



Investments and Financial Flows Induced by Climate Mitigation Policies

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The Challenge of Financing Low-Carbon Growth
Climate Policy Initiative, Fondazione Eni Enrico Mattei and
International Center for Climate Governance
Venice, 15-16 April 2010

Introduction & Motivations

Studies on optimal mitigation strategies usually deal with overall macroeconomic costs.

Focus on investments and **pure financial flows** needed to support the required low-carbon transformations of the economies (i.e. only mitigation, no adaptation).

- Some studies **mix the two concepts**: investments are often referred to as costs of the climate policy.

But, costs and investments inform **on two very different aspects** of climate policy and should not be confused.

Introduction

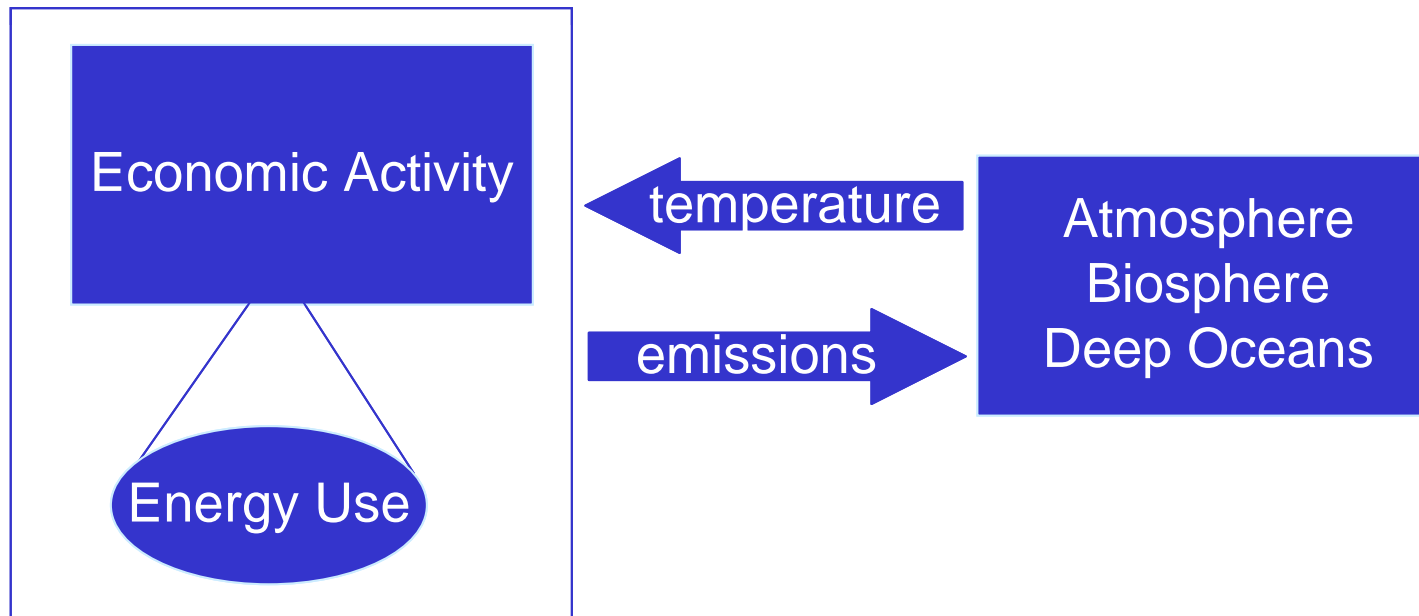
- **Investments**: expenditures to increase productive capital that imply a financial transfer from one agent to another.
 - If investments are re-distributed among capital assets that have the same productivity (i.e. that yield the same output per unit of investment), the level of macroeconomic activity is not affected.
- **Pure financial flows**: transfers that do not result in productive capital investments (e.g. transactions on the carbon markets, revenues from carbon taxes).
- **Macroeconomic costs**: (e.g. a lower level of output) arise only when investments are redistributed from more productive uses to less productive uses.

The WITCH Model - www.witchmodel.org

WITCH: World Induced Technical Change Hybrid model

Hybrid I.A.M.:

- **Economy:** Ramsey-type optimal growth (inter-temporal)
- **Energy:** Energy sector detail (technology portfolio)
- **Climate:** Damage feedback (global variable)



Scenarios

- Reference/BaU Scenario: there is no policy to reduce global warming
- Policy scenario (550 ppm CC): stabilization of GHGs concentrations at 550 ppm CO₂-eq at 2100. Full immediate co-operation among countries
- Policy tool: international carbon market, no limit on international offsets.

Transforming the Power Sector



Key Facts:

- Cumulative global investments in the power sector changes modestly
- Important changes in the distribution of investments...
 - ... across time
 - ... across regions
 - ... across technologies

Transforming the Power Sector: Overview

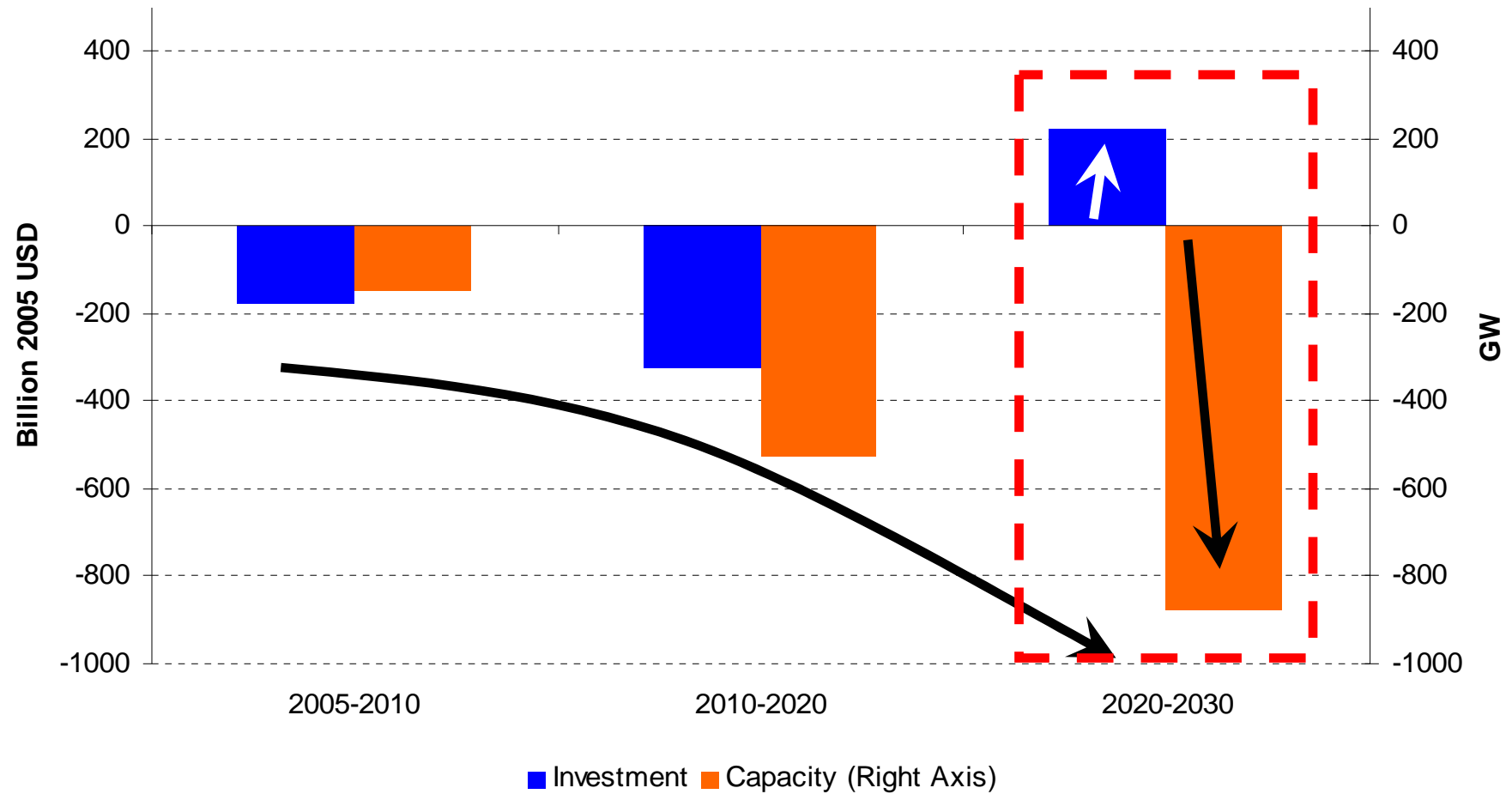
- Financial requirements to transform the power sector and to scale-up R&D activities in the energy sector.
- No investments in transmission grids.

Implementation of the climate policy has two effects:

- **Effect 1:** Adoption of low carbon generation technologies implies higher investment costs per unit of installed capacity (w.r.t. traditional power plants).
- **Effect 2:** Higher energy efficiency (w.r.t. Reference) implies reduced demand for energy (w.r.t. Reference).
- The two effects roughly compensate each other.

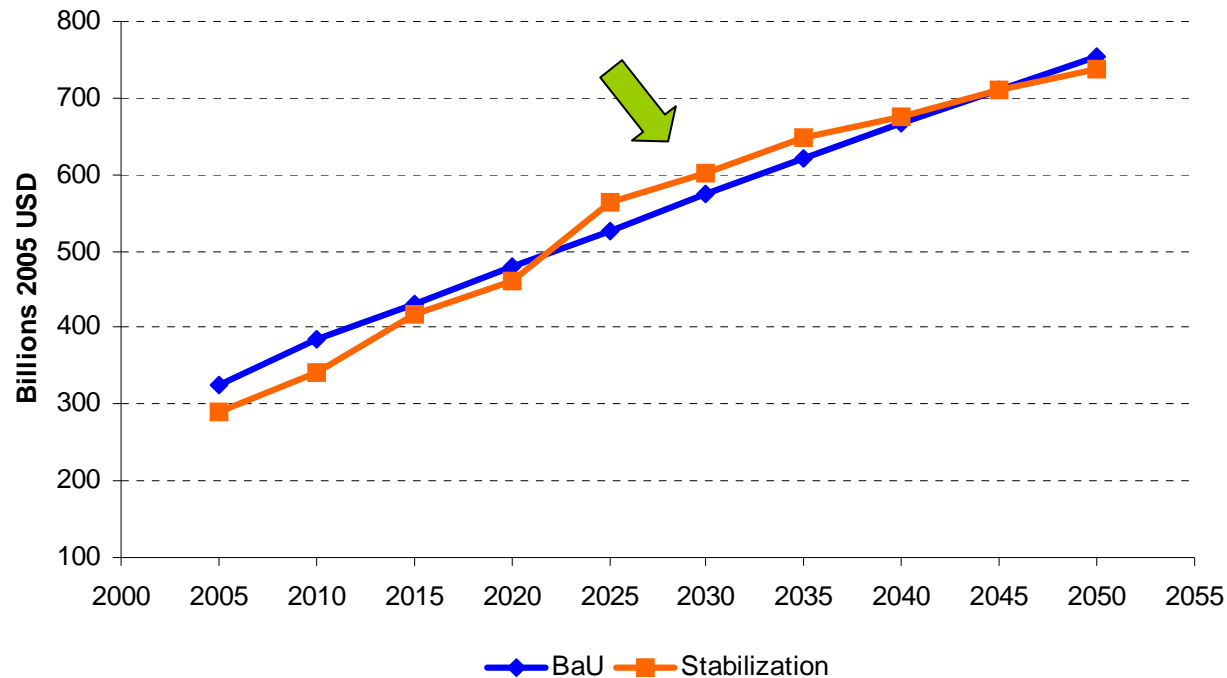
Result: Financial requirements of the power sector do not change significantly

Transforming the Power Sector: Capacity vs Investments



Transforming the Power Sector: the Time Pattern

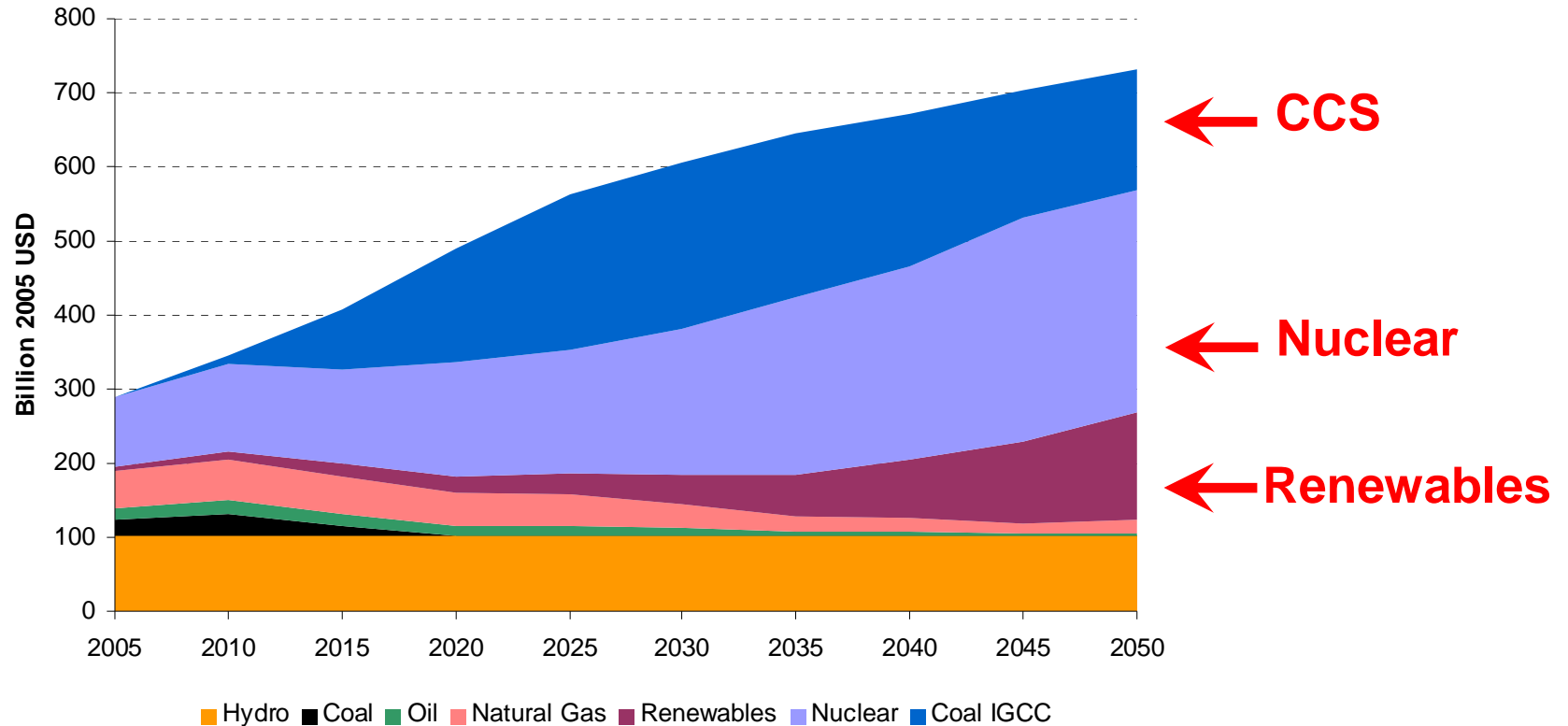
World investment in the power sector, 2005-2050



- Patterns in BaU and Stabilization are similar and converging
- Tackling climate change requires additional effort over a short period of time (2020-2045)

Transforming the Power Sector: Technologies

Total investment in the power sector 2005-2050, by production technology



The decarbonisation of energy supply asks for a completely new energy mix:

- Conventional fossil fuels power plants are progressively substituted by nuclear, coal power plants with CCS and renewables

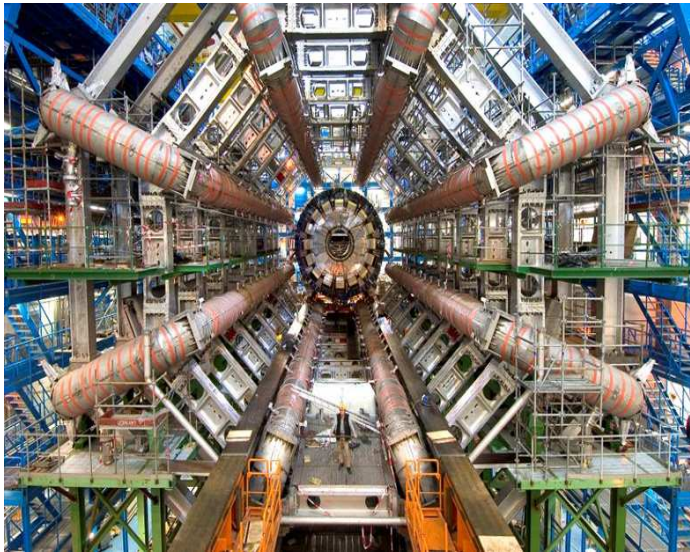
Transforming the Power Sector: Criticalities

- The investments needed seem to be affordable from a macroeconomic point of view
- Are they also manageable?

An example for the US:

- A total of USD 355 billions is the additional cumulative investment from 2010 to 2050 to transform the power sector in the USA
- Interstate Highway System, whose construction took 35 years (46,876 miles), required USD 425 billion of investment

Financing Innovation



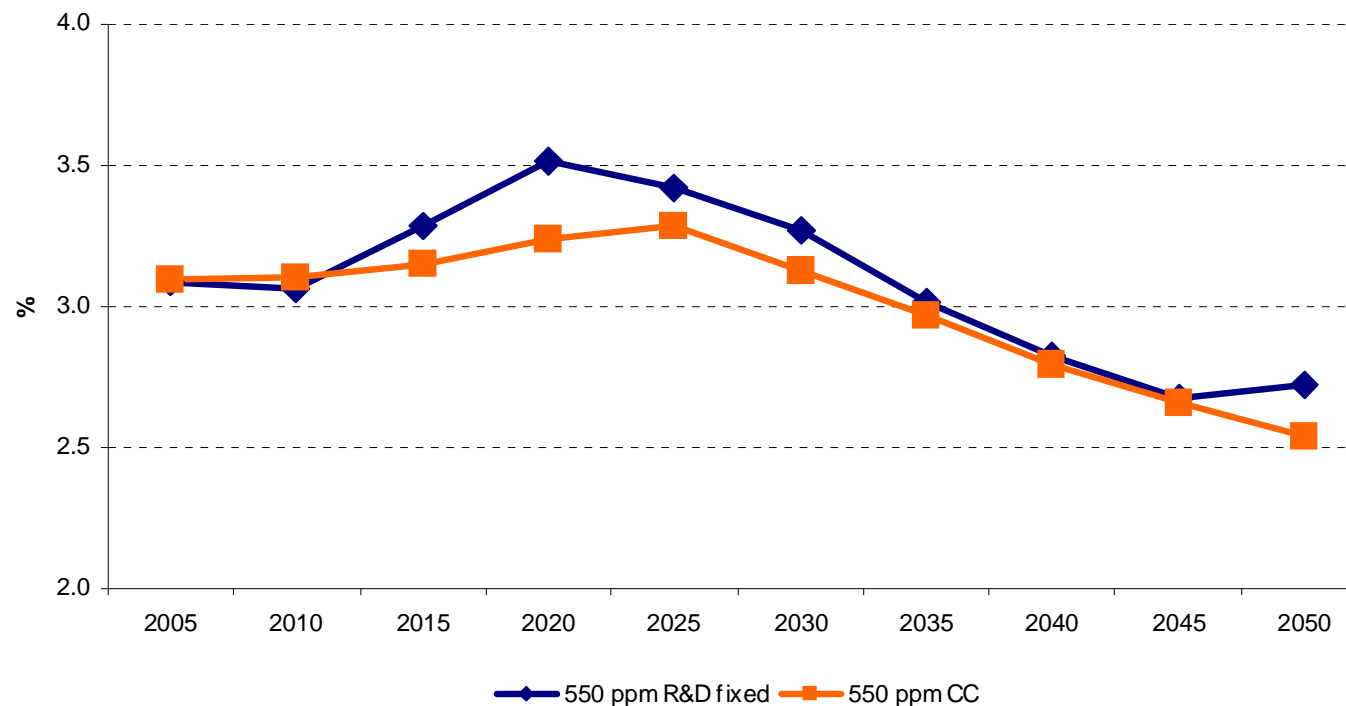
Key facts:

- R&D investments reduce the need of investments in the energy sector
- R&D investments are modest in monetary terms but require fast expansion
- Revenues from auctioning carbon allowances can be a major source of income for R&D investments

Investments in R&D and in the Energy Sector

- Higher investments in R&D will imply lower cost of breakthrough technologies and faster substitution of fossil fuels
- The percentage of investments directed to the energy sector is higher when R&D investments are forced to remain the same as in the Reference scenario

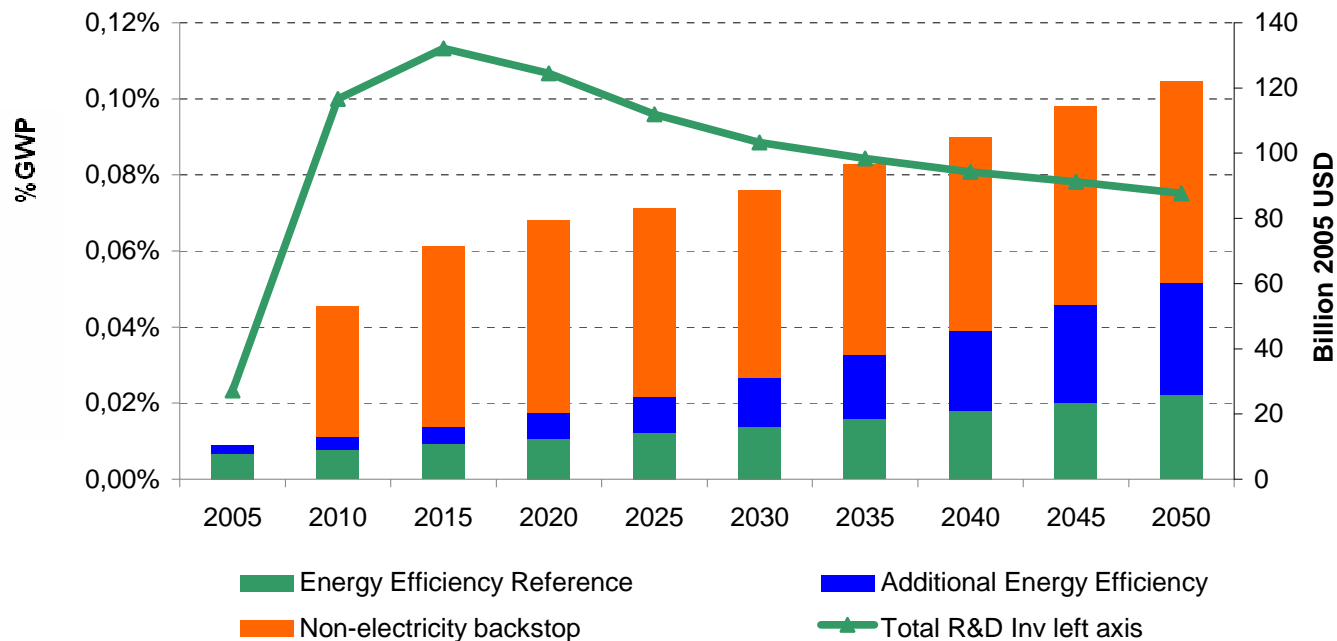
Investment in the Energy Sector as % of Total Investment



R&D Investments: Monetary and Temporal Dimension

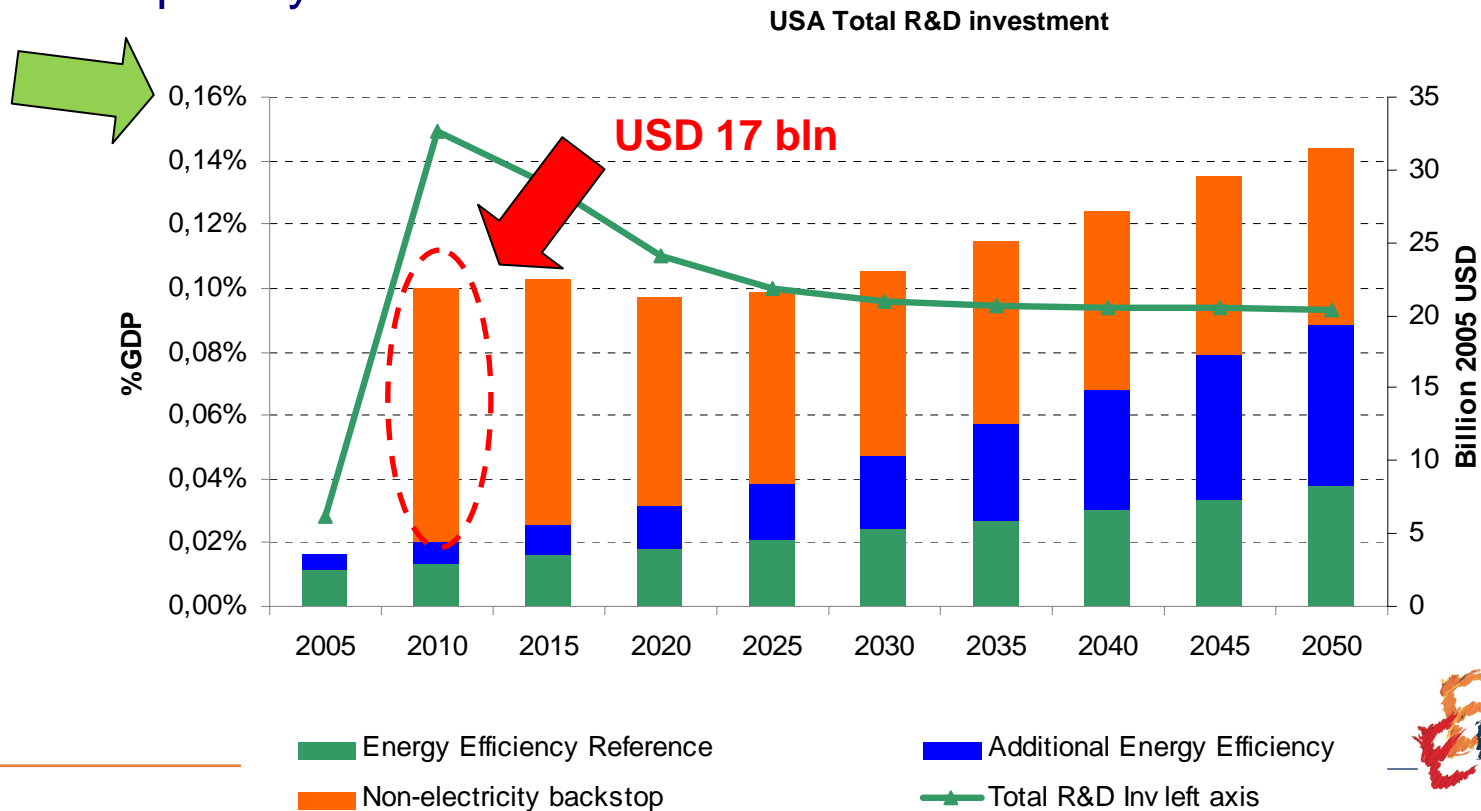
- Fast expansion
- Modest in GWP terms
- A managerial effort rather than a purely financial effort

Total R&D investment under different scenarios



Past Experience: the USA and the Apollo Programme

- The 1960s NASA Apollo Space Programme 97.9 billion over 13 years (around USD 7.5 bln per year)
- Apollo investments 0.4% of the average national GDP during the peak year



Financing Innovation

- Suppose all permits are auctioned: we compute the share needed to cover investments in R&D
- Initially low carbon price and high R&D spending require about three quarters of permits to be auctioned
- In 2030 the share declines to a modest 5% mainly because the price will increase substantially after 2020

	OECD		USA		Europe	
Years	% of permits auctioned	R&D investments = auctioning revenue (Billion 2005 USD)	% of permits auctioned	R&D investments = auctioning revenue (Billion 2005 USD)	% of permits auctioned	R&D investments = auctioning revenue (Billion 2005 USD)
2010	76%	48.128	71%	21.906	75%	15.296
2015	28%	51.151	27%	22.453	27%	15.494
2020	14%	49.917	13%	21.278	13%	15.380
2025	9%	50.634	8%	21.541	8%	15.540
2030	5%	53.686	5%	23.005	5%	16.270

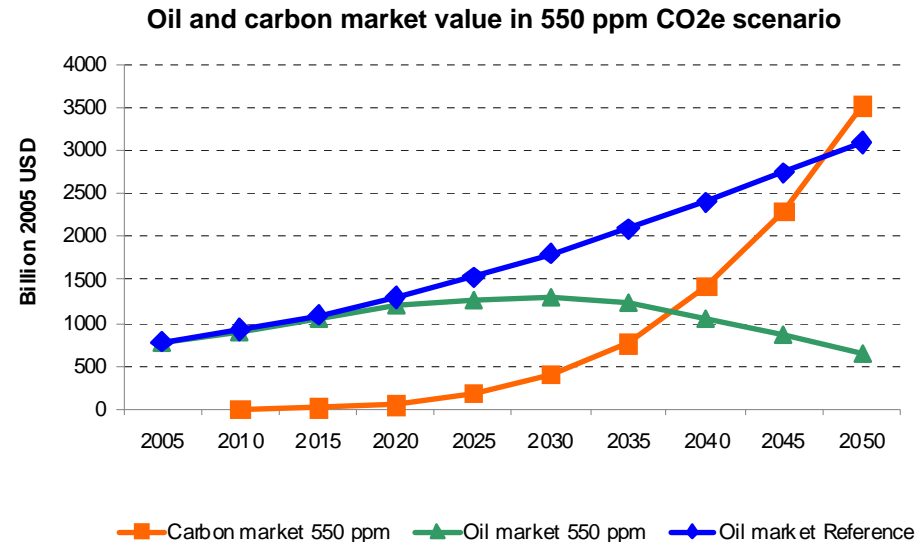
From “Fossil Finance” to “Carbon Finance”



Key facts:

- Carbon market dominates oil market in terms of value
- Carbon market could act as a tangible indirect source of investments in the energy sector

The Carbon Market Dominates the Oil Market

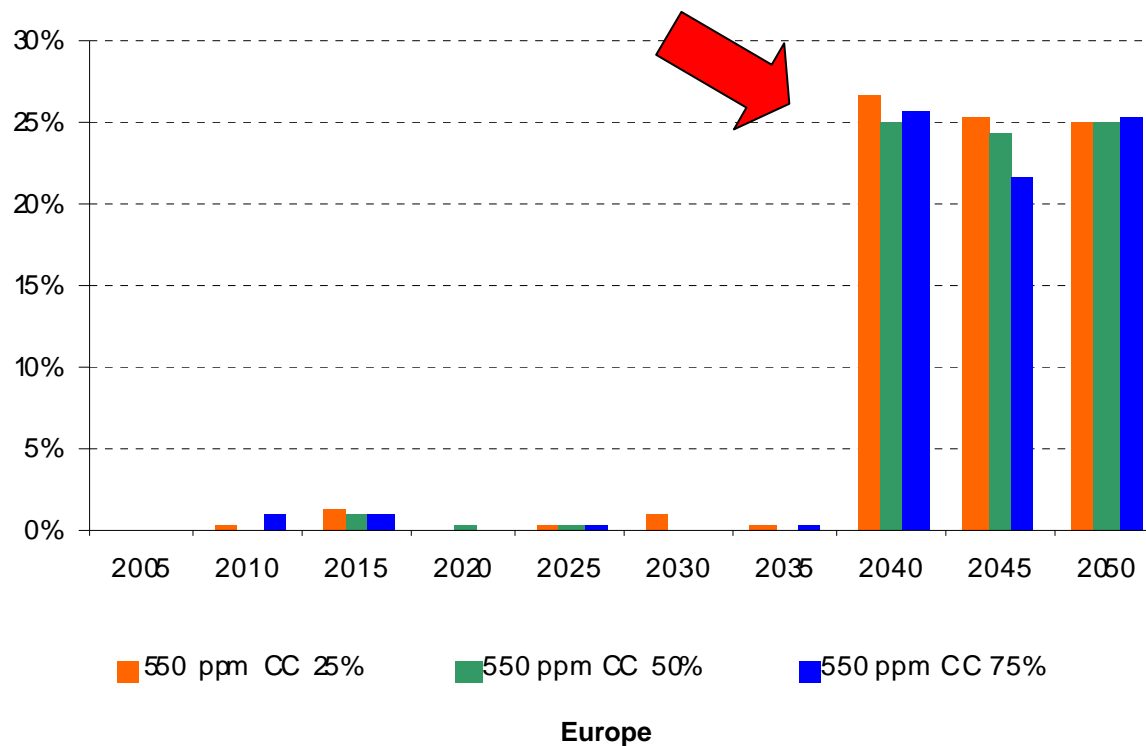


- Carbon market is larger than the oil market by a factor of 6 by 2050 with the take-over between 2035-2040
- The value of the carbon market increases exponentially reaching more than USD 3.5 trillion in 2050 for the combined effect of
 - larger trade of carbon permits
 - growing carbon price
- The financial flows associated to oil transactions will decline for
 - a contraction of demand
 - lower oil prices

Impact on Investments in the Energy Sector

With limits to international offsets investments to decarbonize the energy sector will increase with respect to the Policy scenario without constraints:

- by 25% in Europe by 2040
- between 25-30% in the US by 2035





www.witchmodel.org

www.policysimulator.org