

# Reflections on Green Transition

Atle Midttun

Sept. 2014

Salzburg Energy Seminar



# Optimism about mature economies



- Chris Huhne former Secretary of Energy UK (Liberal Party) (Guardian 25 August)
- We are growing richer while using less energy
- Many green thinkers suspicious of growth
- Today you can have both, no need for «green puritanism»

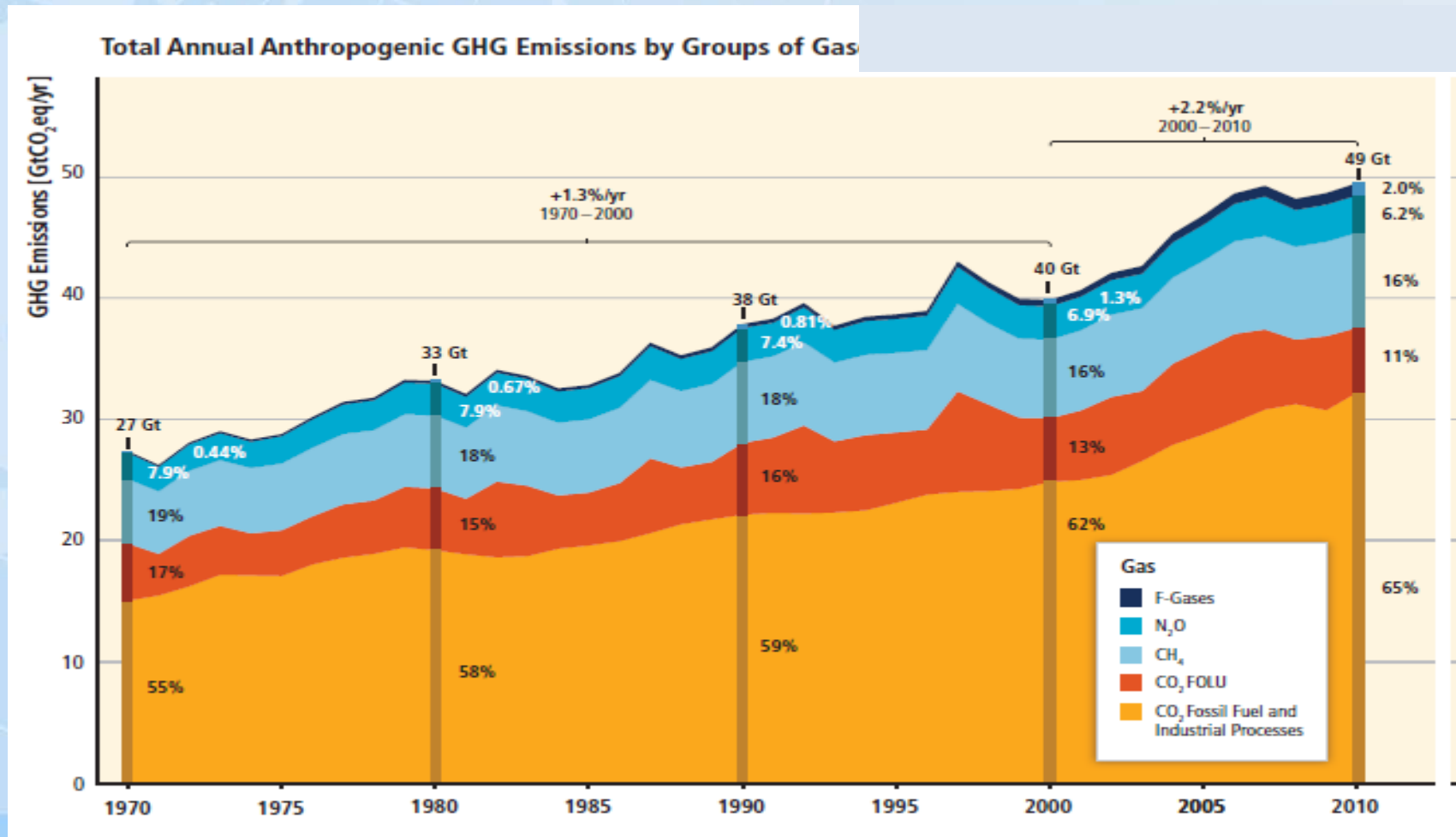
- Technology now allows us to increase growth and heighten living standards without increasing emissions.

- Cars are far more efficient
- We are taking the train more
- Lighting has increased tremendously in energy efficiency – LED light saves electricity by 93%

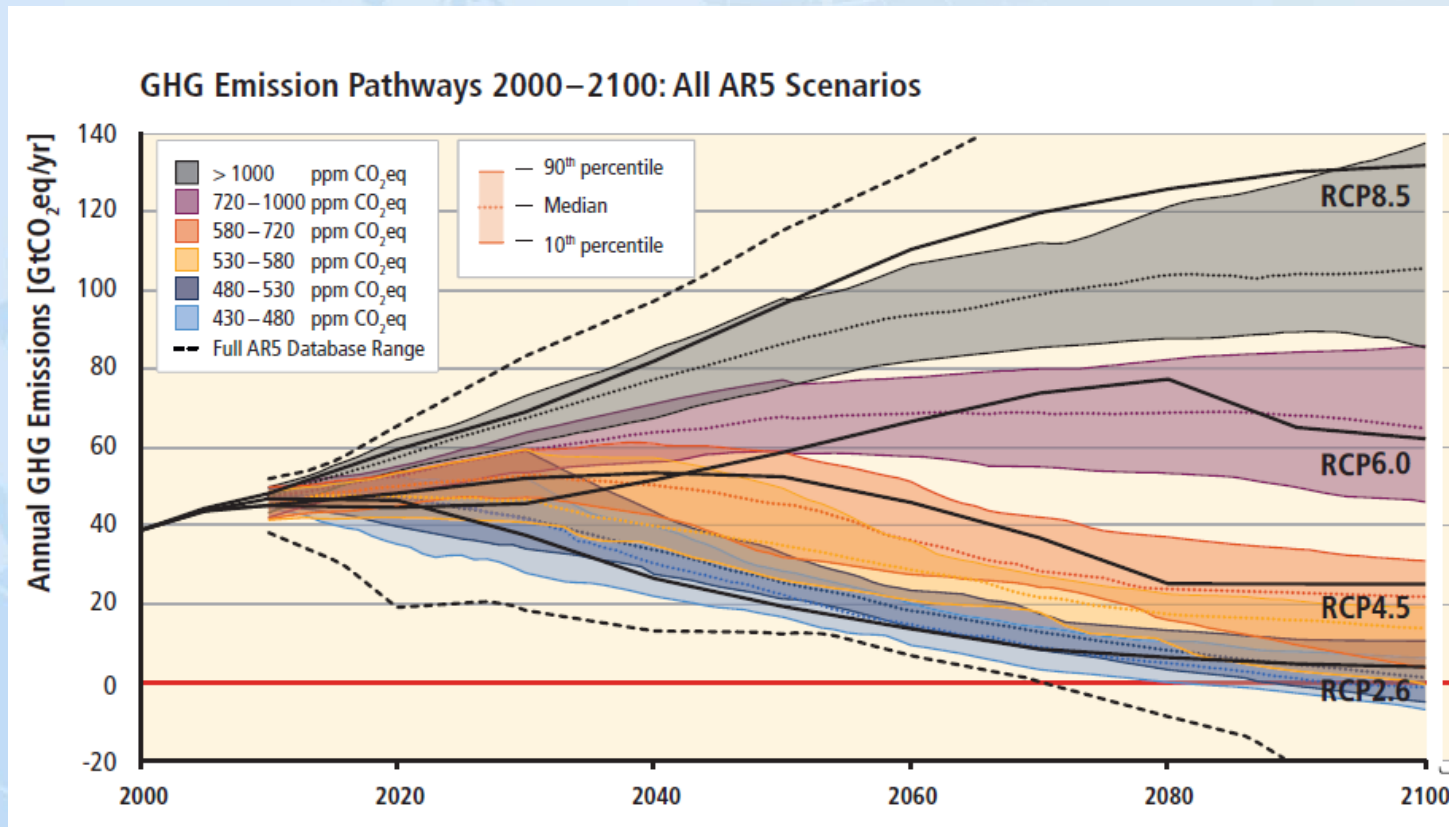
- Our living standards are rising, while our energy use is not.



# IPCC Pessimism



# IPCC Pessimism ctd.



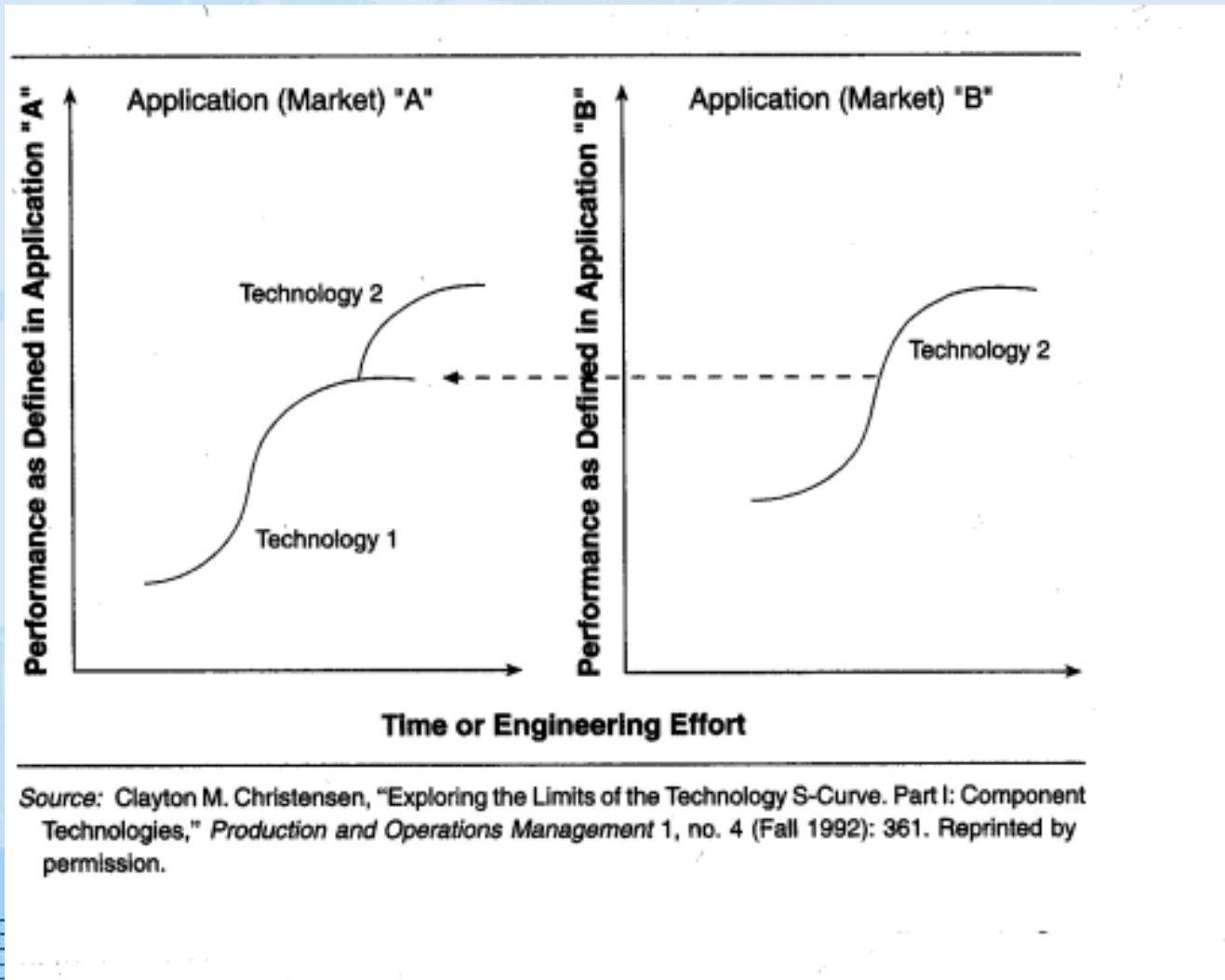


# I Equilibrium versus Creative Destruction



# The challenge of Managing Disruptive Technologies

Clayton Christensen, 1992



# Business Transformation

**How  
Broad?**

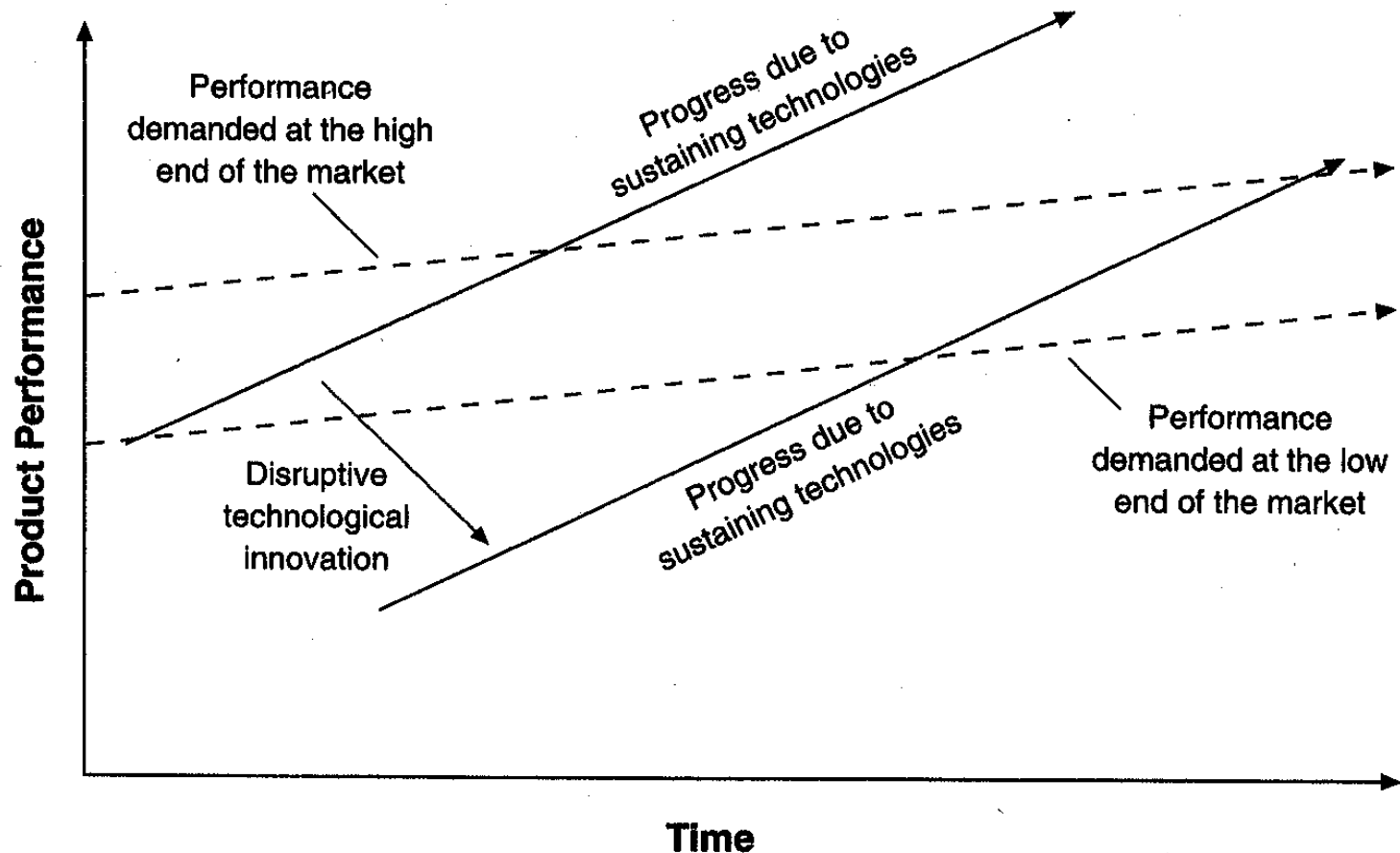
<b>Industry</b>	B2B and supply chain integration	Inventing new industry structures
<b>Business</b>	Re-engineering business processes	Creating entirely new business concepts
<b>Product/ process</b>	Refining product & processes	Reconfiguring Products & processes
	<b>Incremental</b>	<b>Radical</b>

**How radical?**



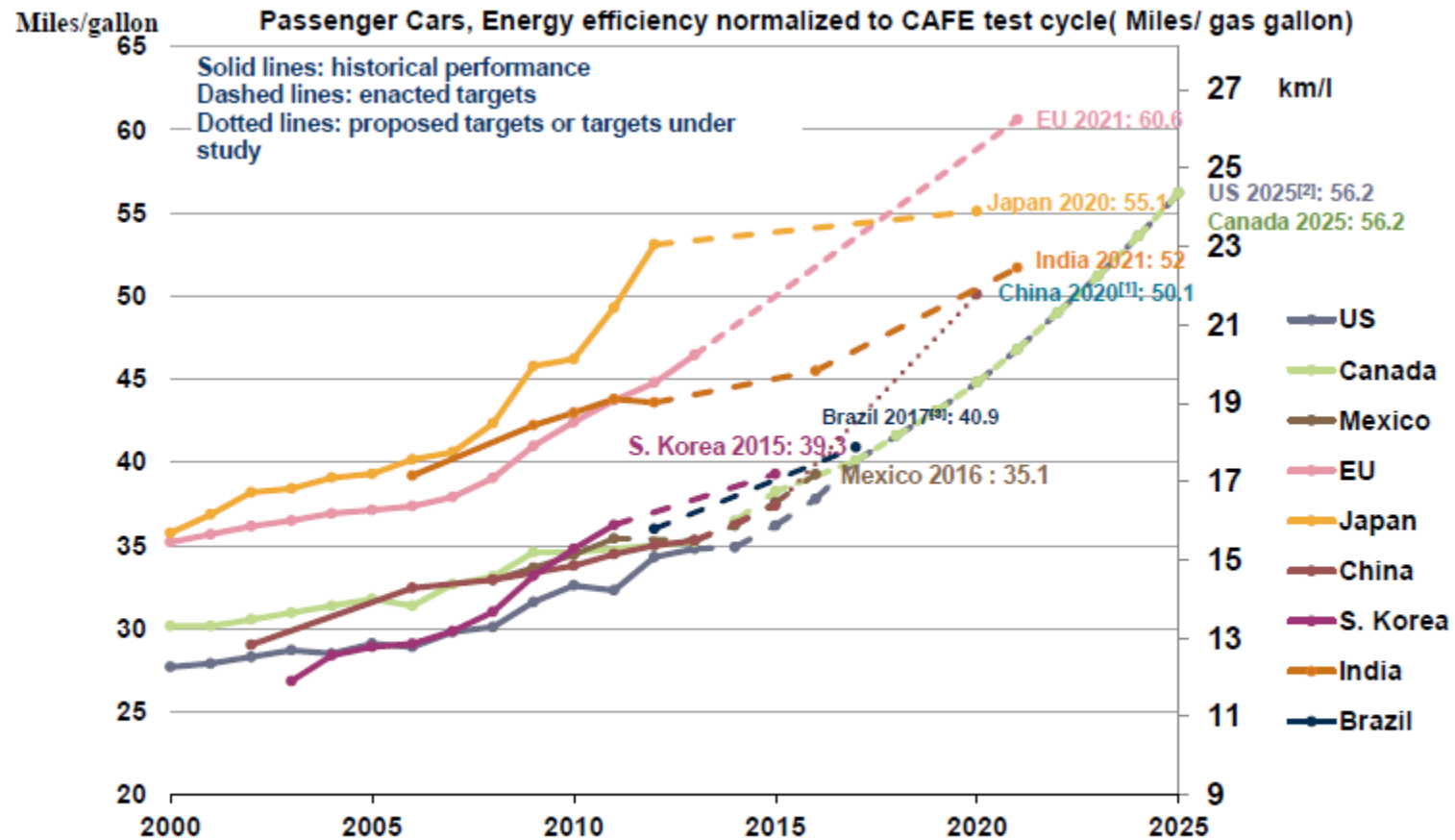
# Sustaining (ST) versus disruptive technologies (DT)

Figure 1.1 The Impact of Sustaining and Disruptive Technological Change





# Incremental innovation



[1] China's target reflects gasoline vehicles only. The target may be higher after new energy vehicles are considered.

[2] The U.S. standards are fuel economy standards set by NHTSA, which is slightly different from GHG standards due to A/C credits.

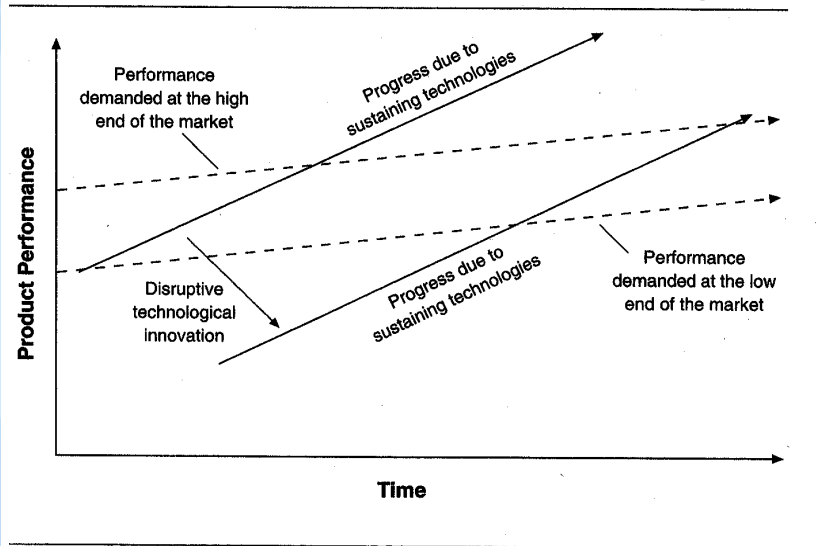
[3] Gasoline in Brazil contains 22% of ethanol (E22), all data in the chart have been converted to gasoline (E00) equivalent

[4] Supporting data can be found at <http://www.theicct.org/info-tools/global-passenger-vehicle-standards>.

Figure 11: Passenger Cars, Energy efficiency normalized to CAFE test cycle<sup>15</sup>

# Sustaining versus disruptive technologies

Figure 1.1 The Impact of Sustaining and Disruptive Technological Change

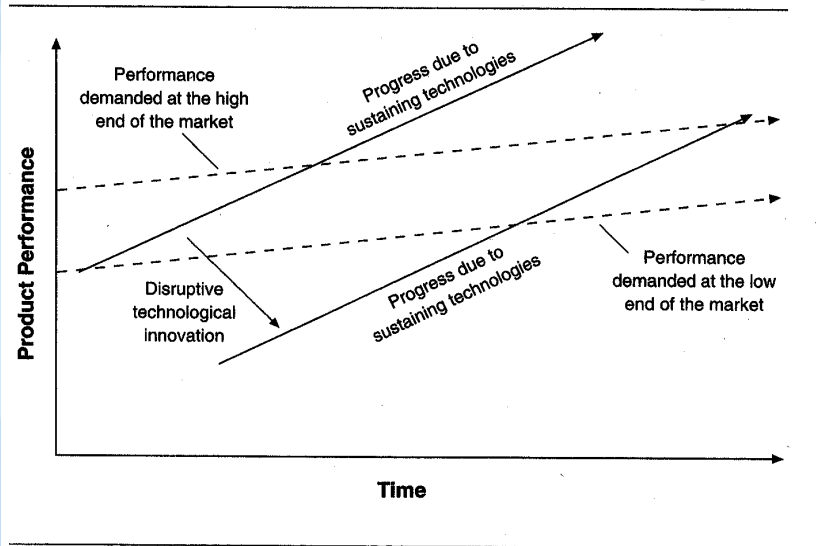


The Innovation may demand significant changes by not only the consumer, but also the infrastructure.



# Sustaining versus disruptive technologies

Figure 1.1 The Impact of Sustaining and Disruptive Technological Change

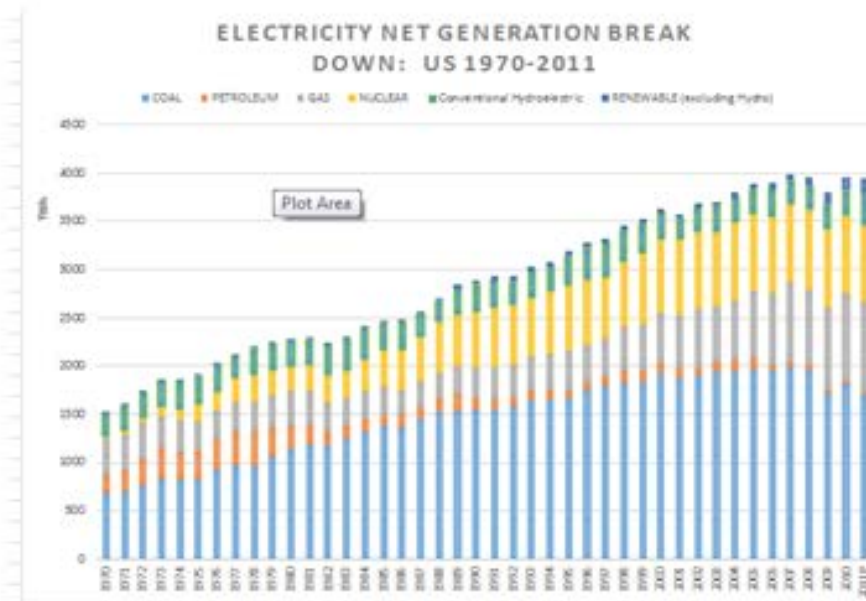


The Innovation may demand significant changes by not only the consumer, but also the infrastructure.

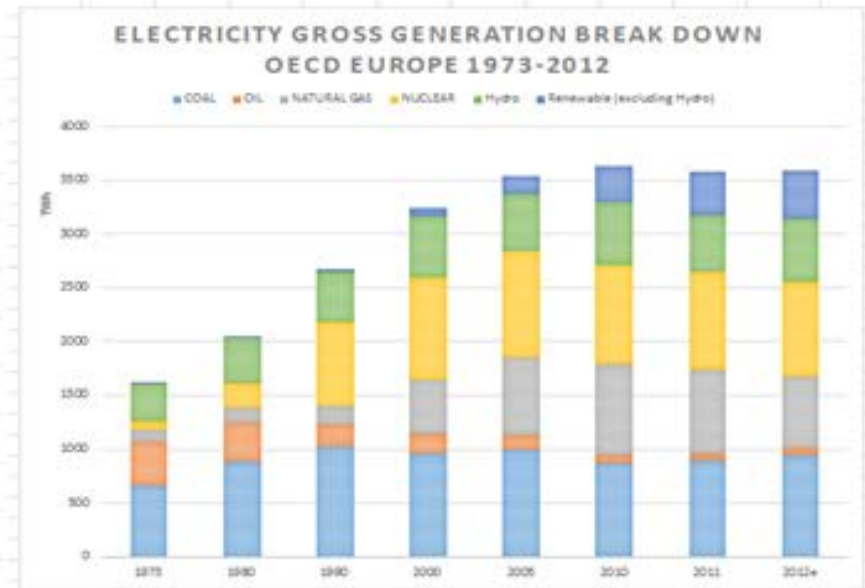




# Stabilisation of electricity in mature economies



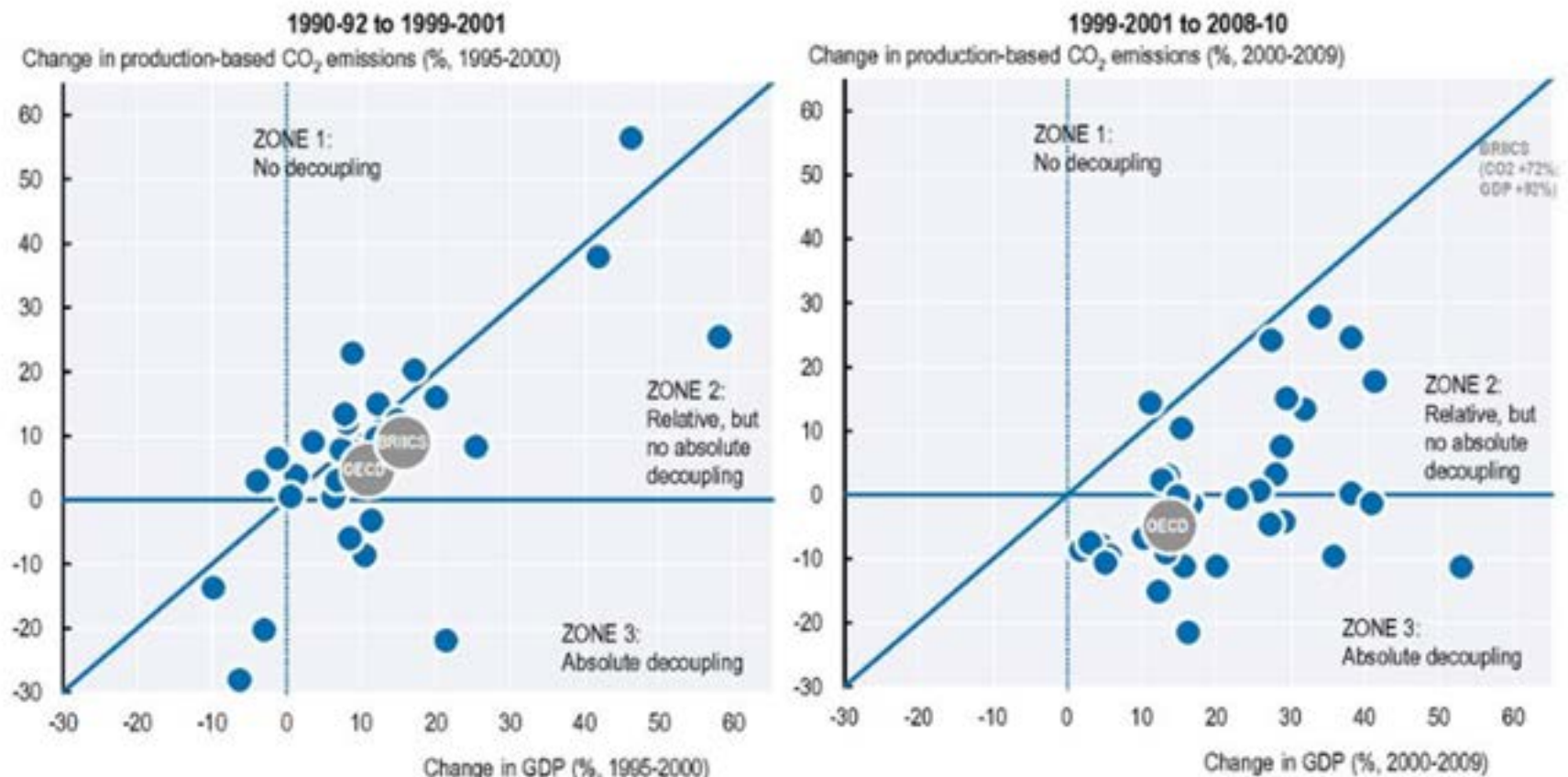
Source : EIA  
Original Version at <http://www.eia.gov/totalenergy/data/annual/showtext.cfm?wptb0802b>



Source : IEA (2013), Electricity Information 2013, IEA, p IV59

# Increased Carbon and Energy Productivity Production-Based

**Figure 4.3. Decoupling trends: Production-based CO<sub>2</sub> emissions vs. GDP**  
OECD countries



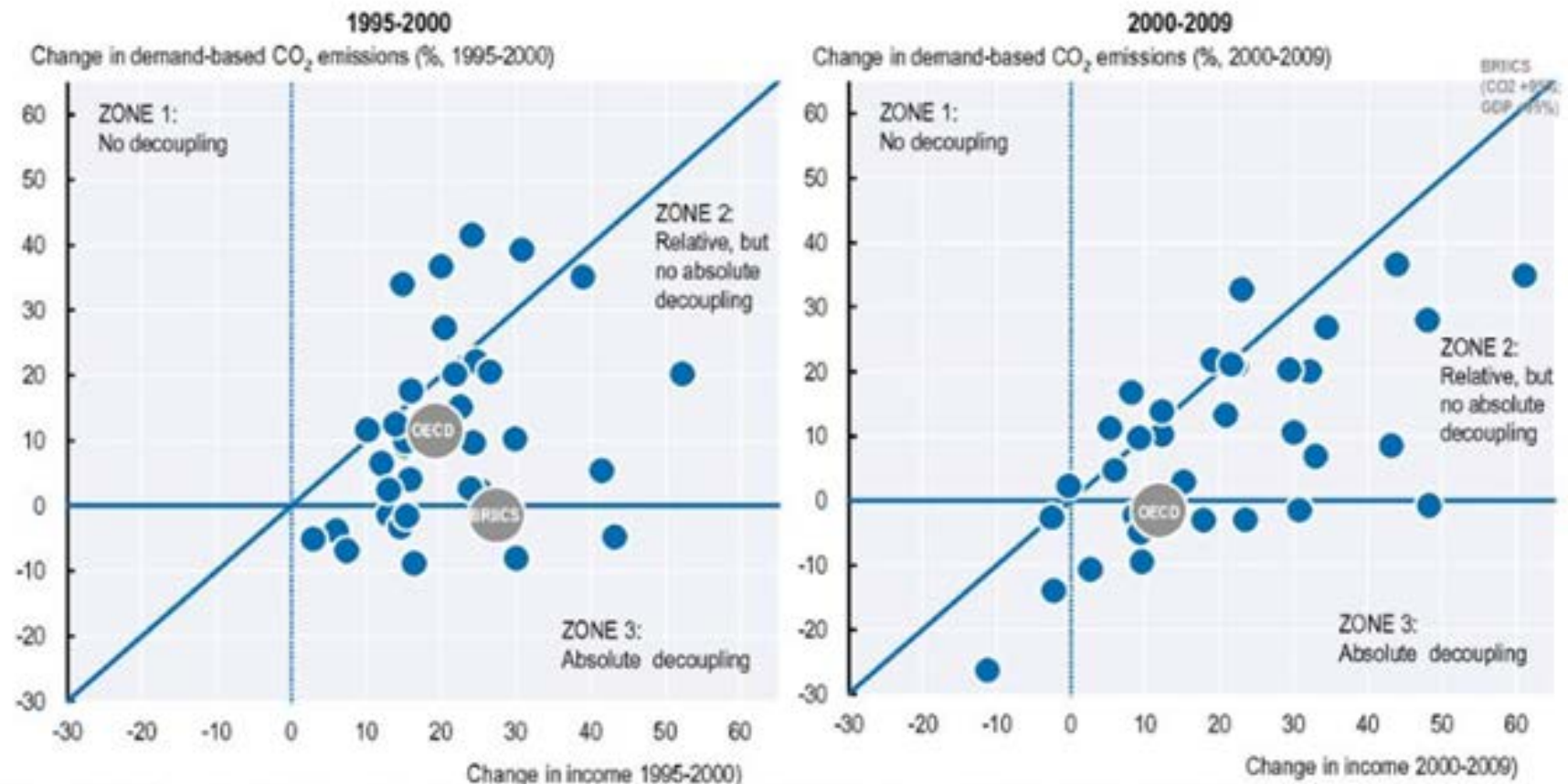
Source: IEA CO<sub>2</sub> emissions from fuel combustion statistics (database), OECD Economic Outlook: Statistics and Projections (database)

StatLink <http://dx.doi.org/10.1787/888932925198>



# Carbon and Energy Productivity Demand-Based

**Figure 4.4. Decoupling trends: Demand-based CO<sub>2</sub> emissions vs. income**  
OECD countries

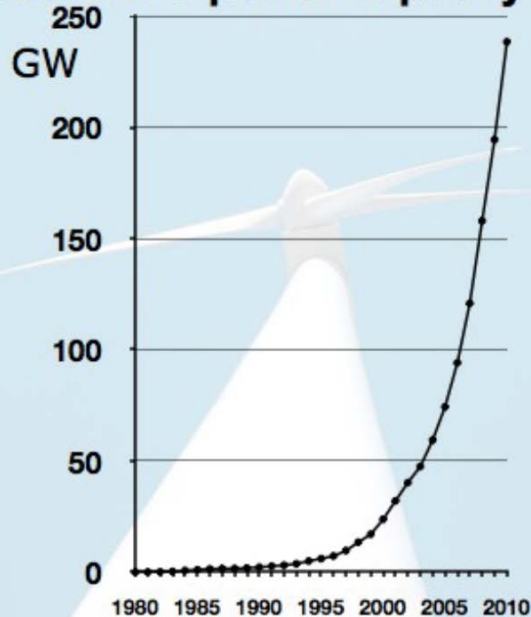


Source: OECD Carbon Dioxide Emissions Embodied in International Trade (database), OECD National Accounts Statistics (database); World Bank, World Development Indicators.

StatLink  <http://dx.doi.org/10.1787/888932925217>

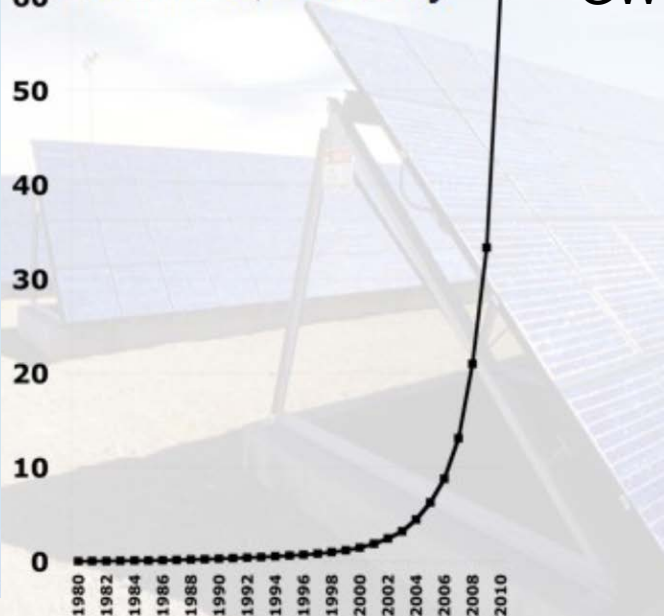
# Takeoff for Green Energy

Global Wind power capacity 1980-2011



Data from GWEC

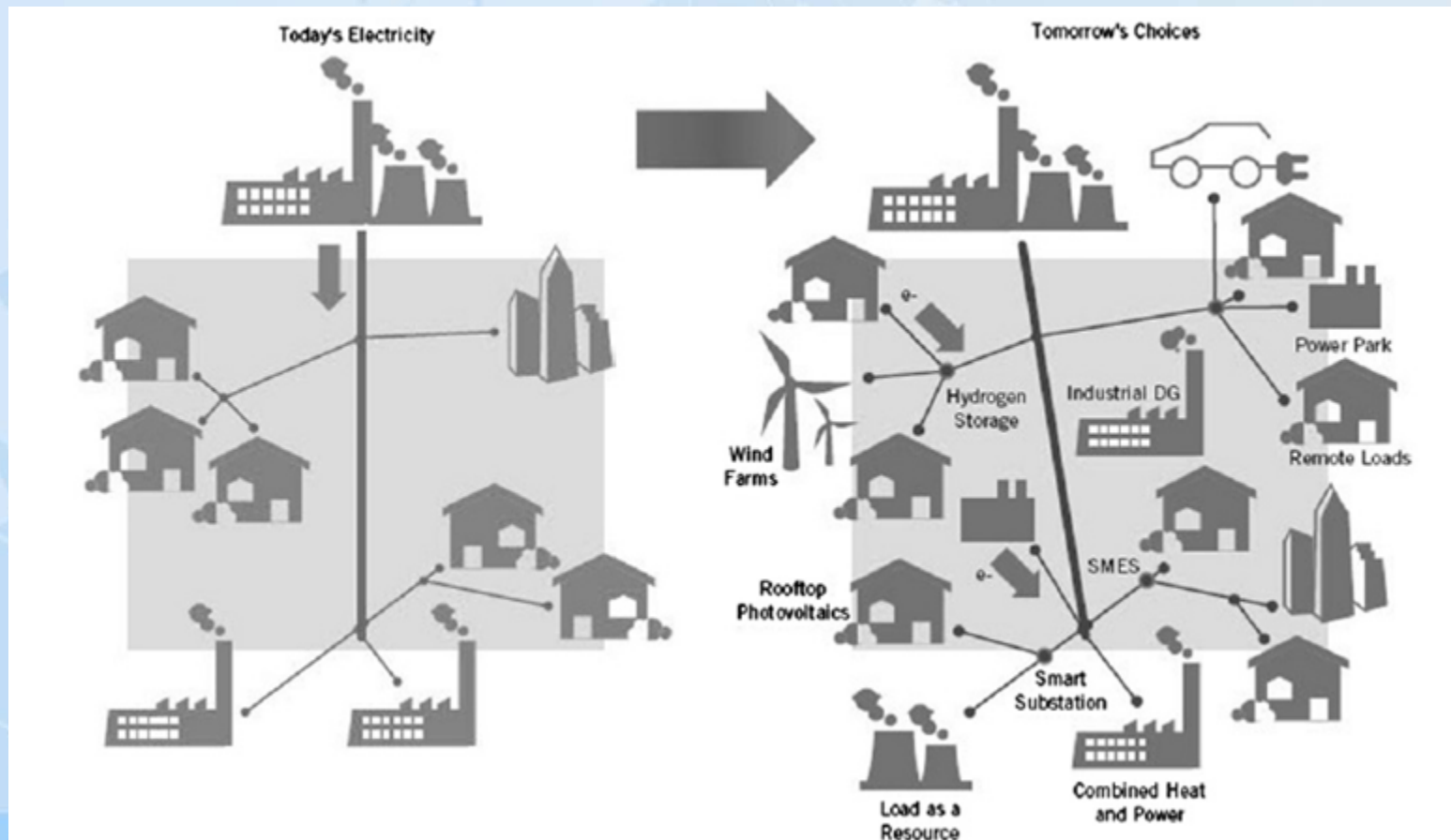
Solar PV, Globally GW



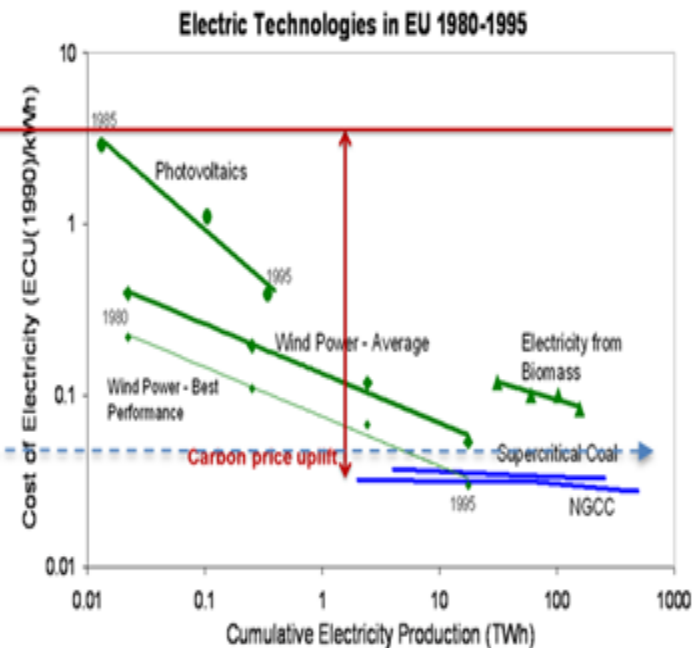
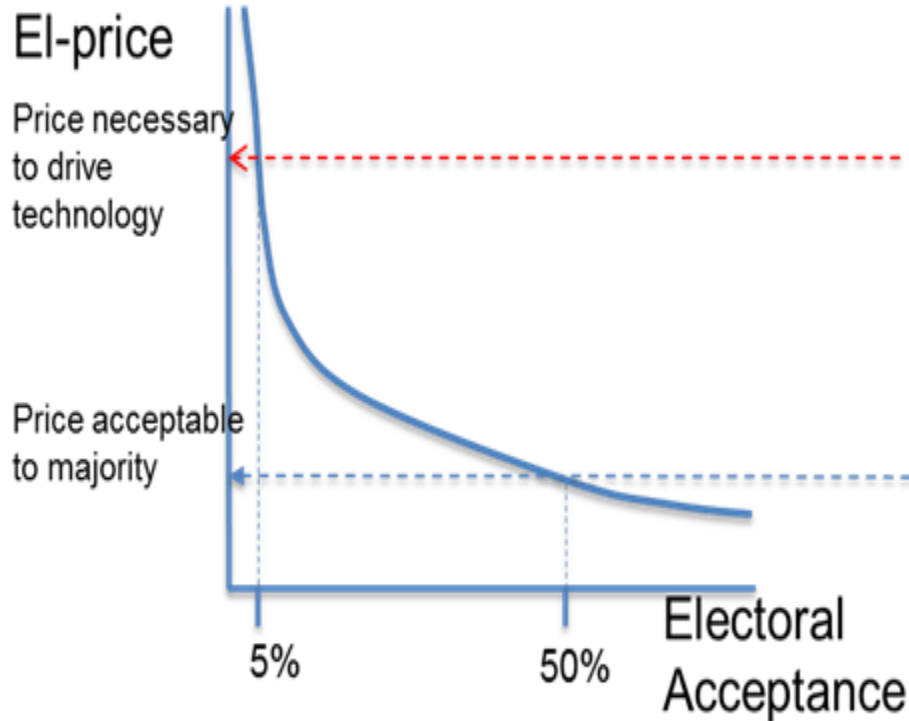
From Kåberger 2012

## A Result of Policy and Technology Migration

# Transformation of el-system



# The Problem of Marginalism in Staging Transition





# Sub-National Initiatives and Networks

benarr of more than 40 C40 mayors to Dr. Joan Clos, Executive Director of UN-Habitat, urging the UN's Open working Group on Sustainable Development Goals to include a specific urban goal.

**The C40 Cities Climate Leadership Group (C40) is a network of the world's megacities committed to addressing climate change.**

Acting both locally and collaboratively, C40 Cities are having a meaningful global impact in **reducing both greenhouse gas emissions and climate risks**. C40 brings together a unique set of assets and creates a shared sense of purpose. C40 offers cities an effective forum where they can collaborate, share knowledge and drive meaningful, measurable and sustainable action on climate change.

**Explore an interactive list of the C40 Cities** and our **Networks** and **Research** connecting them.

## LATEST FROM OUR BLOG

September 01, 2014

**C40 & Siemens Kick Off Voting for this Year's Citizen's Choice Award**

Voting opens today for the Citizen's Choice Award, which will honor one of the 31 finalists of this year's C40 & Siemens City Climate Leadership Awards... chosen by you!

August 28, 2014





POPULAR

Call for 2017 Applications  
now open!

or

Ljubljana wins 2016  
European Green Capital  
Award

New video now available

## Latest news

**GreenHopping –  
Changing the Future of  
Travel**

**BI** NORWEGIAN  
BUSINESS SCHOOL



2014 – Copenhagen

Climate neutral by 2025

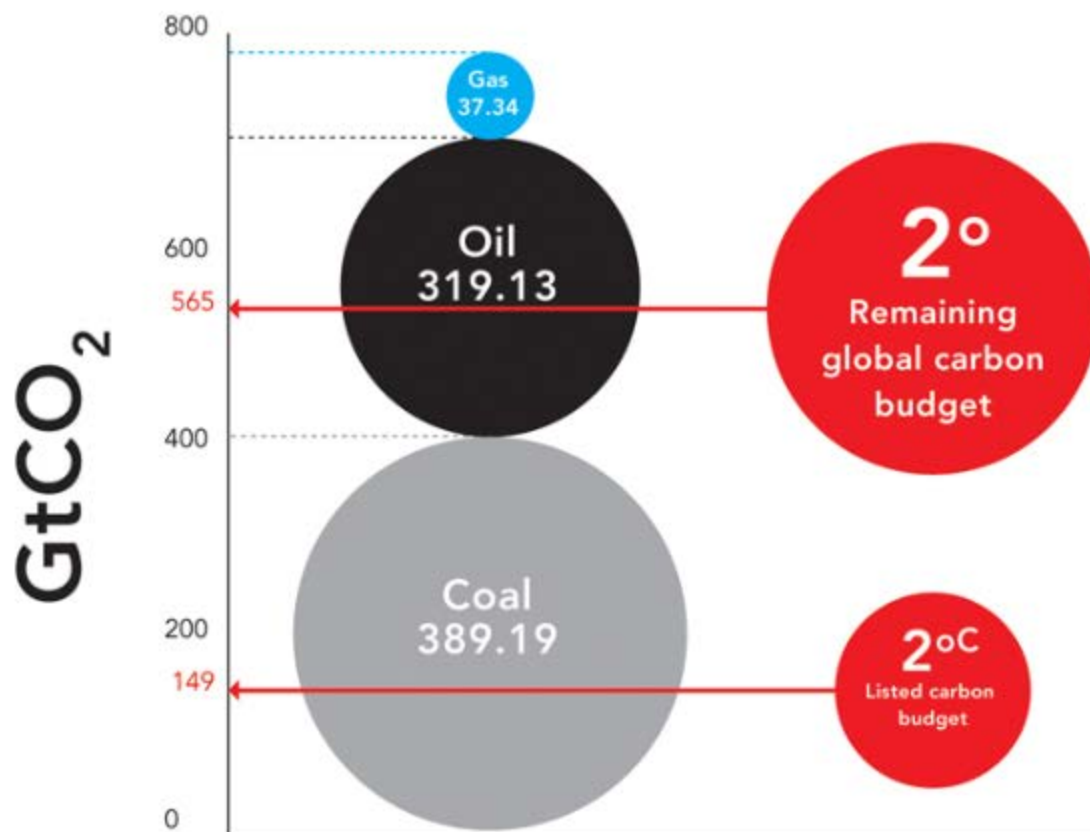
# Mature, Catchup and Developing Economies



# Responsible Finance

## Carbon dioxide emissions potential of listed fossil fuel reserves

Fig.3





# Mature Economies

## Advantages

- Have technology competencies and resources to stage green transition.
- Have largely stopped expanding energy consumption due to high efficiency and saturated demand.

## Disadvantages

- Large investments and sunk costs in the carbon economy
- Strong vested interests in carbon.
- Green growth become a zero sum game as it has to displace carbon in non-expanding energy sectors.



# Catchup Economies

## Advantages

- Are gaining technology competencies and resources to stage green transition.
- Green growth is part of a positive sum game where there is room for everything due to rapid expansion.
- Have a chance to implement latest technology when they start upgrading

## Disadvantages

- Are committed to strong growth
- Have high demand expectations
- Growth is prioritised before anything else





# Developing Economies

## Advantages

- Are at a low level of consumption, and have a long way to go
- Green growth could be part of a positive sum game where there is room for everything due to rapid expansion.
- Have a chance to implement latest technology or leapfrog when they start upgrading,

## Disadvantages

- Are committed to strong growth
- Have high demand expectations
- Growth is prioritised before anything else
- Are probably hindered by developmental limitations
- Low technological competencies may limit opportunities
- Governance problems in weakly developed states



# Infrastructural Hurdles in a Development context: African Automotive Sector

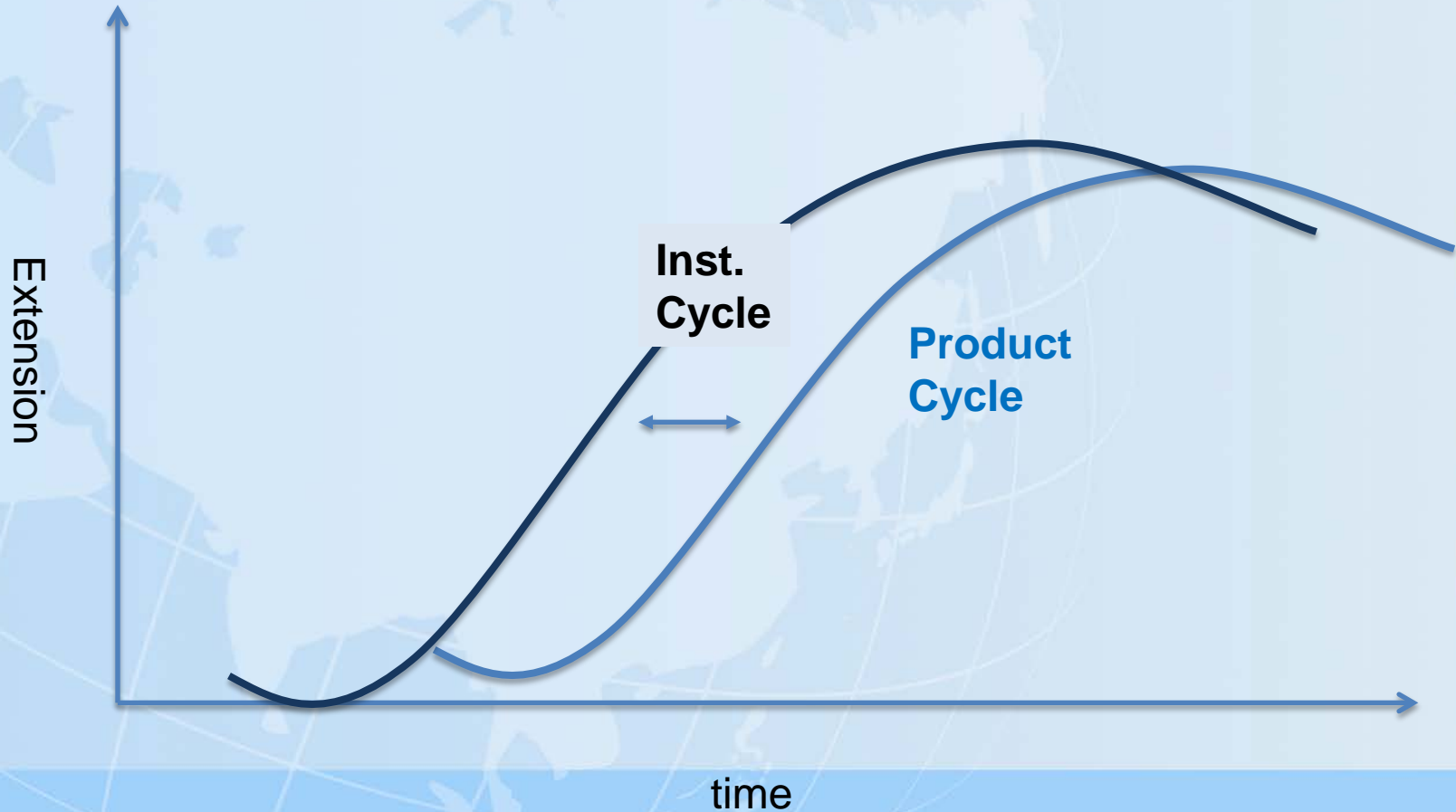
- Tough roads do not allow too advanced vehicles.
- Toyota Hillux – preferred vehicle comes in a rough version for African roads
- Oil refineries deliver qualities that do not allow most advanced engines
- Car mechanics not able to repair advanced electronics
- Change with emerging urban markets and middle class car use



# Product cycle

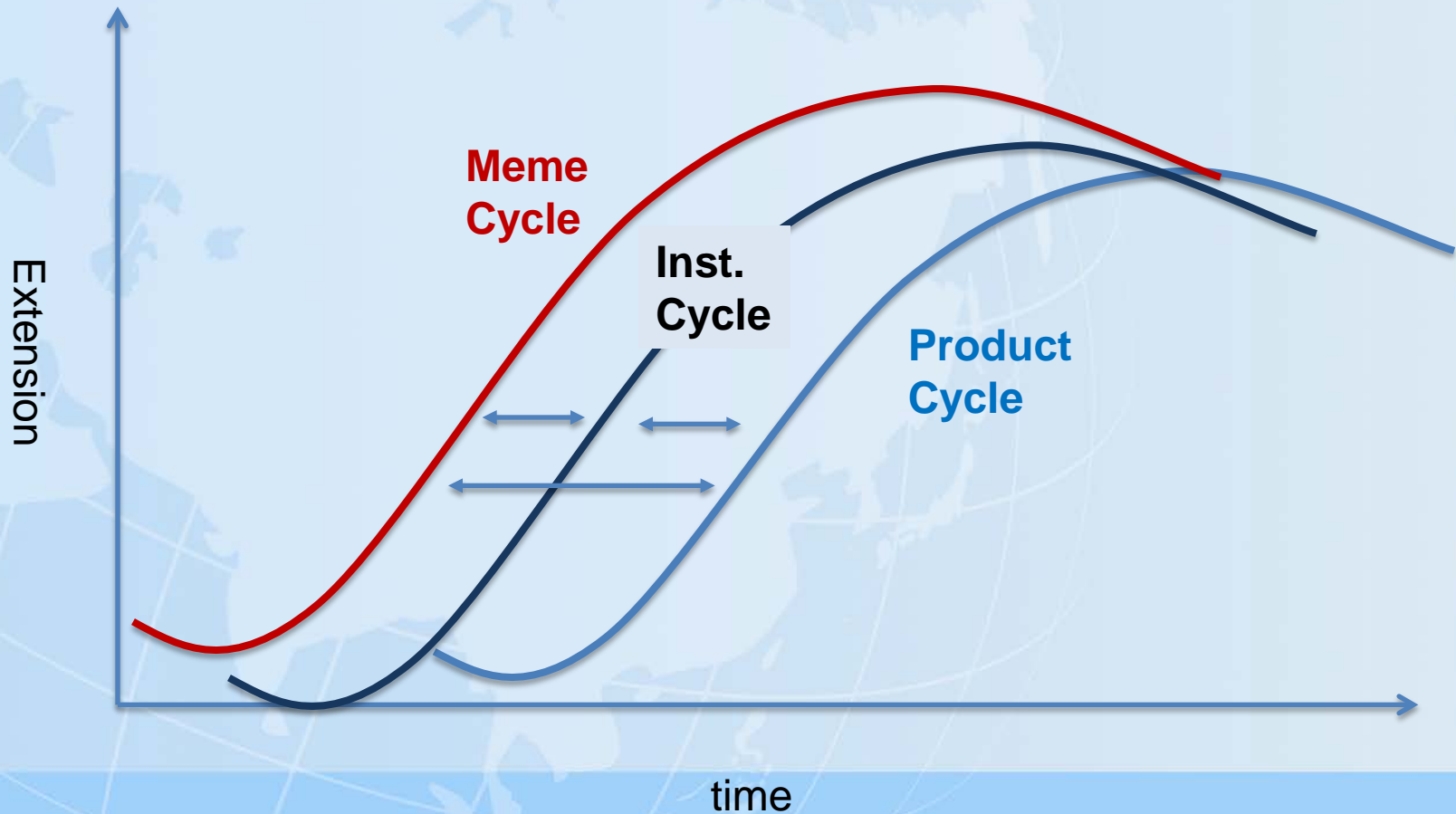


# Institutional & Techno-Economic Dynamics





# Cultural, Institutional & Techno-Economic Dynamics





## European Climate Foundation's Roadmap 2050 Project

From Roadmaps To Reality is the latest step in the project

Phase

1

Roadmap 2050: a practical guide to a prosperous, low Carbon Europe

2010

EC Low-carbon 2050 Roadmap

Phase

2

Power Perspectives 2030: on the road to a decarbonised power sector

2011

EC Energy 2050 Roadmap

Phase

3

From Roadmaps to Reality

2013

Robust technical and economic basis

# Green Roadmaps



Search | About this site | Contact | Legal notice | English (en)



## ENERGY

European Commission > Energy > Energy 2020 > Roadmap 2050

[Initiatives](#)



## Roadmap 2050

### Energy Roadmap 2050

On 15 December 2011, the European Commission adopted the Communication "Energy Roadmap 2050". The EU is committed to reducing greenhouse gas emissions to 80-95% below 1990 levels by 2050 in the context of necessary reductions by developed countries as a group. In the **Energy Roadmap 2050** the Commission explores the challenges posed by delivering the EU's decarbonisation objective while at the same time ensuring **security of energy supply** and **competitiveness**. The Energy Roadmap 2050 is the basis for **developing a long-term European framework** together with all stakeholders.

[Video recording of the High-level Stakeholder Conference on the Energy Roadmap 2050 of 7 February 2012](#)

Facts & Figures

Policy initiative

Press room

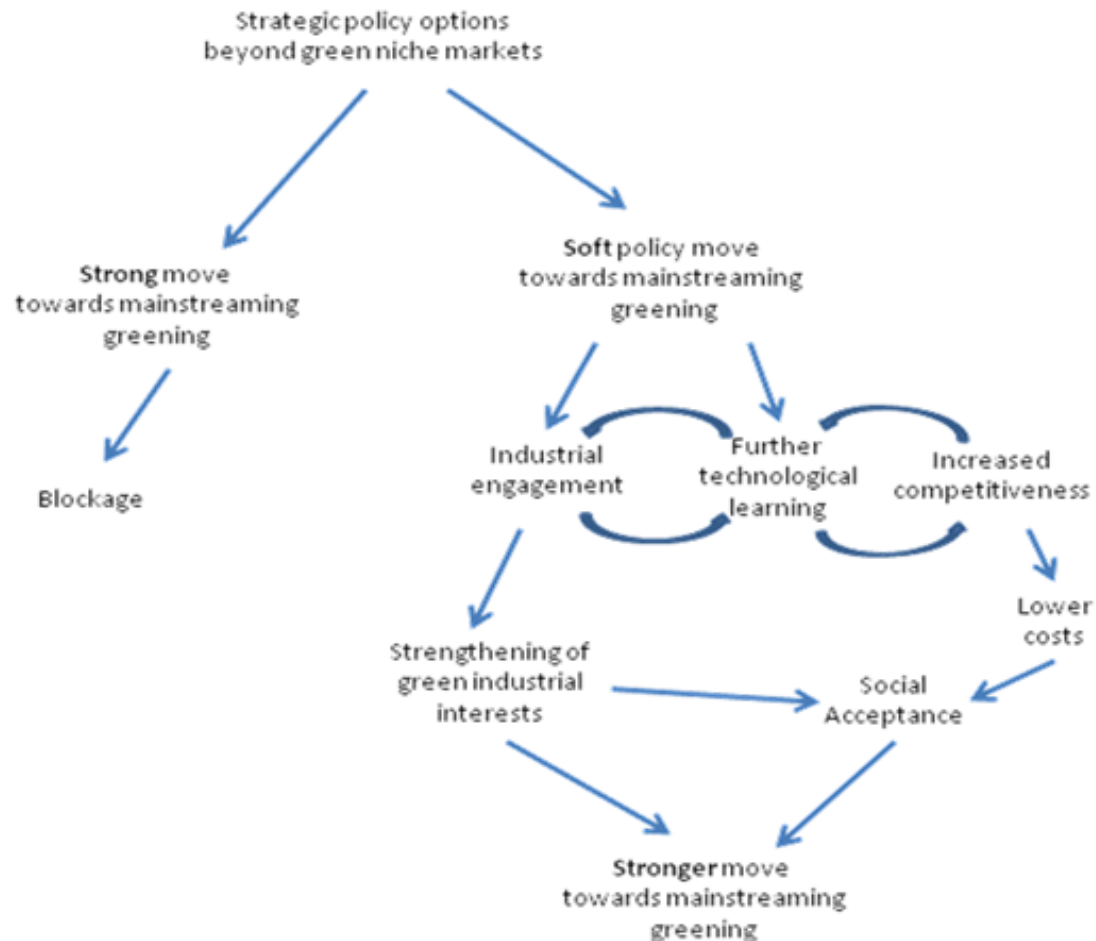
Library

BI

NORWEGIAN  
BUSINESS SCHOOL

# Transition by Sequential Triggering

Figure 15: The Relay Model in Open Game Form

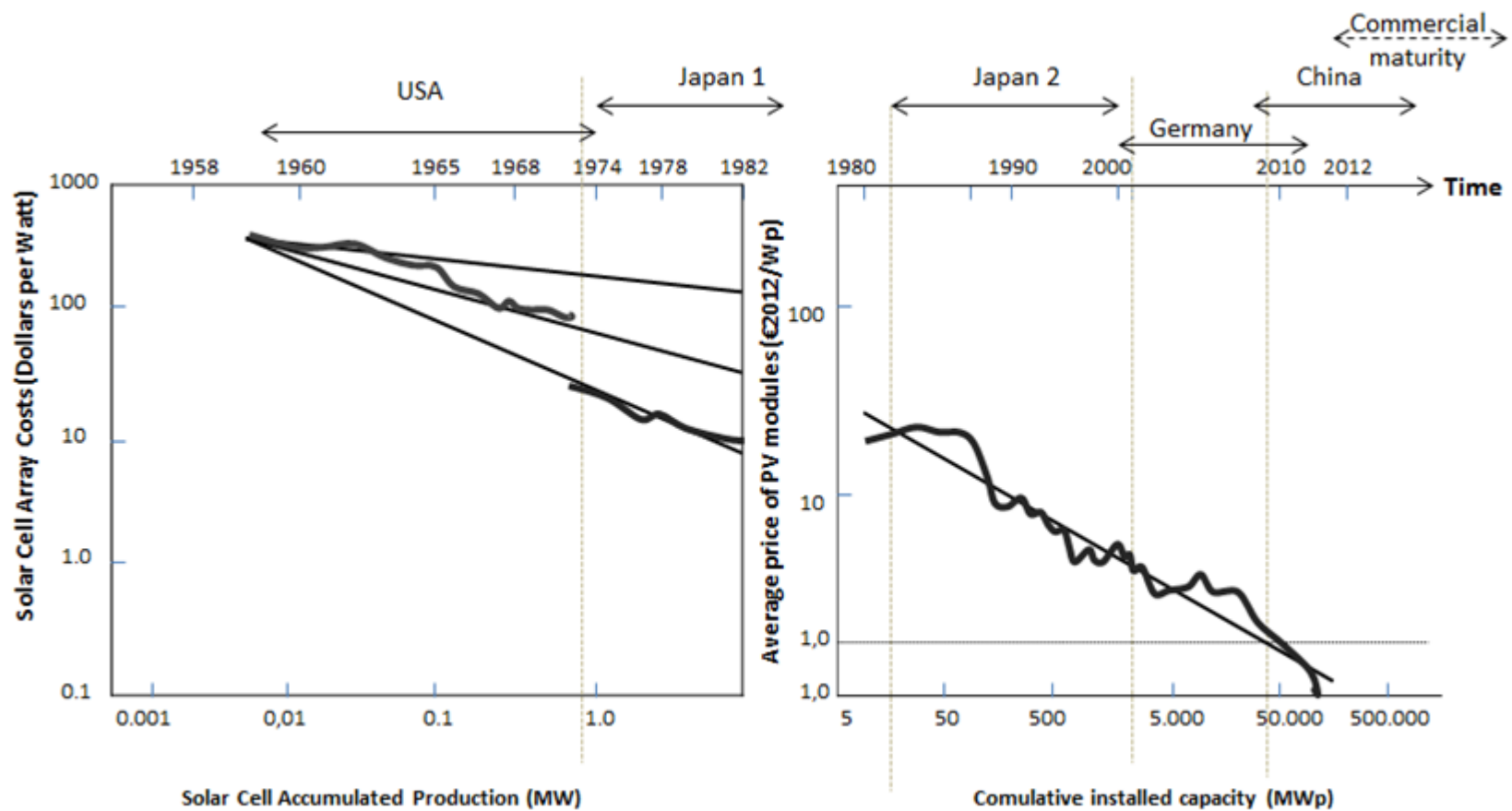


# Migration of Technologies and Lead Markets





# Global Innovatorium





# Technological Innovation Perspective on Kondratieff waves

