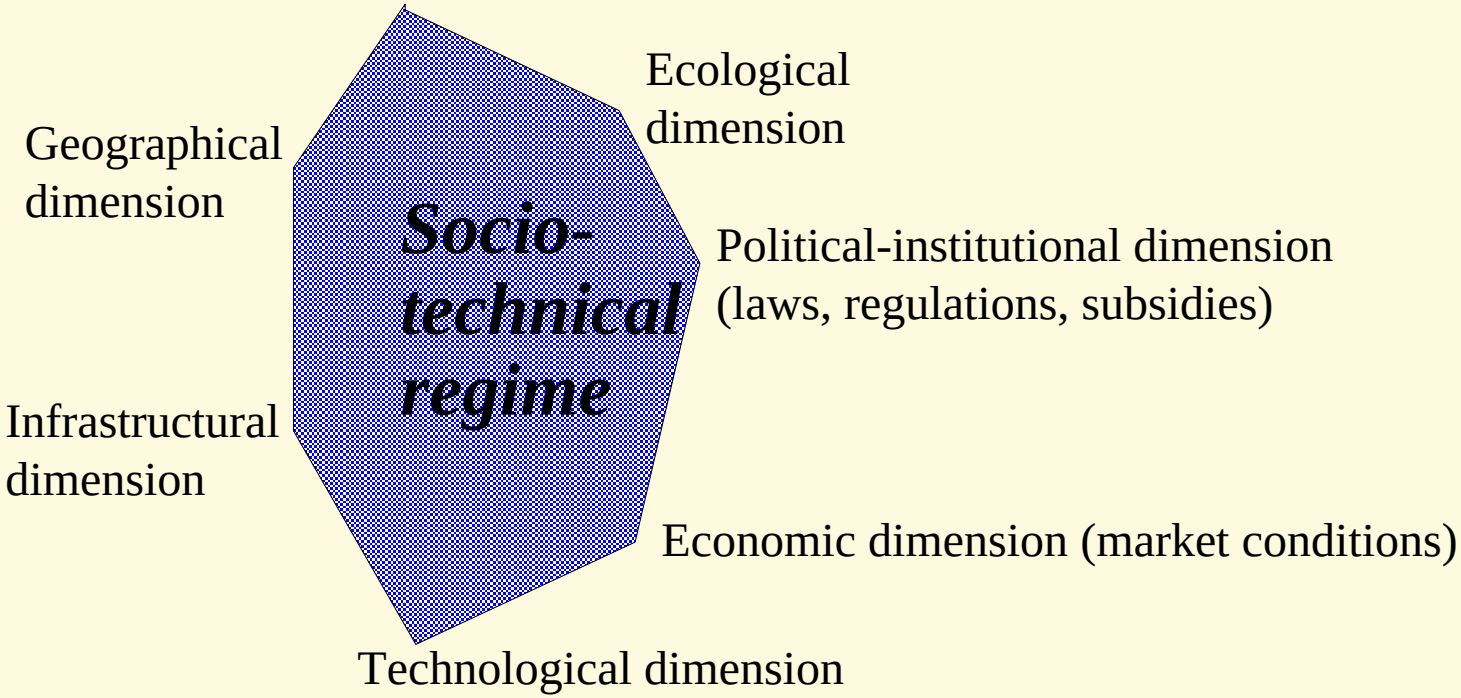
What is a transition ?

- A transition is a process of system innovation or societal change
- After the transition is complete, society, or a large part of it has changed structurally.
- Transitions are not blueprints, but possible development pathways.
- The direction, shape and fastness of a pathway can be influenced by policy and specific conditions

Source: Rotmans et al , 2000

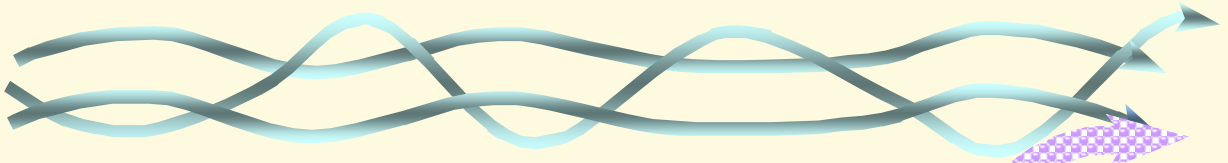
The multi-dimensional perspective

Social-cultural dimension:
Symbolic meaning of particular technology



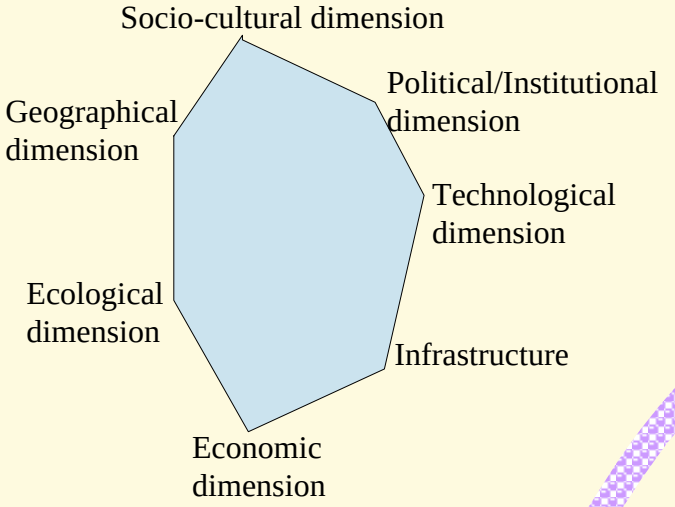
Transition at work: mechanisms towards societal change

Macro: Landscape developments



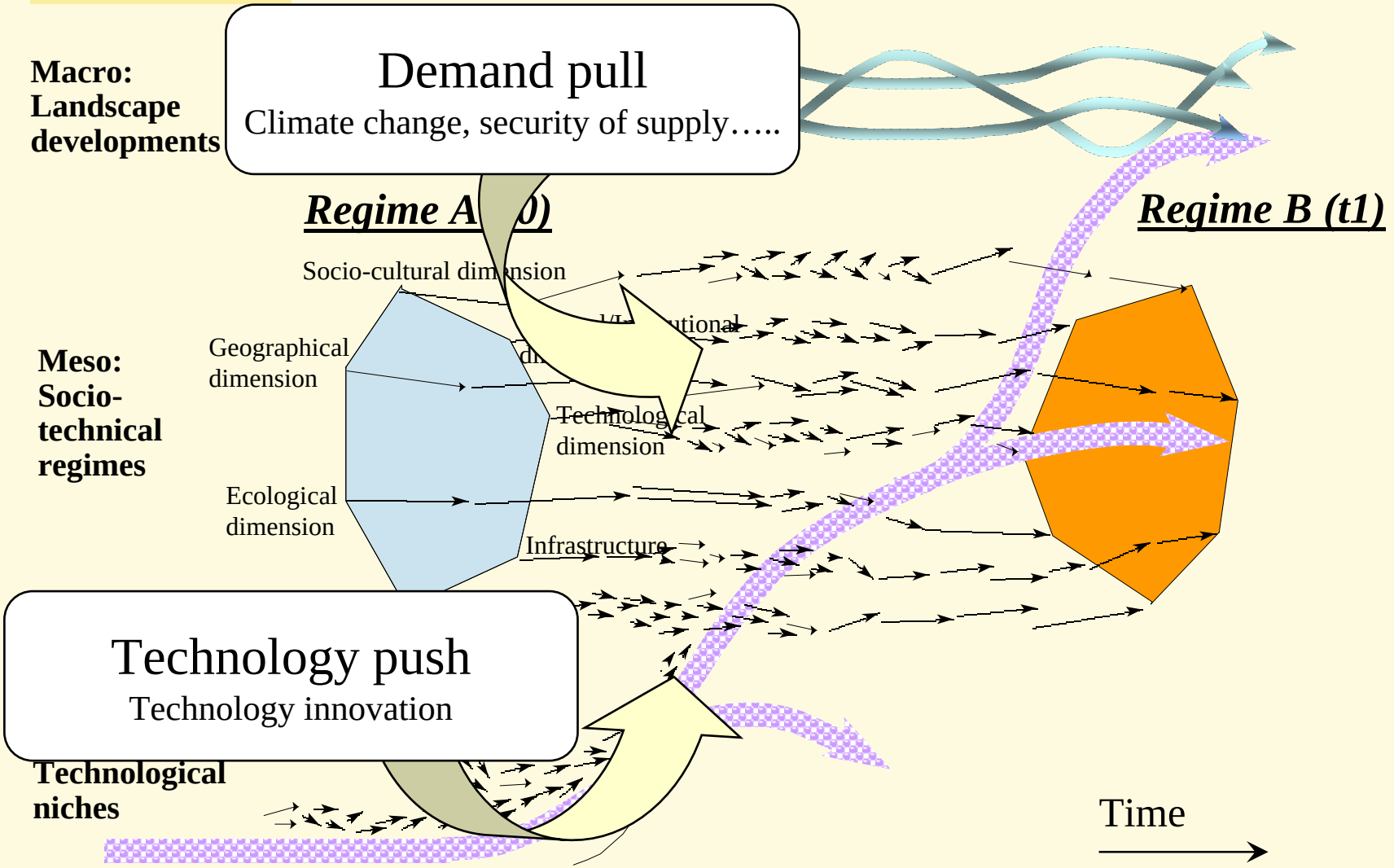
Regime A (t0)

Meso: Socio-technical regimes



Micro: Technological niches

Transition at work: mechanisms towards societal change

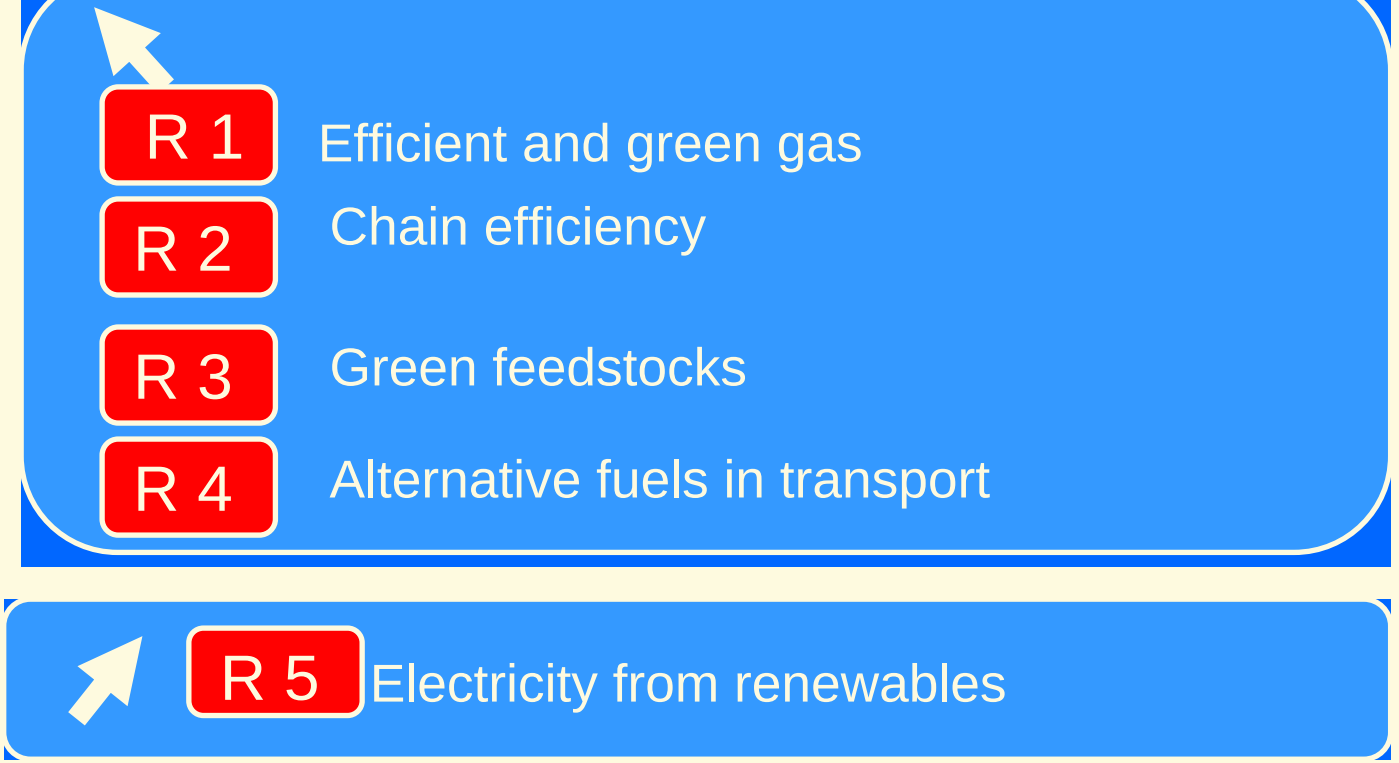


Transition approach in Dutch policy

- Transition concept was launched in National Environmental Plan Four
- Adopted by Ministry of Economic Affairs for long term energy strategy

Five main routes for energy transitions

Policy
Conditions



Source: Ministry of Economic Affairs

Agenda coming years

- Stimulate transition experiments
- Deepen transition paths and make them more concrete
- Couple transition paths and energy R&D
- Strengthen collaboration with private sector
- Share transition approach with other countries

Barriers for energy transition

- Sense of urgency too small
- Actors not willing to switch roles
  - Not in line with short term self interest
  - Approach too vague
- Only successful if similar approaches are adopted in other countries
- Discontinuities in setting favourable conditions

Four scenarios for the Netherlands towards 2040

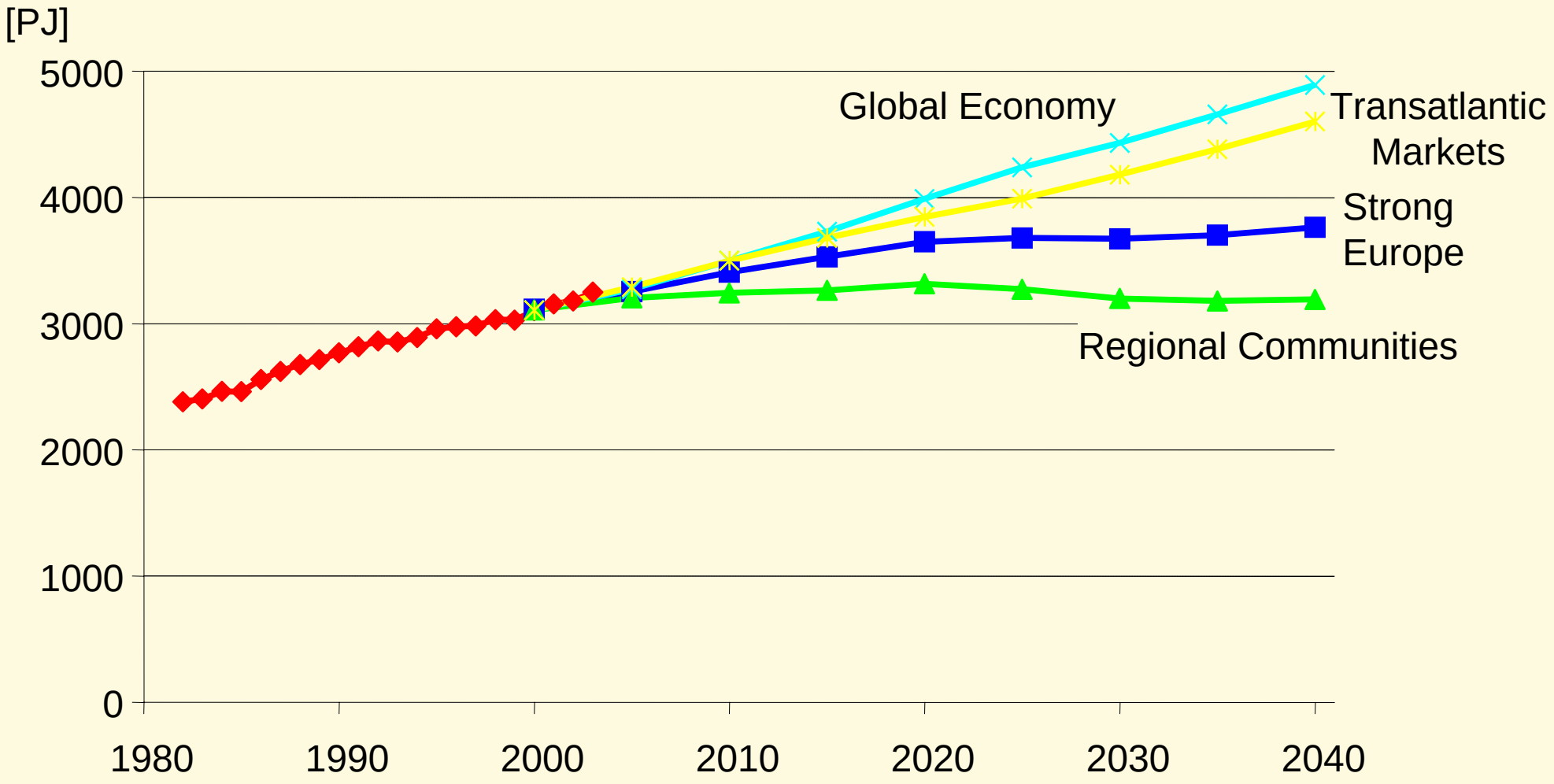
Main differences in driving forces

Strong Europe/B1 •GDP 1.5 %/yr •Energy intensive structure •CO_2 price in 2040 120 €/tCO_2	**Global Economy/A1** •GDP 2.4%/yr •Very energy intensive structure •No climate policy after 2020
Regional Communities/B2 •GDP 0.6 %/yr •Less energy intensive structure •CO_2 price in 2040 20 €/tCO_2	**Transatlantic Markets/A2** •GDP 1.9 %/yr •Energy intensive structure •No climate policy after 2020

Netherlands Energy Outlook Modelling System

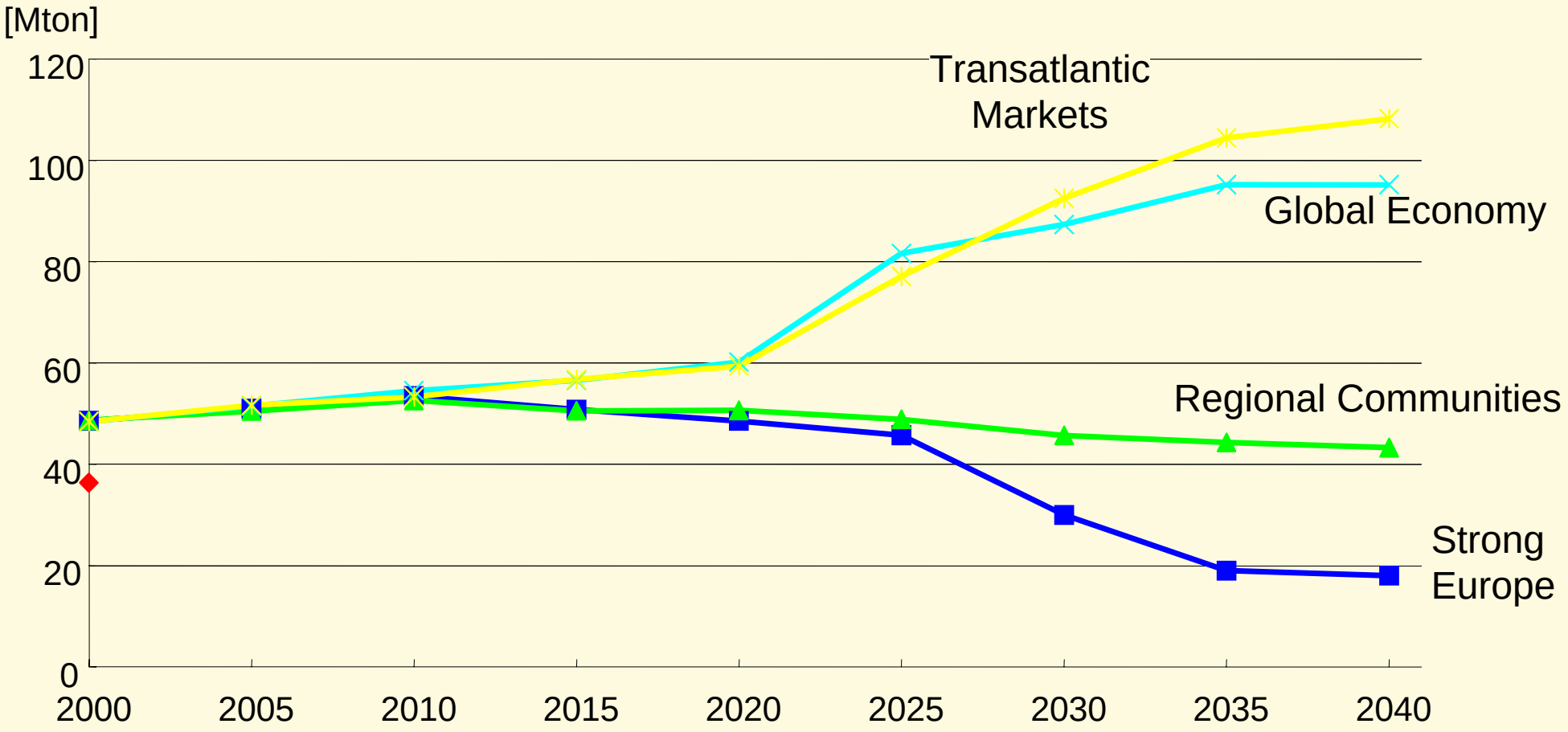
- Simulation of sectoral energy use of energy markets
  - Hybrid models including economic, technical and other considerations
  - Much technological detail
  - Effects of policy instruments covered in detail
  - Calibrated to past trends
  - Starting point is the current capital stock with related energy use

Total primary energy use



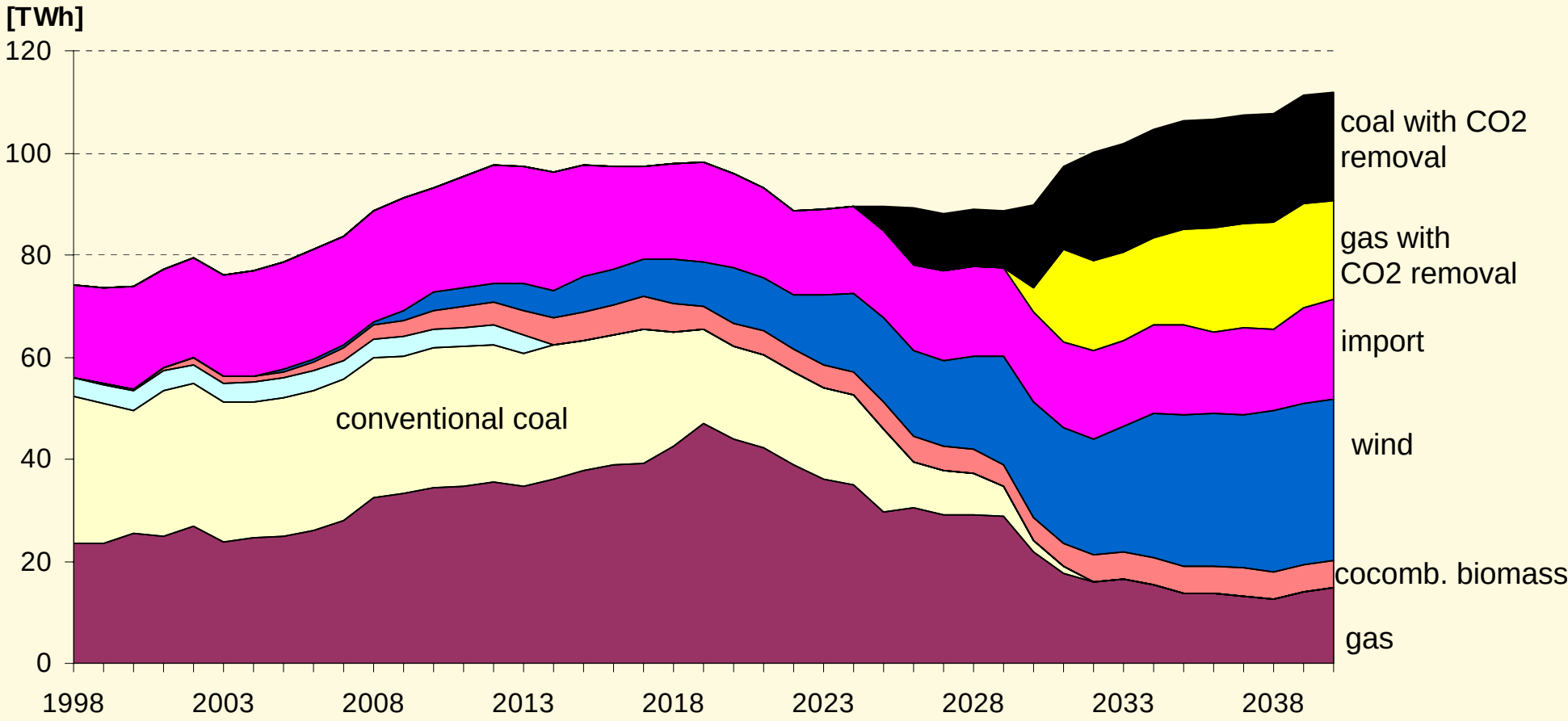
Preliminary results

CO_2 emissions from power plants

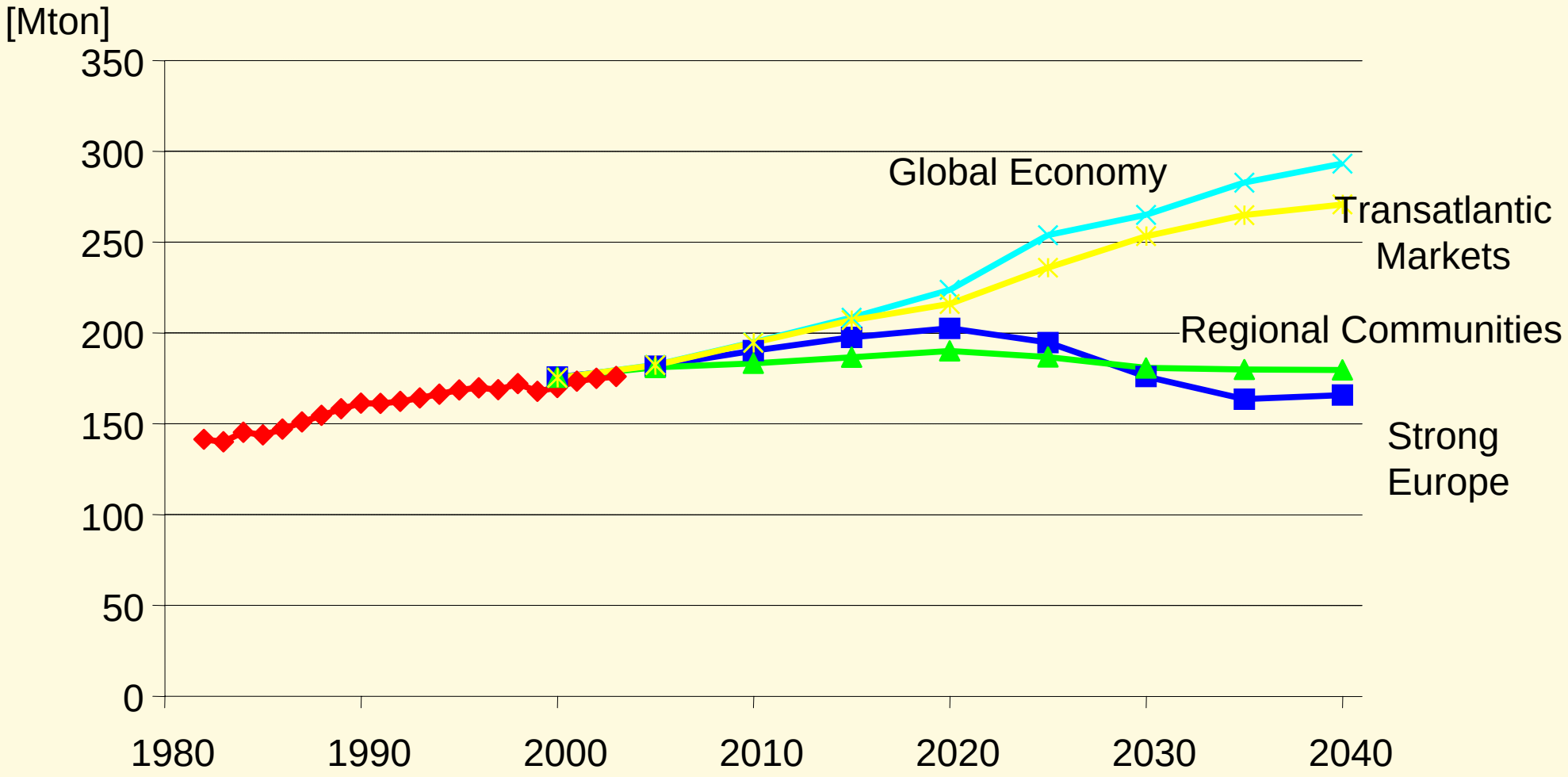


Central electricity generation in Strong Europe scenario

(CHP excluded from graph)

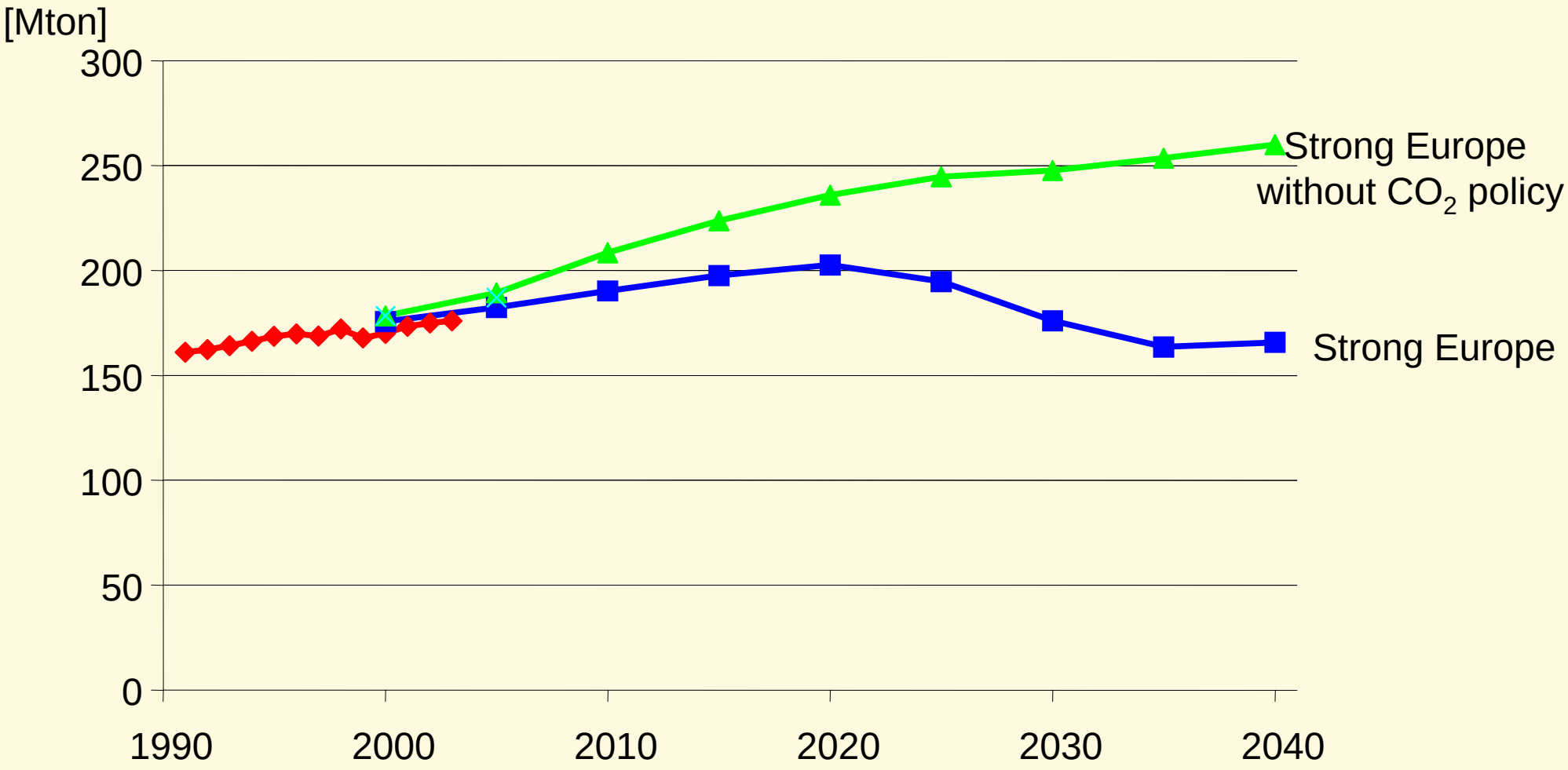


Total CO_2 emissions from the Netherlands



Preliminary results

Effect of policy on CO_2 emissions is significant in Strong Europe



Preliminary results

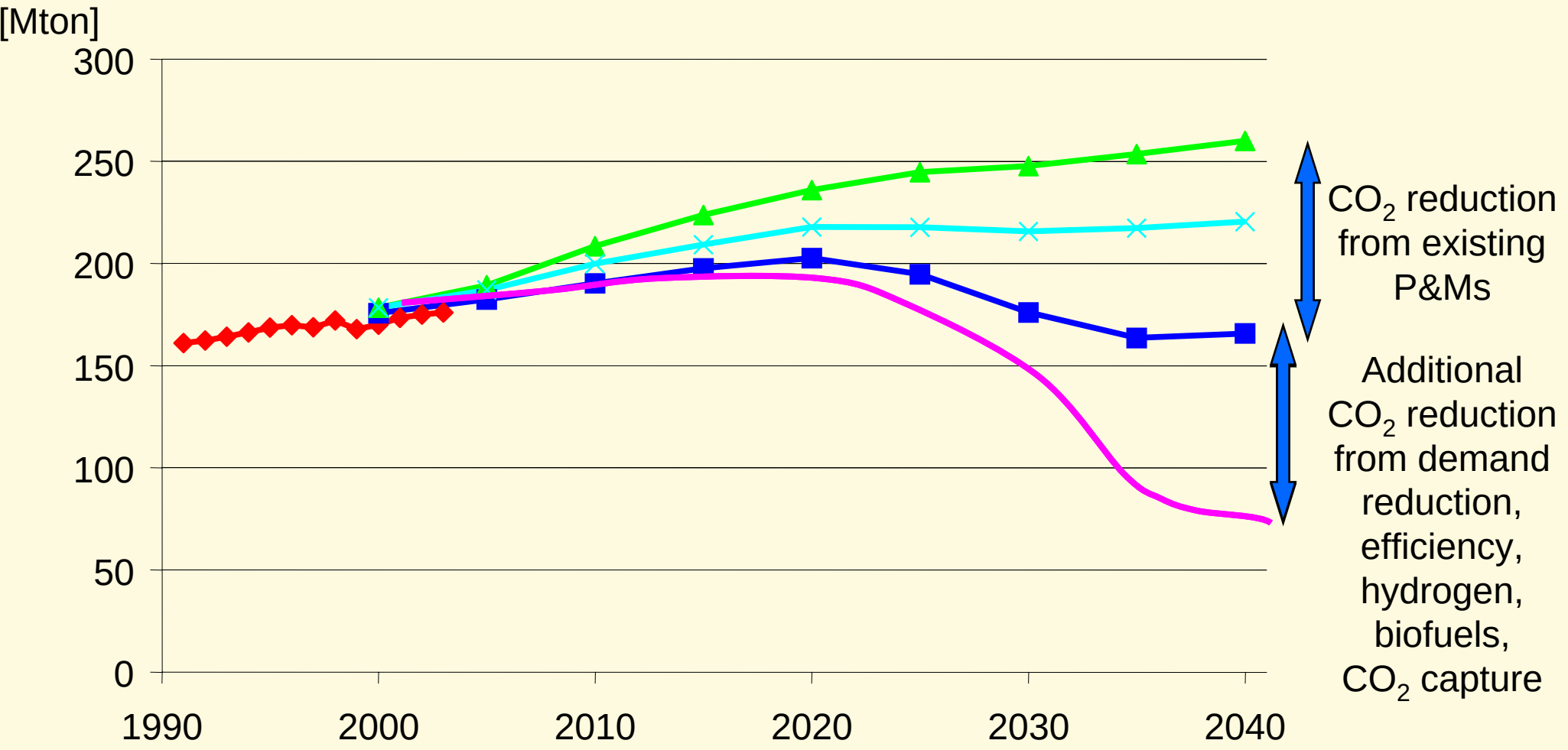
Conclusions from long term scenarios

- Energy use will continue to increase
- CO_2 emissions are expected to increase and will depend on:
  - Growth economy and growth population
  - Fuel mix choices
  - Technological innovation
  - CO_2 policy
- In one scenario CO_2 emissions will decrease after 2020 due to a transition in electricity generation
- No significant reduction of CO_2 emissions
  - Additional policies and measures, energy transition or changes in economic structure are needed

Two approaches towards low carbon society

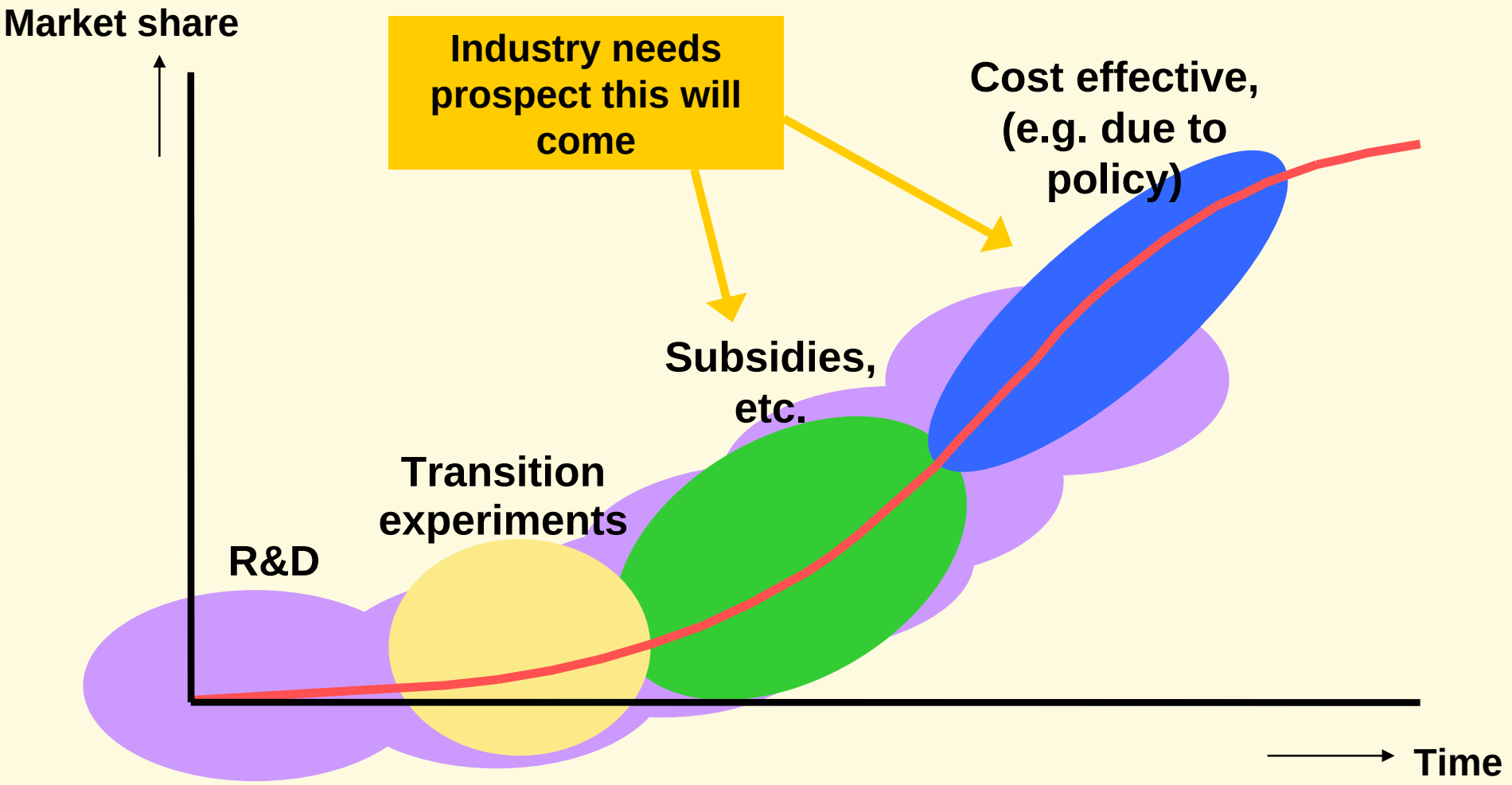
Classical approach: system optimization		**Transition approach: system change**
List possible P&Ms		Set long term goal
Select P&Ms		Create coalitions of stakeholders
Implement P&Ms		Stimulate experiments
Evaluate P&Ms		Create favourable conditions
Forecasting		Backcasting

Dutch CO_2 emissions: indicative additional effect from energy transition



Preliminary results

Stimulation of clean technologies requires a mix op policy instruments



Conclusions and recommendations

- Long term CO_2 reduction will not be met with current policies
- Drastic reduction of CO_2 emissions requires balanced combination of “classical” policy, energy transitions and changes in economic structure
- Challenge for technical options AND policy instruments
- Long term strategy includes:
  - Robust elements: energy efficiency, renewables, CO_2 capture and storage
  - Likely elements: biofuels, hydrogen, nuclear, electrification, lifestyle
  - Too uncertain to make implementation roadmap for long term drastic emission reduction
- Apply classical approach and transition approach
- Sense of urgency needed

THANK YOU
FOR YOUR ATTENTION !

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