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Energy research Centre of the Netherlands

Climate, energy security and innovation

Heleen Groenenberg

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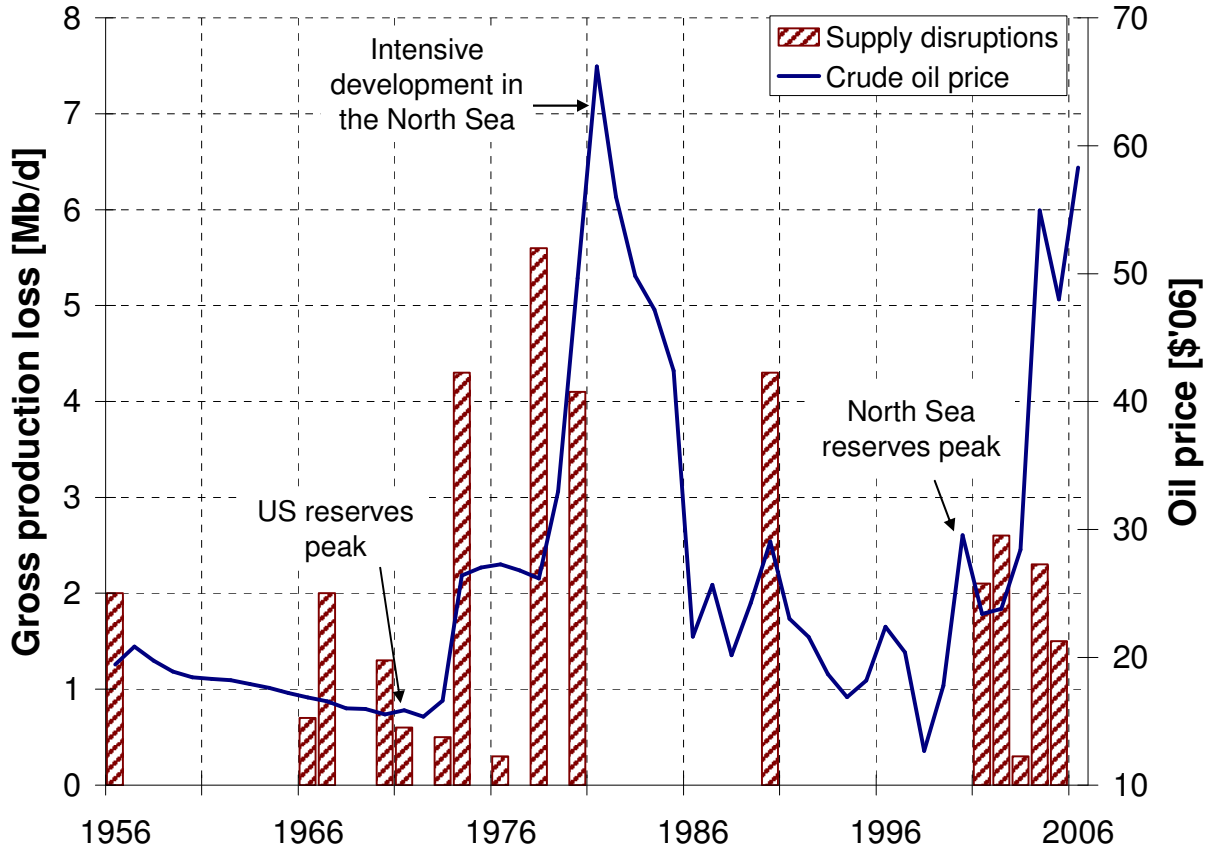
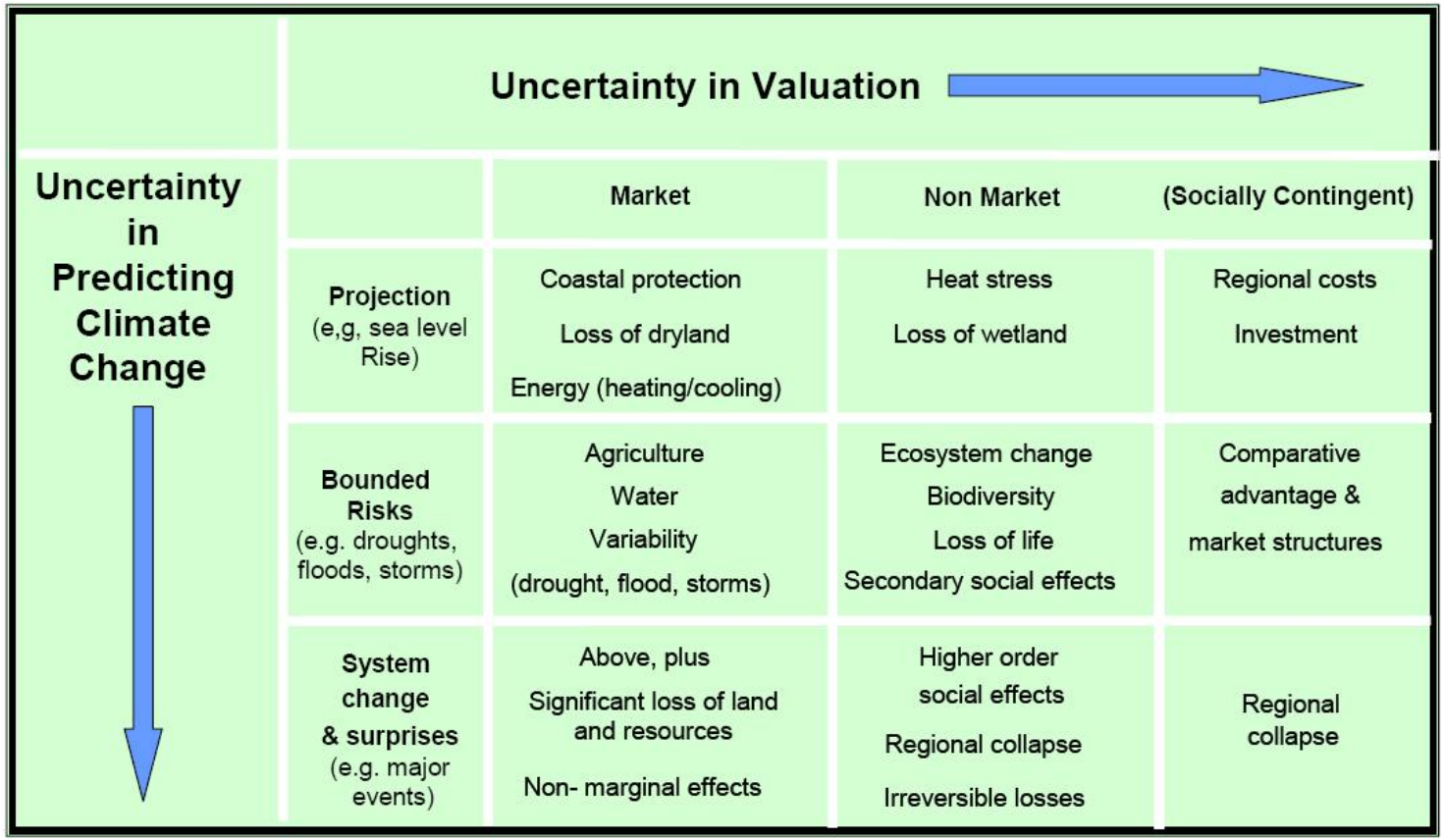
Oil price has an impact on production



..but risks of climate change may be larger



Uncertainty in Predicting Climate Change ↓	Uncertainty in Valuation →			
		Market	Non Market	(Socially Contingent)
	Projection (e,g, sea level Rise)	Coastal protection Loss of dryland Energy (heating/cooling)	Heat stress Loss of wetland	Regional costs Investment
	Bounded Risks (e.g. droughts, floods, storms)	Agriculture Water Variability (drought, flood, storms)	Ecosystem change Biodiversity Loss of life Secondary social effects	Comparative advantage & market structures
	System change & surprises (e.g. major events)	Above, plus Significant loss of land and resources Non- marginal effects	Higher order social effects Regional collapse Irreversible losses	Regional collapse

Scenario analysis

	2020		2050	
Intensity [%]	Ref	EU climate objective	Ref	EU climate objective
Gas	28	30	18	19
Coal	17	13	17	8
Import dep [%]				
Oil	87	87	92	92
Gas	75	75	83	84

(WETO-H_2)

Synergies in EU energy policies?

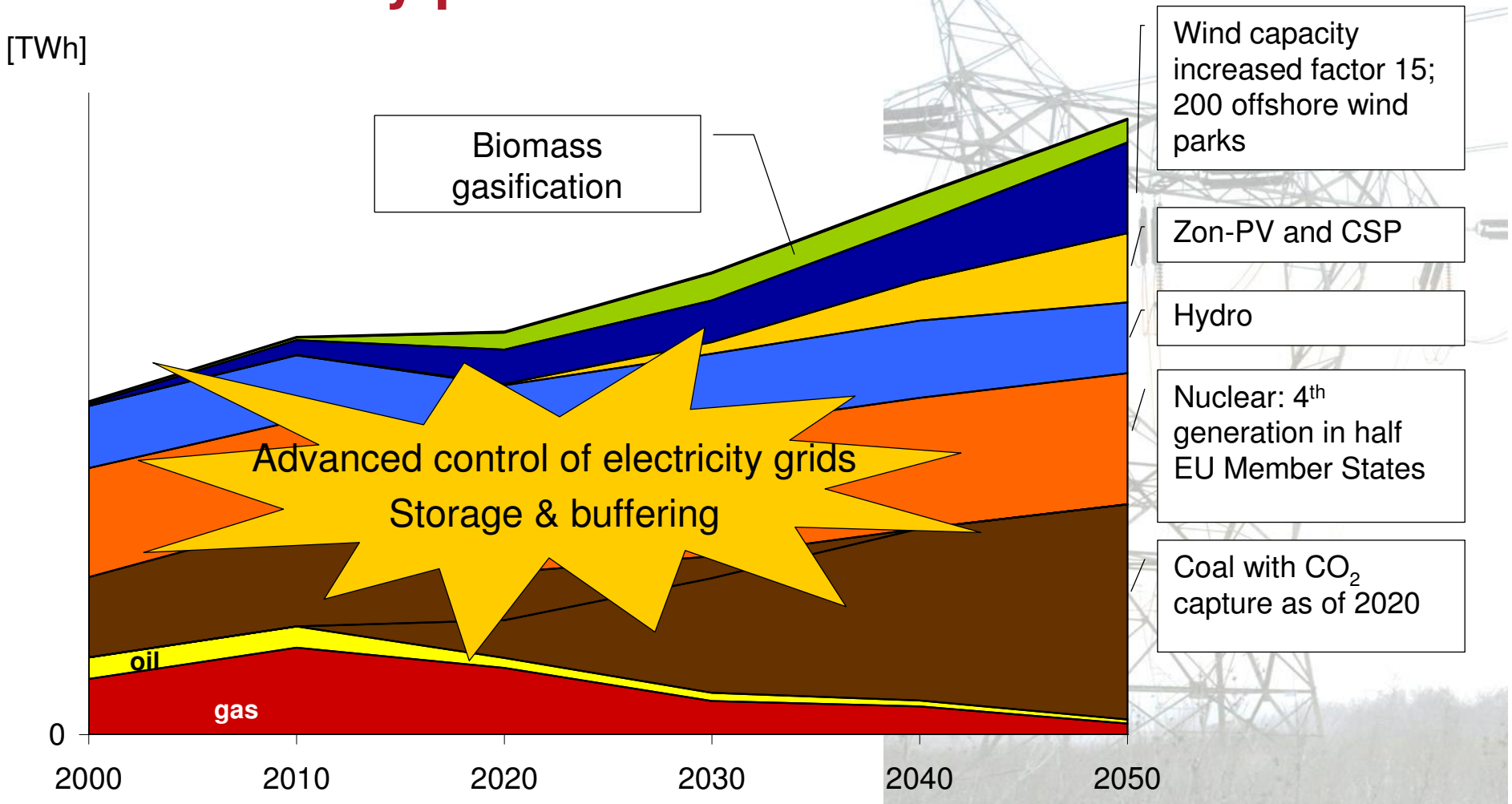
- Long term impacts CC likely to exceed short/medium term impacts of supply disruptions
- Not all technologies contribute to both better climate and SoS
- Cost effective package to lower CO_2 by 50% in 2050 has only a modest positive impact on energy security
- Short-medium term: no technological breakthroughs needed to stabilize GHGs below 570 ppm (IPCC 4AR)

Why technological innovation?

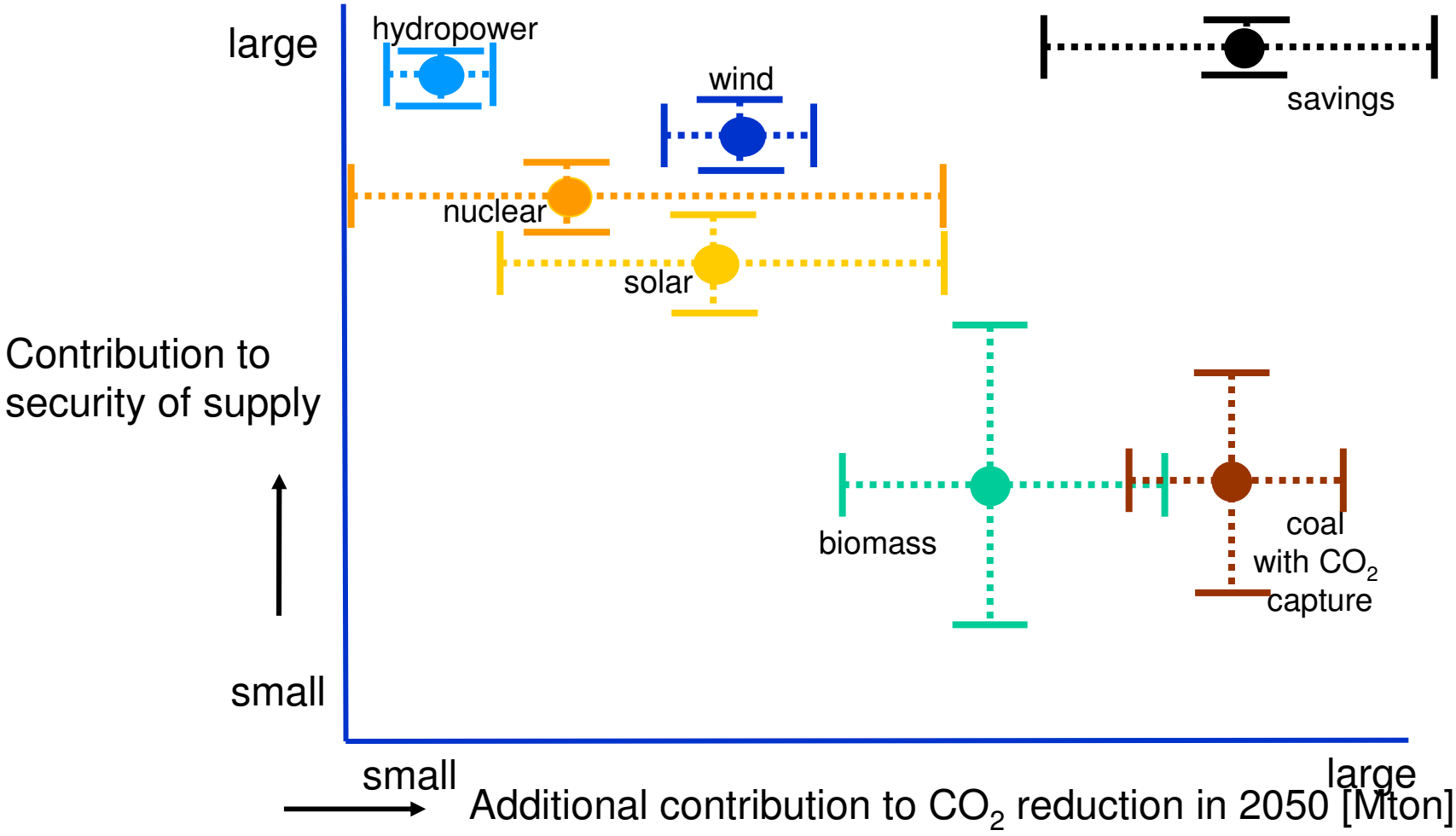
- Long term contribution CC mitigation, SoS
- Success available technologies uncertain
- Competitive advantage
- Improved performance traditional technologies
- Reinvestment saved costs
- Capital and labour productivity, recycling

Contribution of innovation to competitiveness and jobs yet to be demonstrated

Electricity production and distribution



Which technologies make a difference?



Power

	CC	SoS	Innov
Nuclear II and III	++	++	Comm
Biomass power	++	++	Upsc
Wind	++	+	Upsc
(Small) hydro	+	++	Upsc
Solar heating/cooling	+	+	Upsc
Geothermal	0	0	Upsc
Coal CCS	++	++	Demo
Gas CCS	+	0	Demo
CSP	0	0	Demo
Nuclear IV	++	++	R&D
Stationary fuel cells	0	0/+	R&D
Photovoltaics	0	0	R&D
Ocean energy	0	0	R&D

Cars

	CC	SoS	Innov
Ethanol flex-fuel	0/+	0/+	Comm
Fuel economy, non engine	0	0	Comm
Hybrids	0/+	0/+	Upsc
Plug-in hybrids	+	+	Demo
H_2 fuel cell	0/+	0/+	R&D

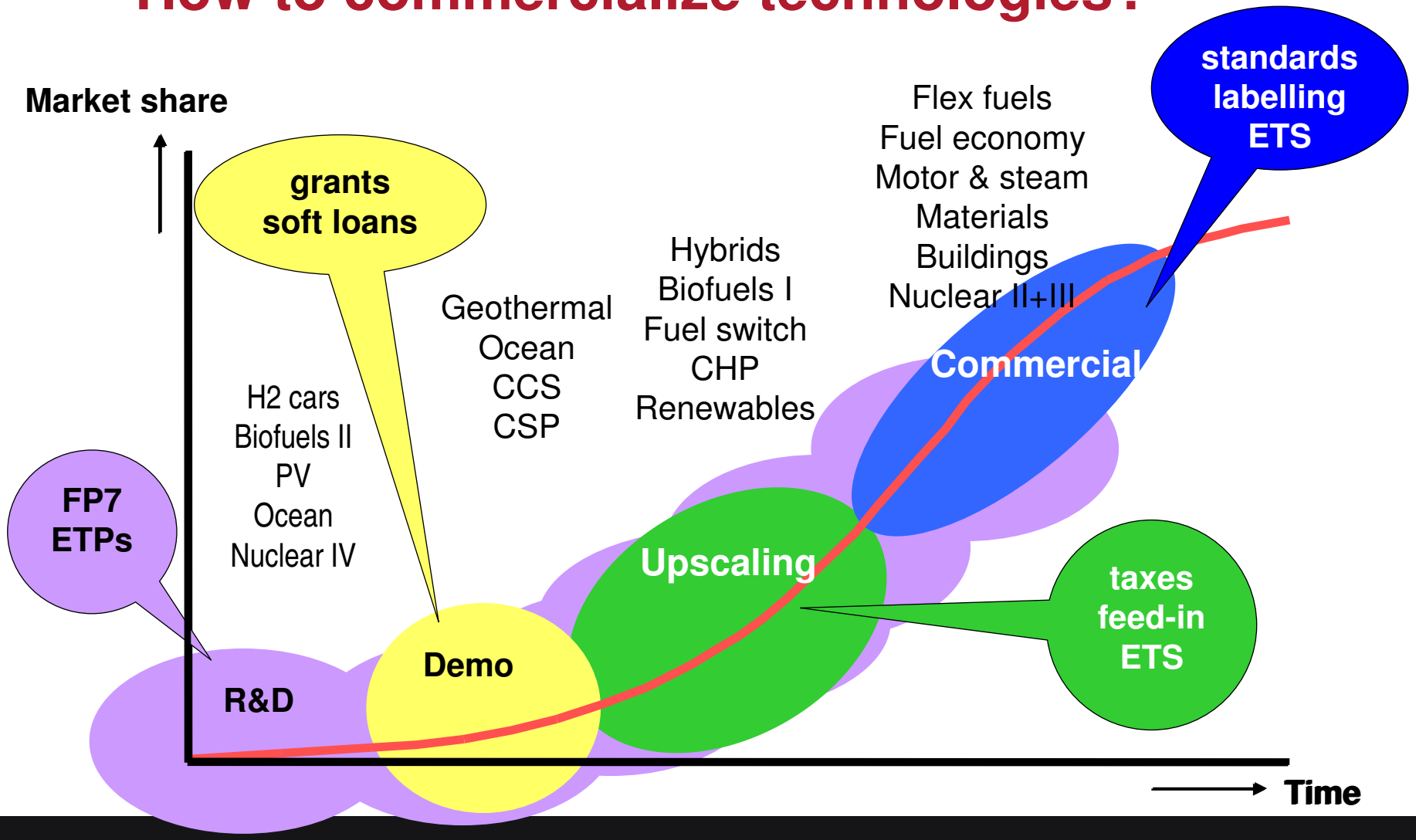
Fuels

Biofuel 1st gen	+	+	Upsc
H_2 from fossils	+	0	Upsc
Coal-to-liquids	-	0	Demo
Bio-to-liquids	++	++	Demo
Ethanol 2nd gen	++	++	Demo/R&D
H_2 renewables	++	++	R&D

Requirements for innovation policies

- ν 1. Short term efficiencies
- ν 2. Diversity and co-evolution
- ? 3. Long term perspective and path dependency
- ? 4. Facilitation

How to commercialize technologies?



What can the EU ETS do?

- Preference for low-cost abatement options
- Innovation market failure
- Need for complementary policies for demos
  - Economic stimulus package
  - 300 Mt allowances new entrants reserve for demos

EU policies for commercial technologies ?

	R&D	*Upscaling*		*Commercial*	
	FP7	ETS	Tax	Standard	Labels
Flex-fuel cars	X	--	--	--	--
Car fuel economy	--	--	--	--	--
Non engine tech	--	--	--	--	--
Motor & steam	--	X	--	--	--
Material efficiency	--	--	--	--	--
Buildings, appliances	--	--	--	X	X
Nuclear II	--	--	--	--	--

Conclusions

Synergies policies for climate mitigation, energy security and innovation not straightforward

Barriers remain, notably high upfront costs for demos and non-financial barriers to commercial technologies

Diversity strategy to be complemented with integral roadmap for energy transition

Prioritization and stepwise actions for demos, upscaling and energy infrastructures

contact: groenenberg@ecn.nl