Politiques d’encouragement à l’émergence des nouvelles technologies (Thomas Sterner)

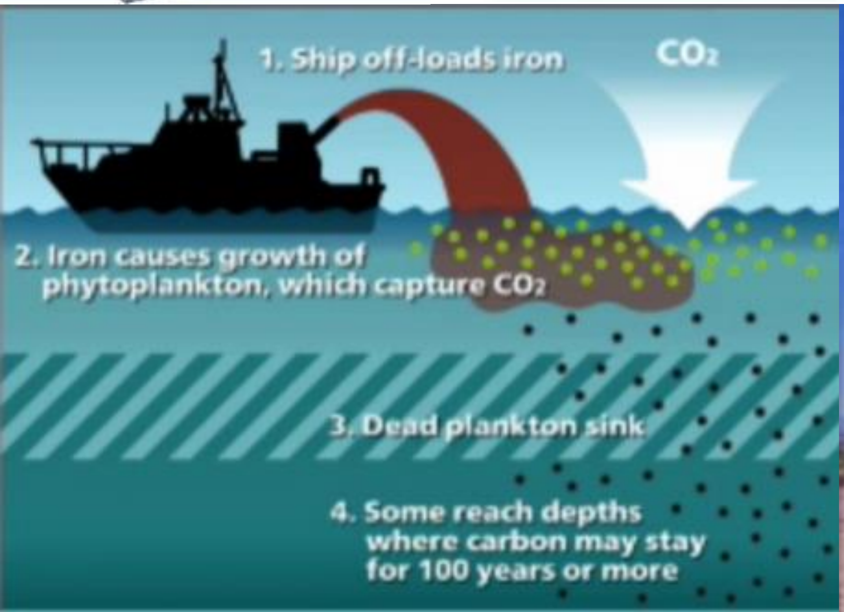
Les scénarios comme outils pour la négociation internationale sur le climat

Patrick Criqui, Grenoble

RESEARCH

A Second Market Failure!

Est-ce que vous seriez riches ?



MASDAR 0-carbon and 0 waste city.

$22 billion

WHAT TYPE OF CELL?

Feed-In tariffs?

”Ordinary Cleaning”

Masdar City

- 0-carbon and 0 waste city.
- $22 billion city, covers 6 sq kilometres,
- Solar, wind & other renewables.
- Motor vehicles banned.
- 1,500 companies; transparent laws business-friendly atmosphere.

Abu Dhabi: Statistics

- Population/capita >3
- Price of Energy ~ 0
- Price of Labour ~ 0
- Price of Money ~ 0

But we all live in Masdar...

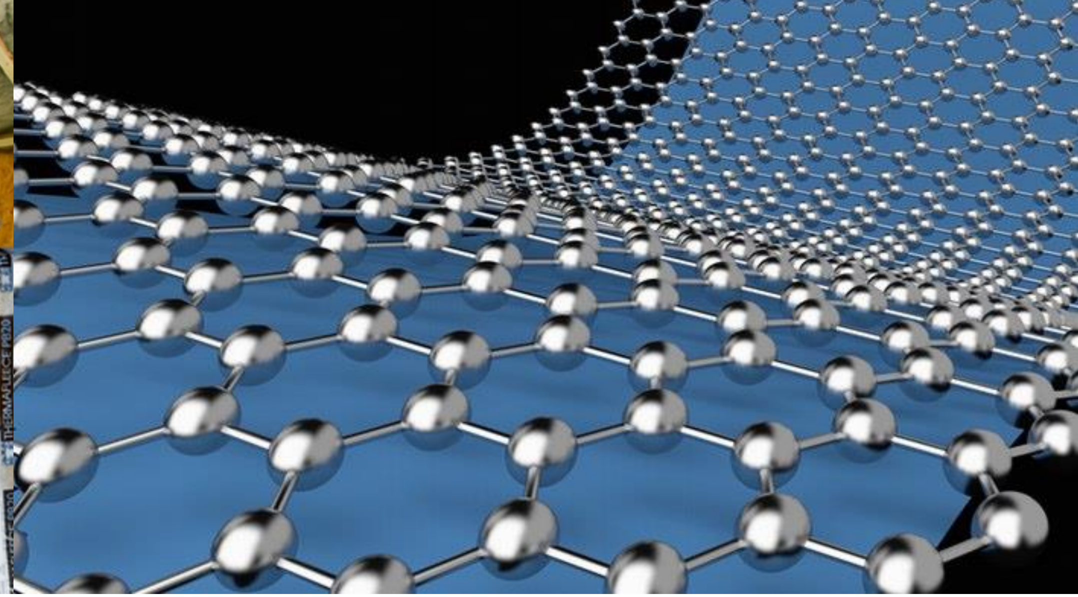
- Prices Wrong --> Market undersupplies R&D
- How are you deciding 2/3 glass window? Next car?

- Subsidize R&D but....
- Put billions into research → articles.

- HOW get technologies that are useful for a shadow price of say 75$/ton CO2?

2 Market Failures:

- Price on carbon
- And
- Subsidies to R&D
- Or Deployment policies:
- Overcome pathdependency, LBD, scale issues, network externalities
- Risk



Climate Policy, Prudence & Innovation

Carolyn Fischer and Thomas Sterner

RFF and U. of Gothenburg

Introduction

- U*ncertainties* about damages
- Many *solutions* for abatement: solar, nuclear, efficiency, CCS
- R&D can lower costs

Uncertainties

- Climate sensitivity ◦C/*2 CO_2
- Feedback (clouds, CH_4, albedo..)
- Feedback (Soc.-pol:conflict/wars)
- → Uncertain TARGET

2 strategies for now:

- Abatement, reduce future effort to meet target
- R&D: lower cost of future abatement
- Effect of <u>target uncertainty ?</u>

General Model

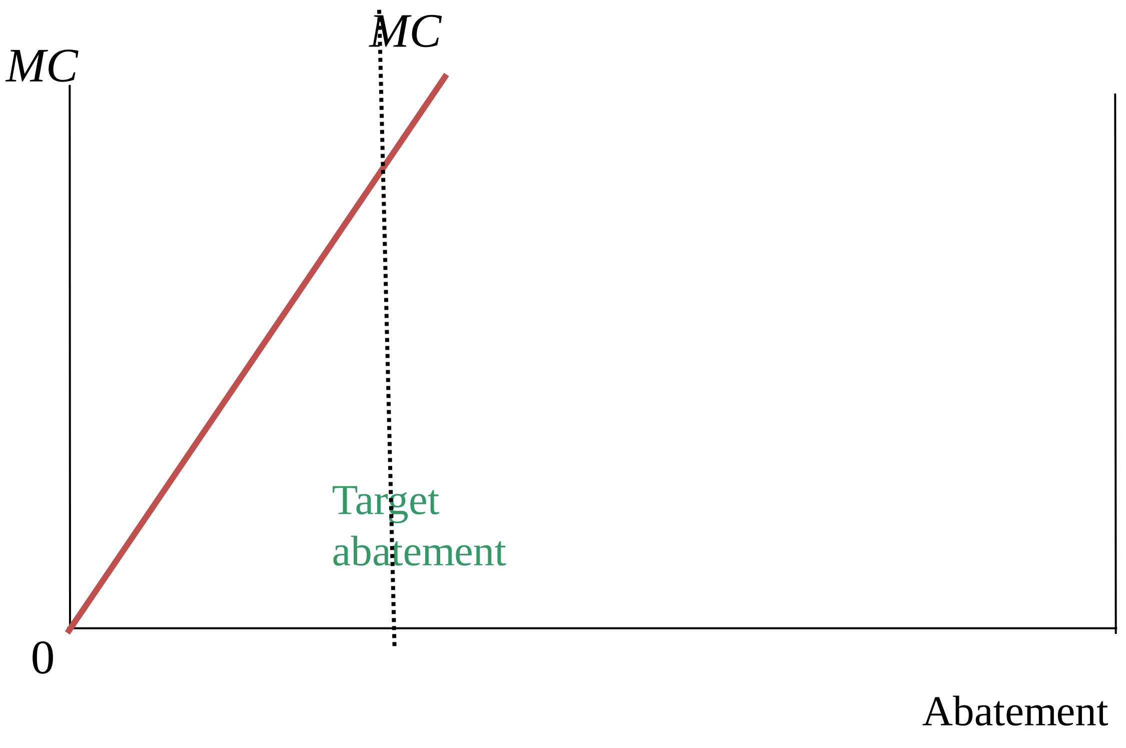
- 2-period model
  - (uncertainty resolved in 2)
- Certain cost for techn. *i*
  - Increasing in abatement *A* $c^i(A_t^i, K_t^i)$
  - Decreasing in knowledge stock *K*
- Uncertain benefit of cum. abatement *B* → uncertain target

$$T = \sum_i (A_1^i + A_2^i)$$

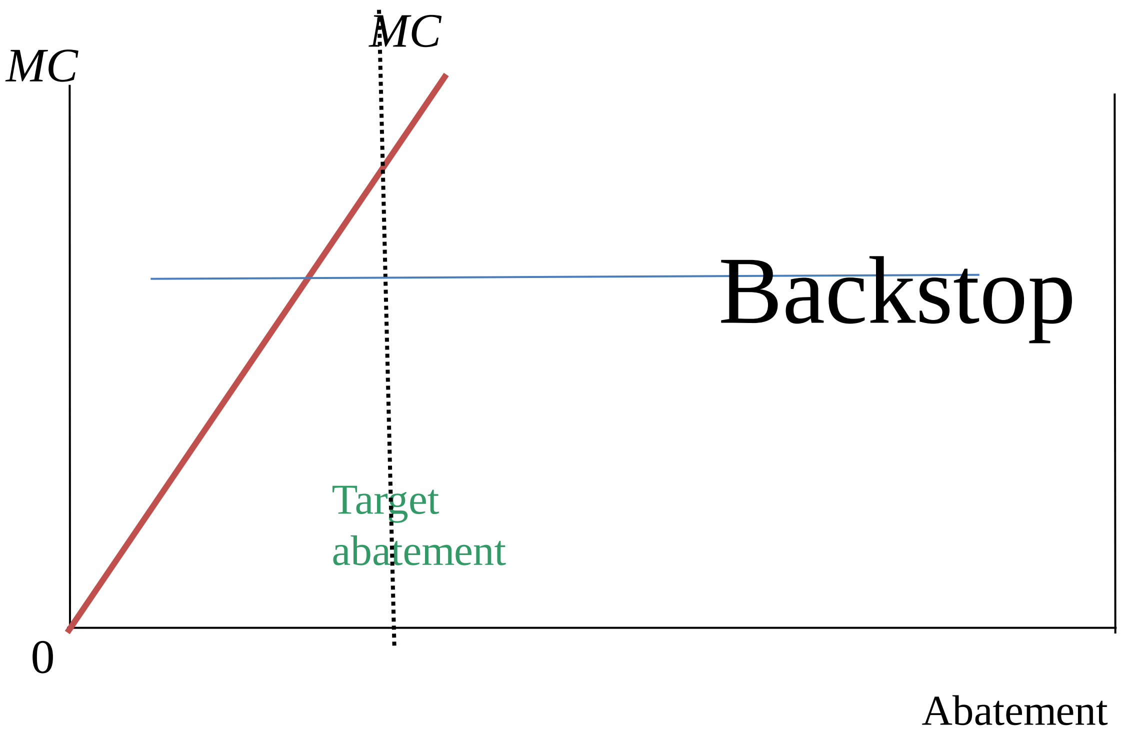
Uncertainties

- Focus on uncertainty in climate
- Not uncertainty in R&D

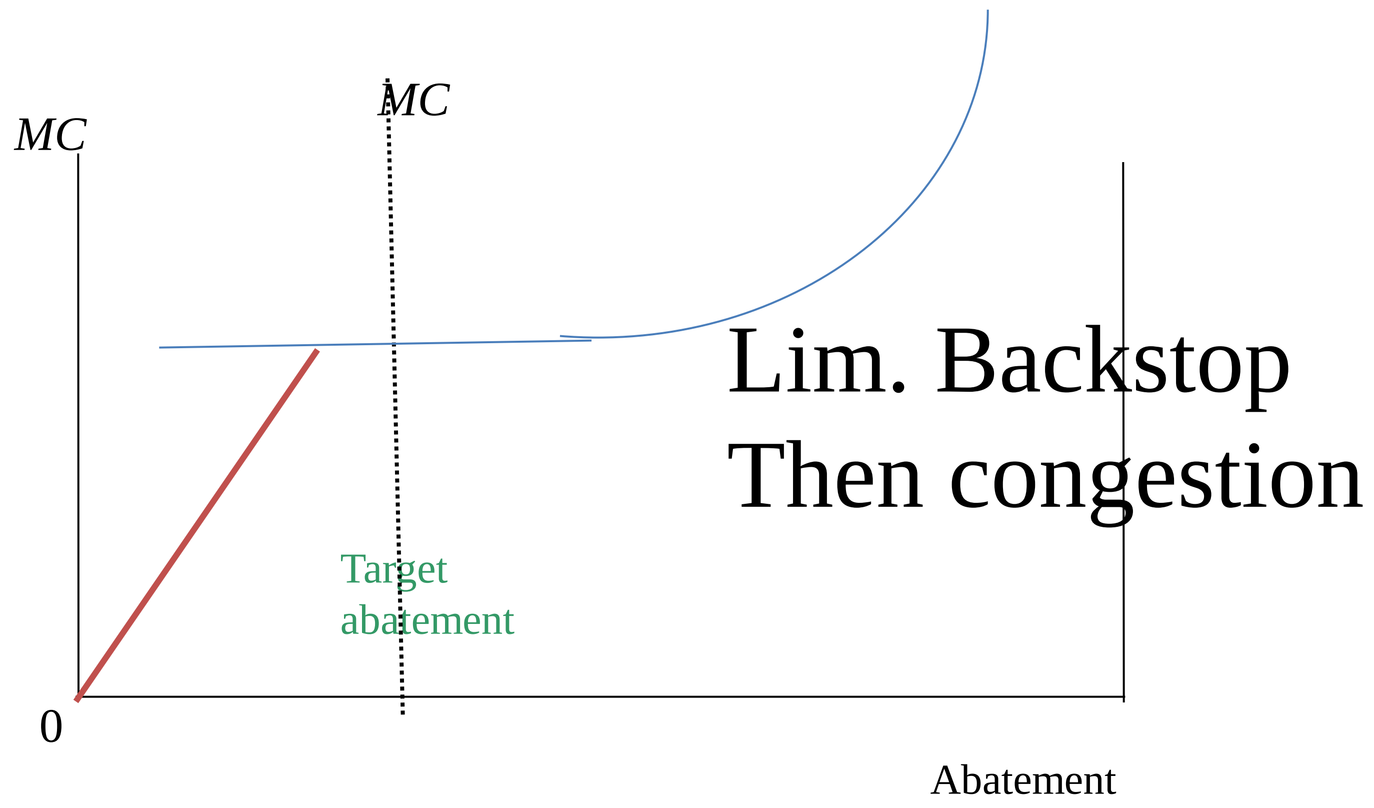
Marginal cost of climate abatement



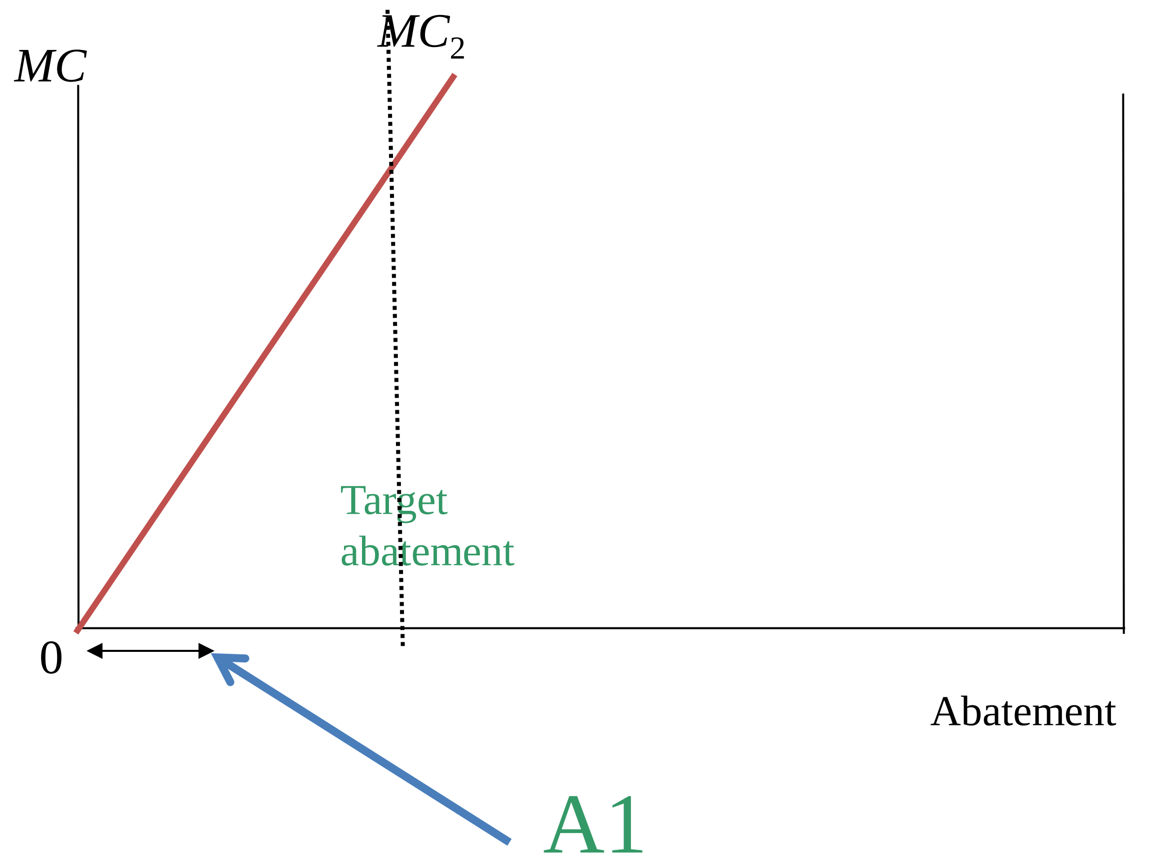
Marginal cost of climate abatement



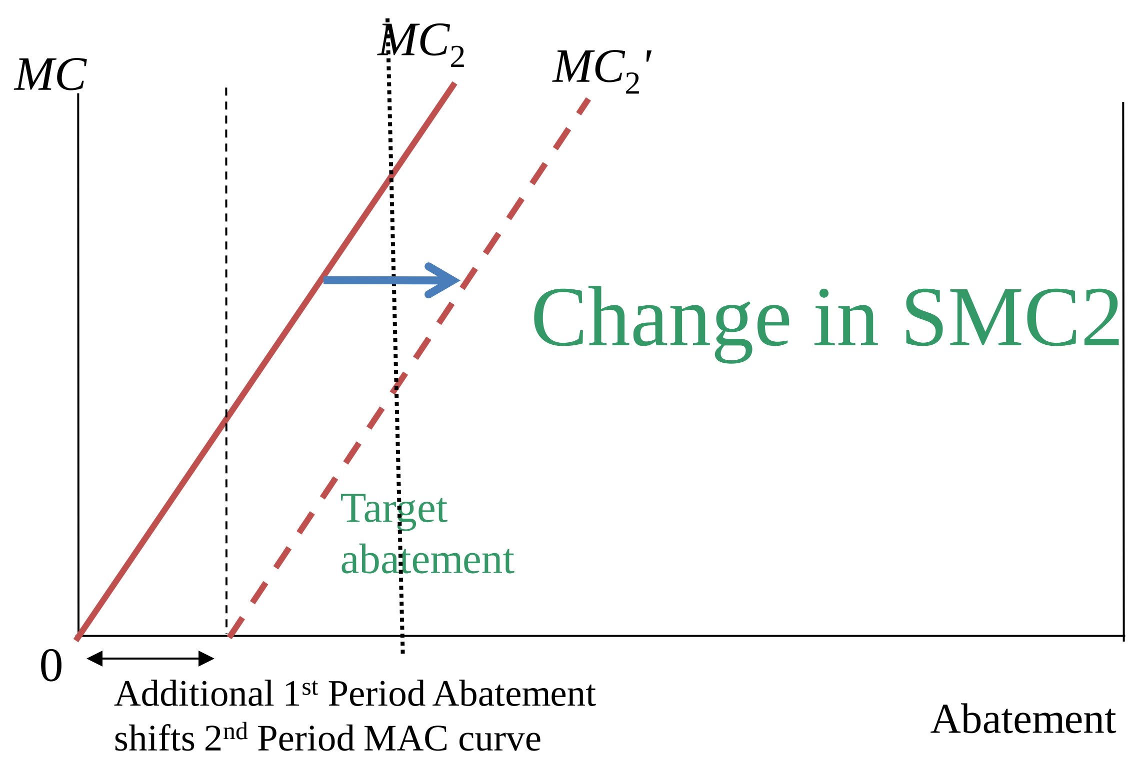
Marginal cost of climate abatement



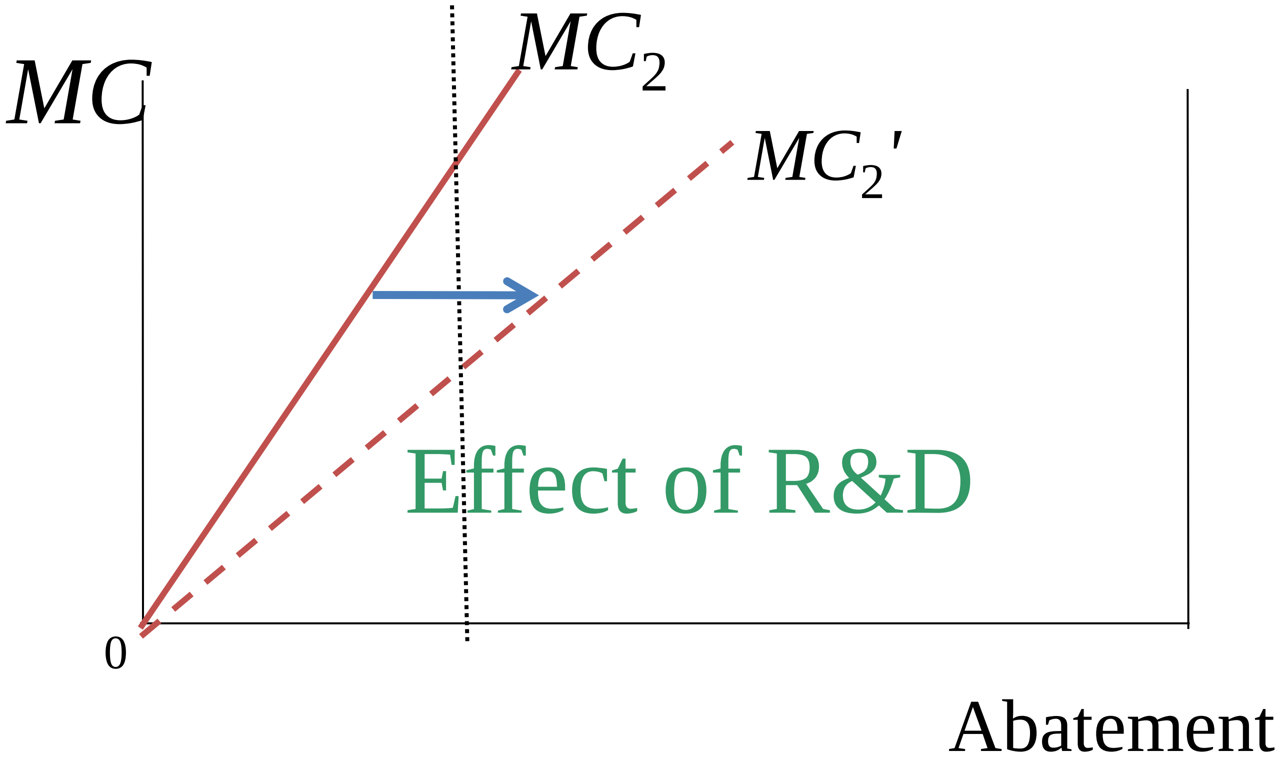
How model Gains to Additional First-Period Abatement?



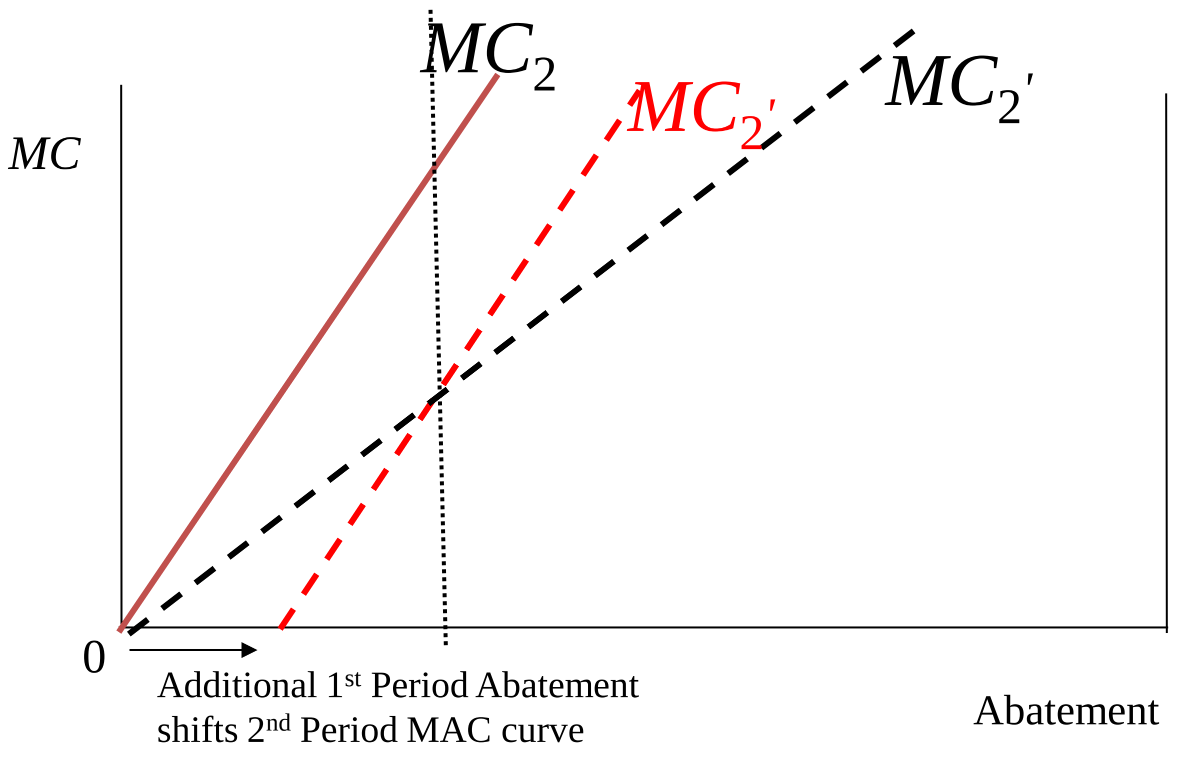
How model Gains to Additional First-Period Abatement?



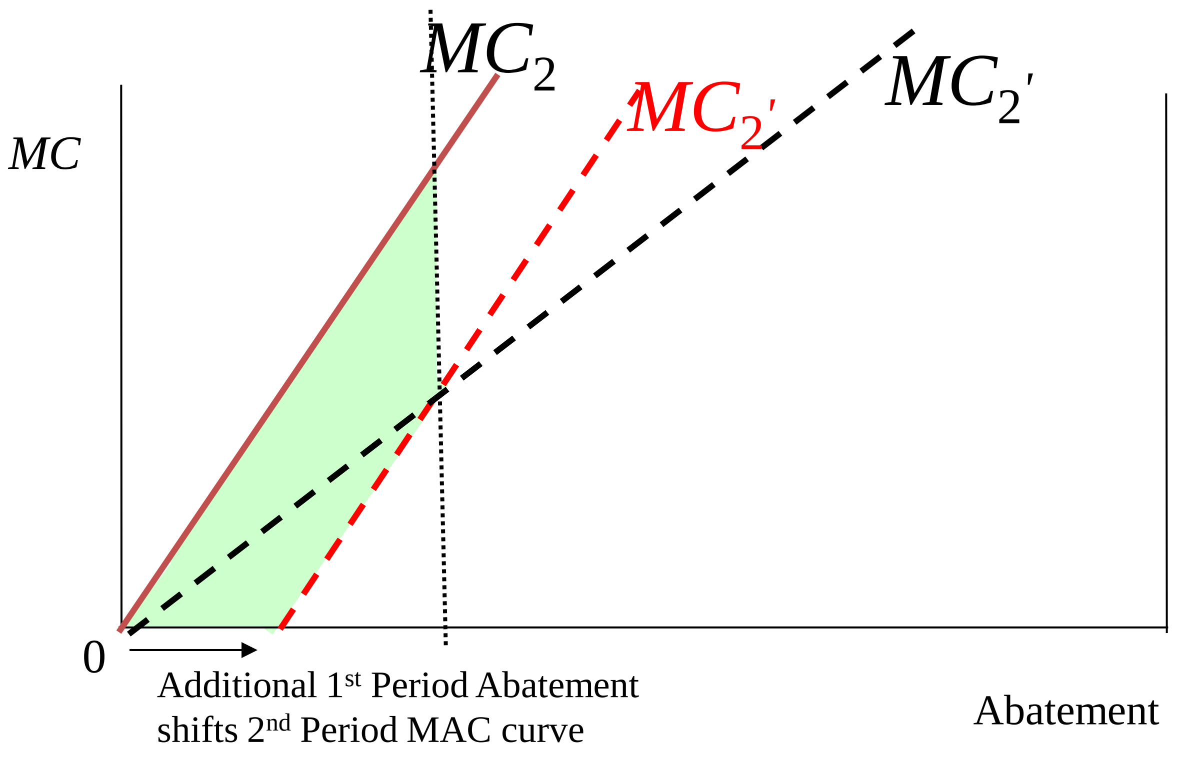
Gains to R&D



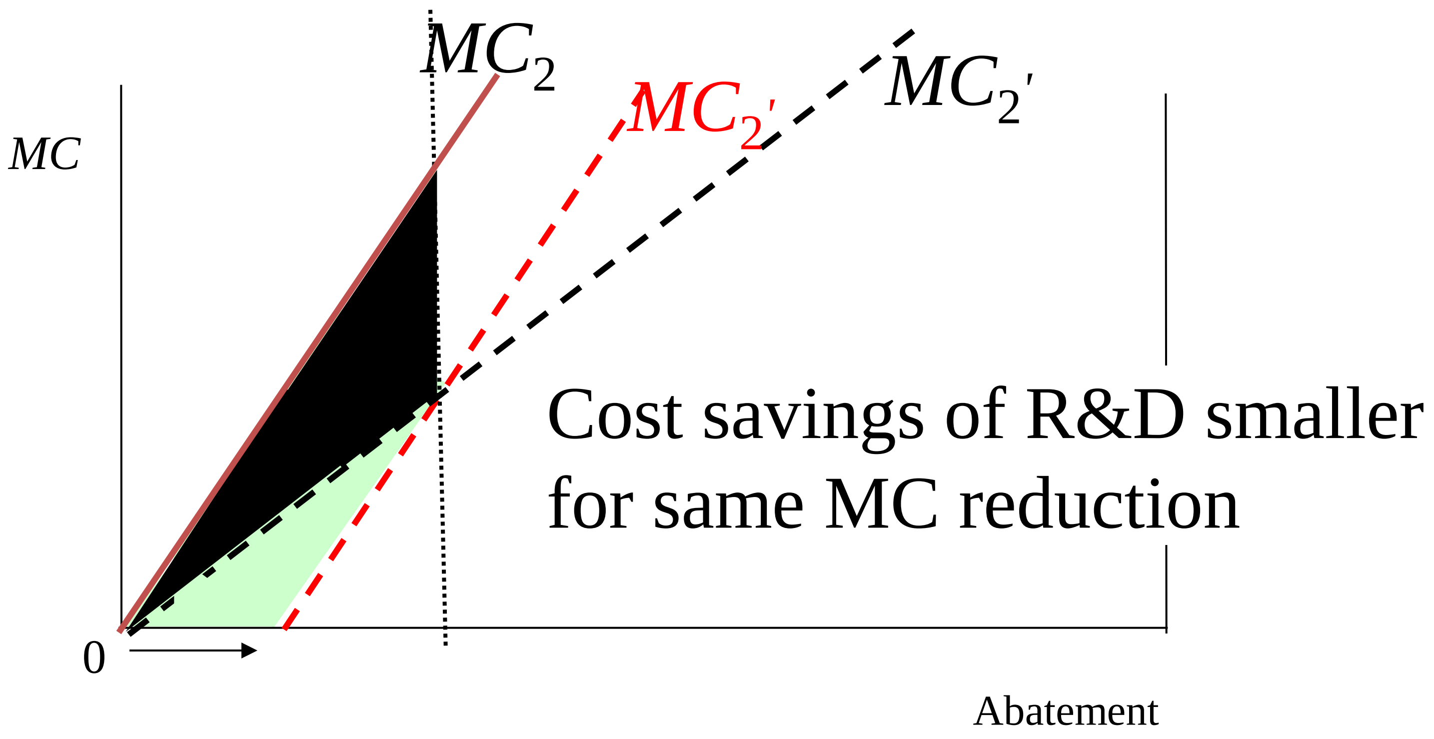
Comparing benefits of abatement and R&D with a fixed climate target



Comparing benefits of abatement and R&D with a fixed climate target

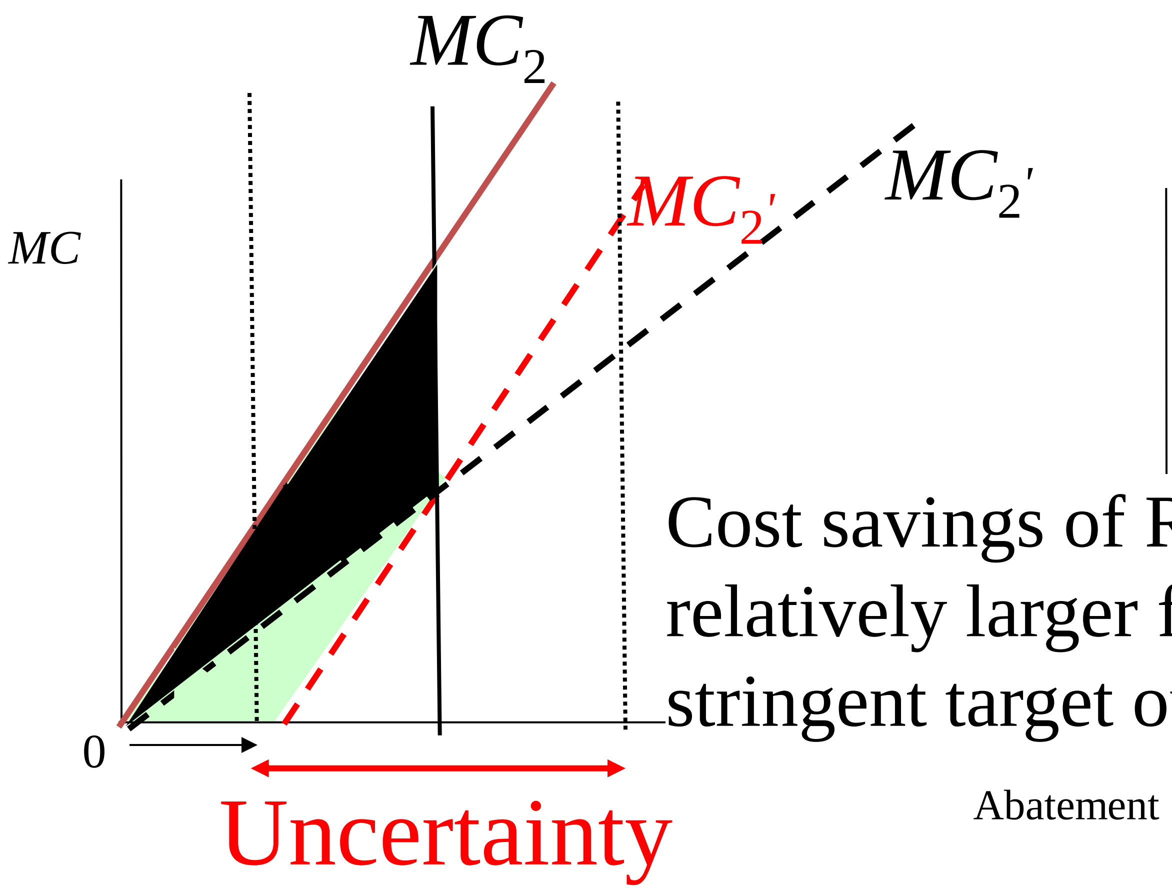


Comparing benefits of abatement and R&D with a fixed climate target



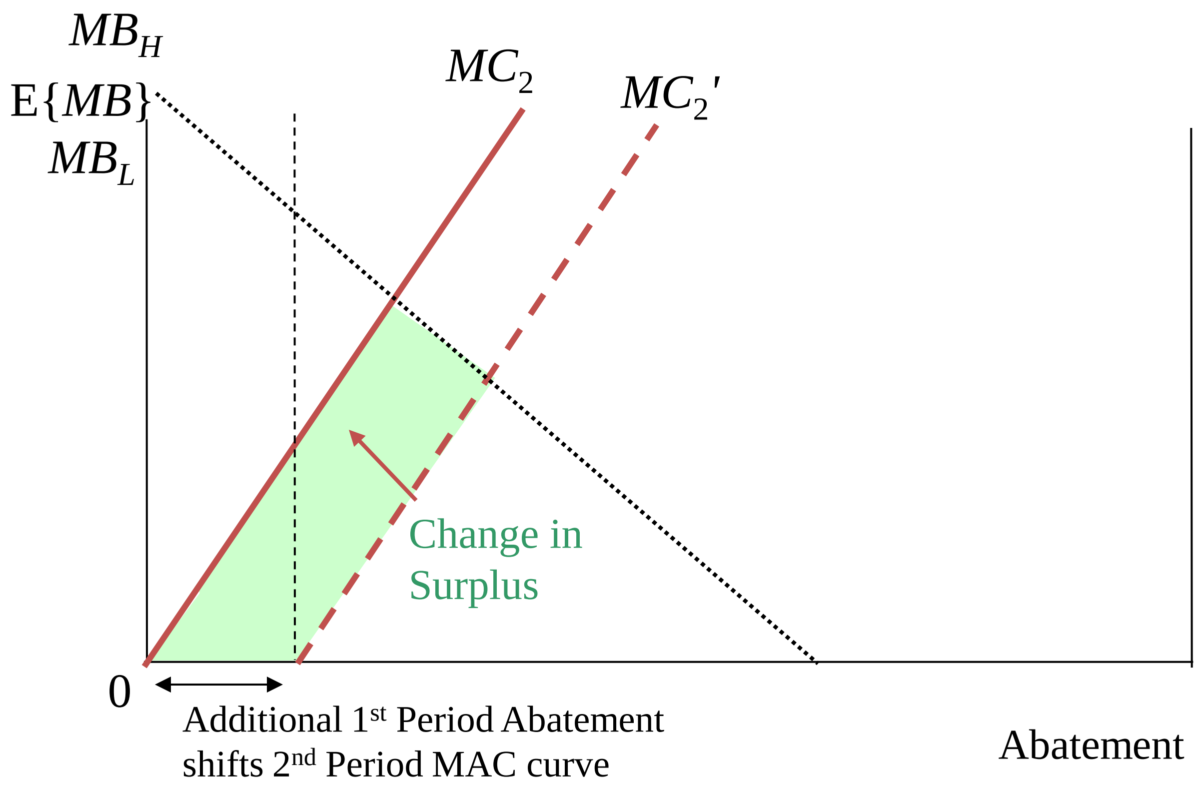
But our interest is still more complex: We are interested in uncertainty in the target!

Comparing benefits of abatement and R&D with a fixed climate target

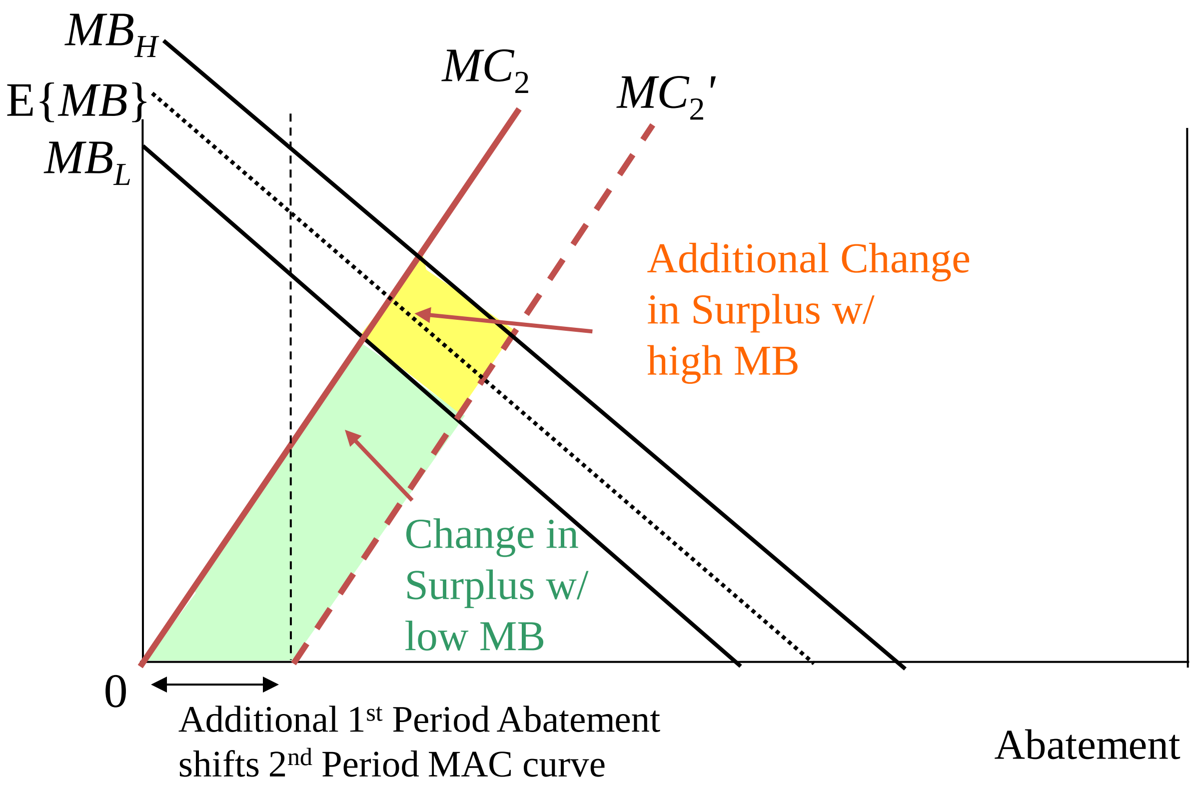


Cost savings of R&D relatively larger for more stringent target outcomes

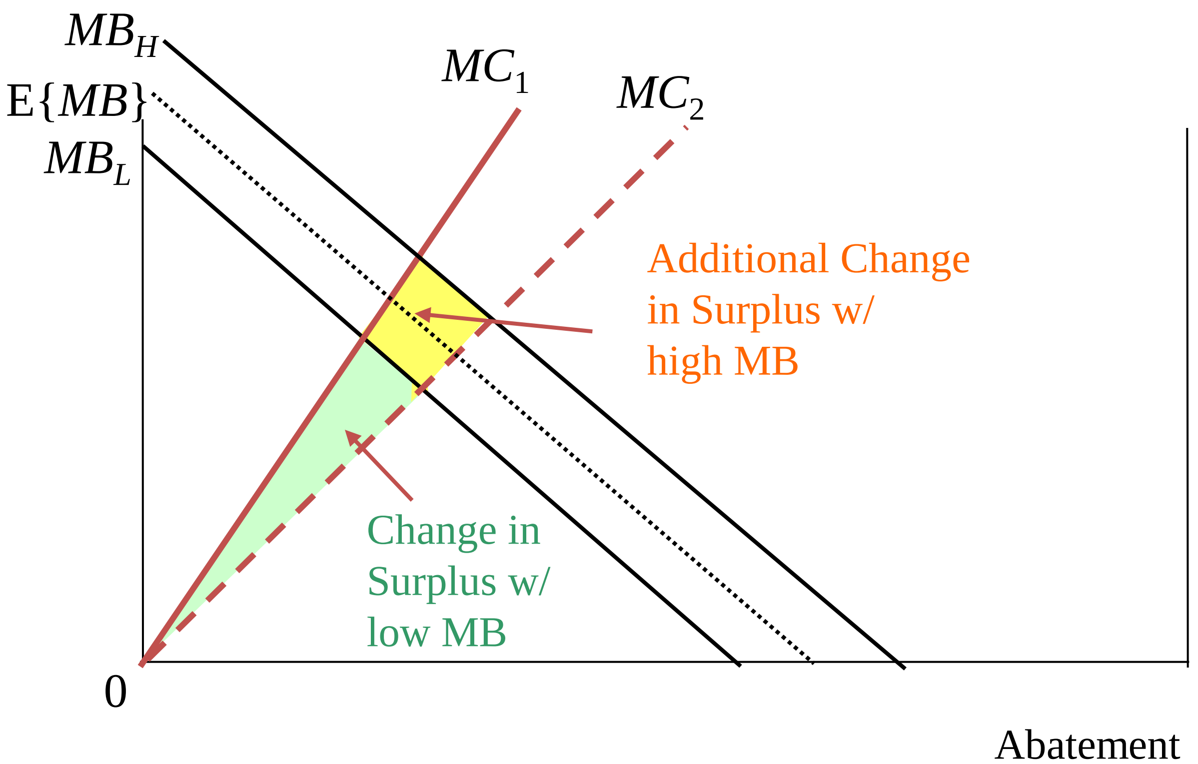
Gains to Additional First-Period Abatement (No Backstop)



Gains to Additional First-Period Abatement (No Backstop)



Gains to Abatement Cost Reductions (No Backstop)



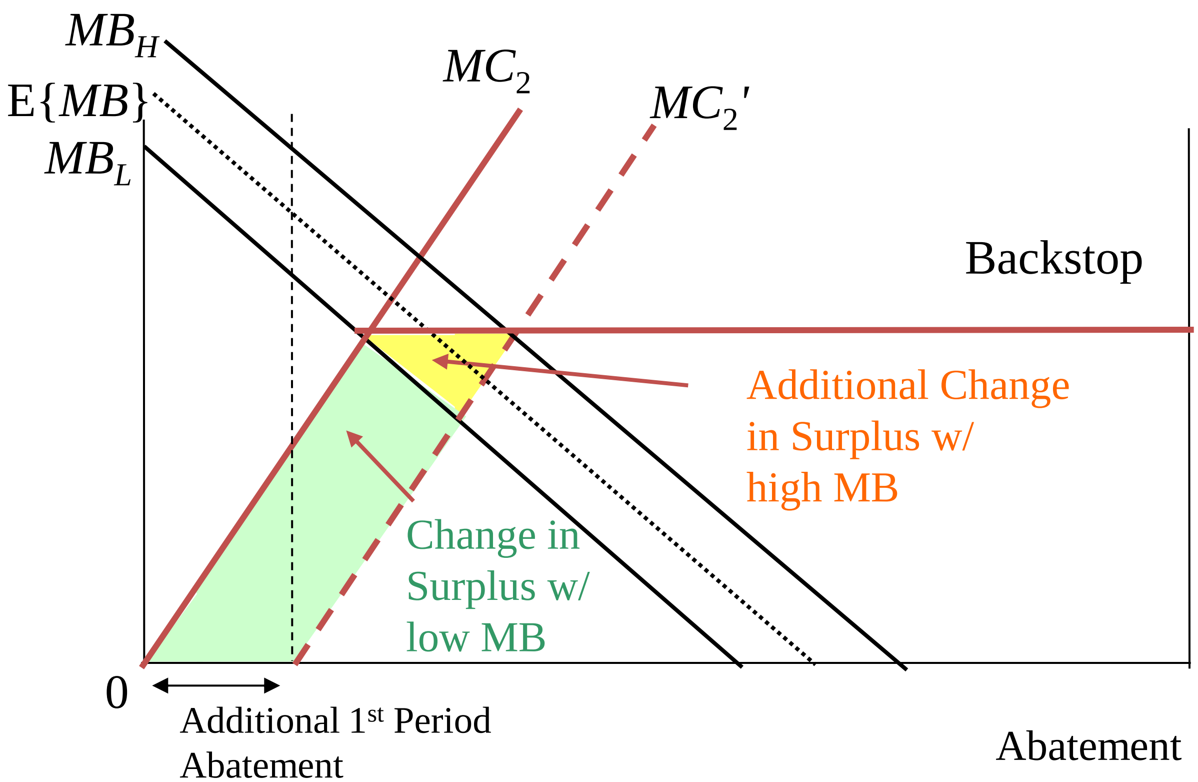
Role of technology is different!

- With A1, there is symmetry w r t uncertainty. If benefits are uncertain → might be bigger /smaller but change is symmetric →EV unchanged.
- Investments in R&D, MAC at time 2 is lowered This is more important if B bigger than expected
- More uncertainty more R&D!
- But not more abatement

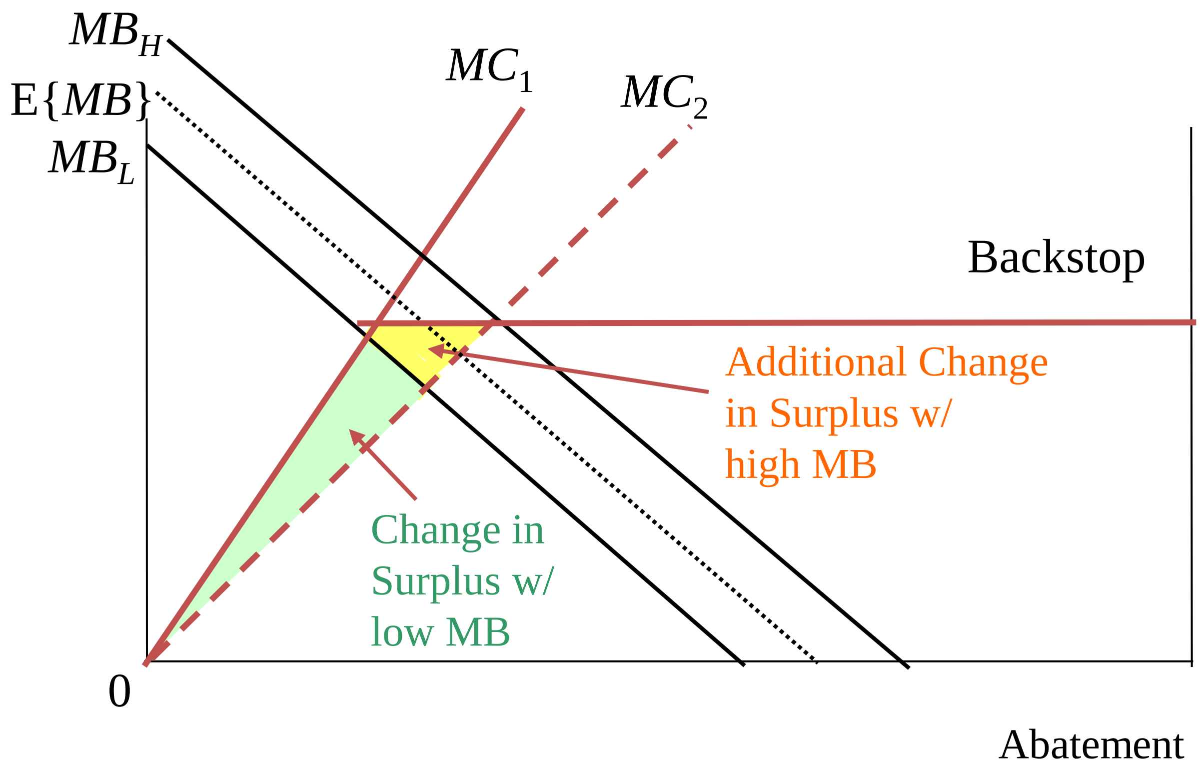
With backstop technology...

- Benefits of conventional abatement truncated in high-cost scenarios
- Uncertainty not an argument for R&D in conventional technology nor abatement.
- Uncertainty → more backstop R&D

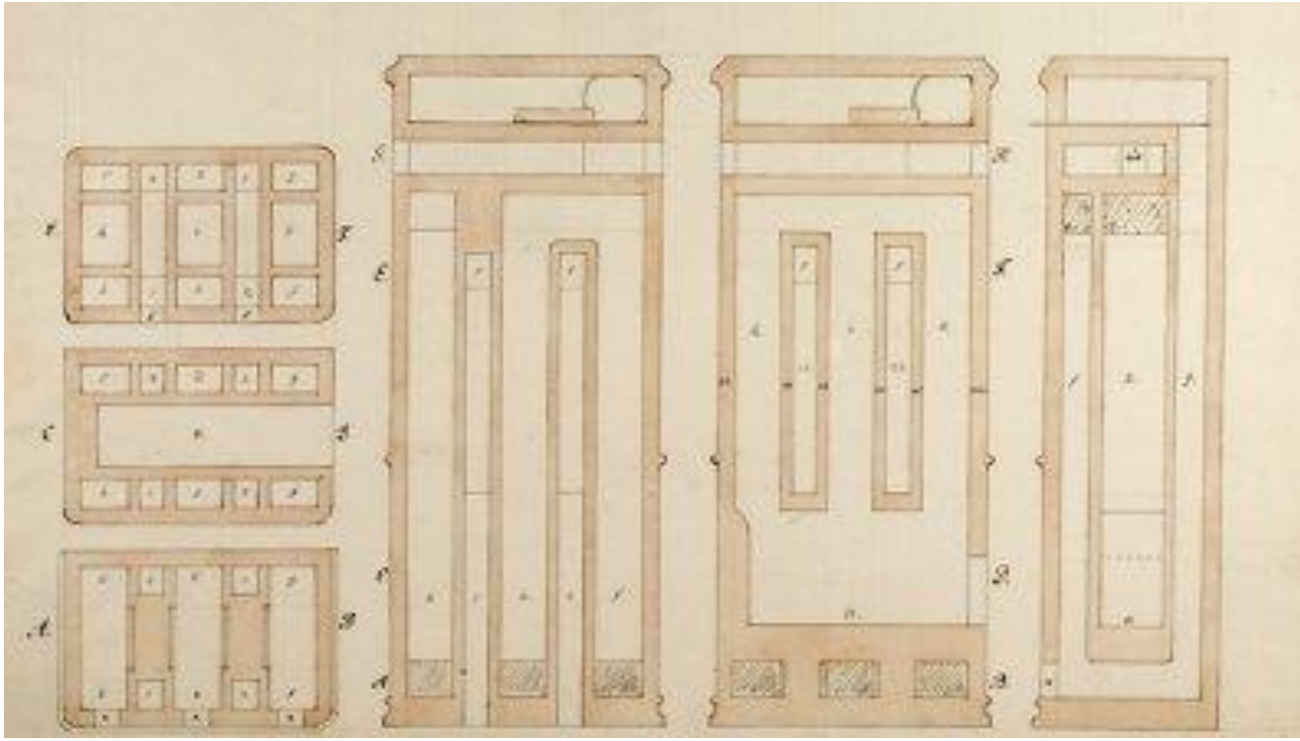
Gains to Early Abatement with Backstop



Gains to Cost Reductions in Regular Technology



Nouvelles technologies



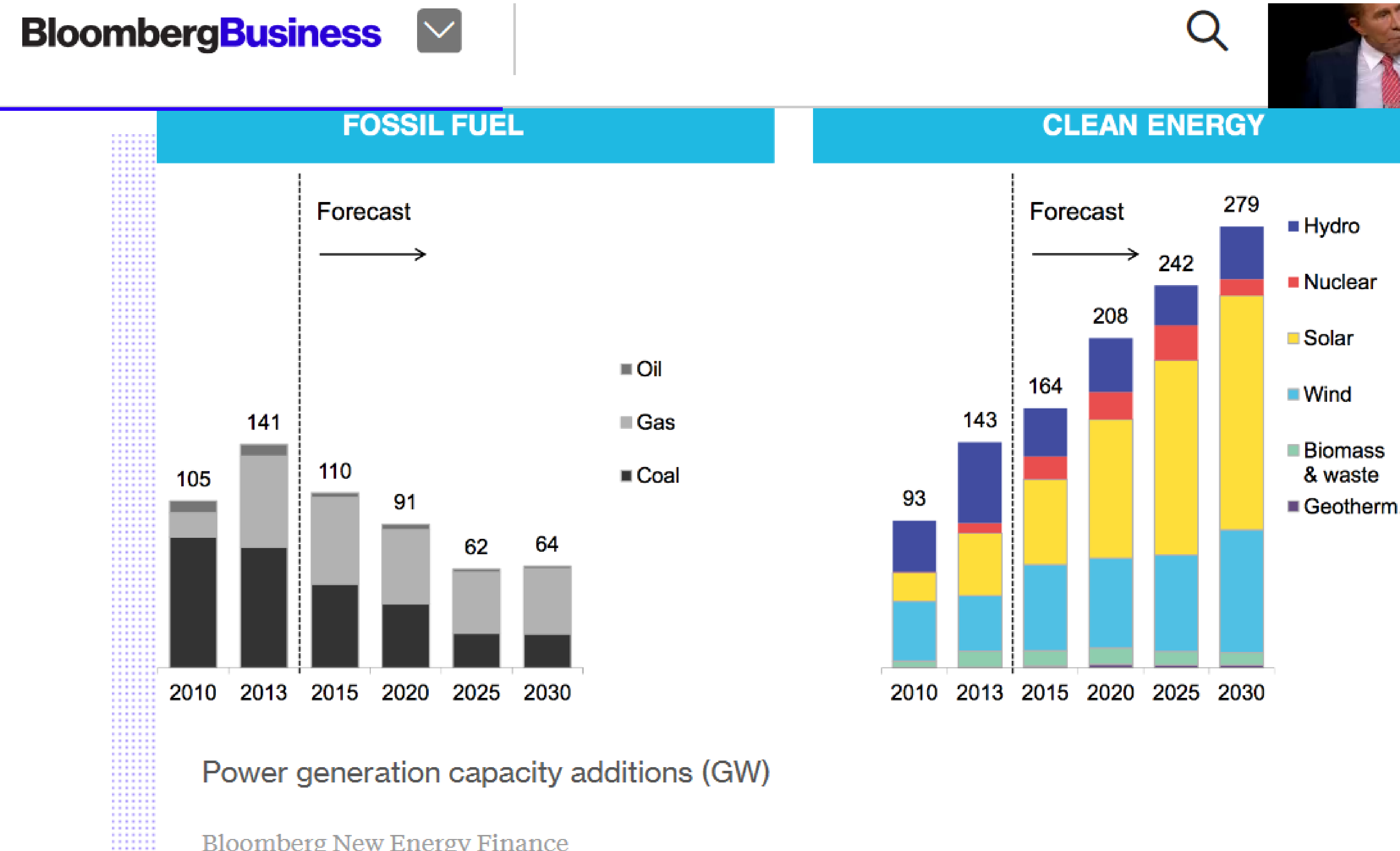

Fossil Fuels Just Lost the Race Against Renewables

This is the beginning of the end.

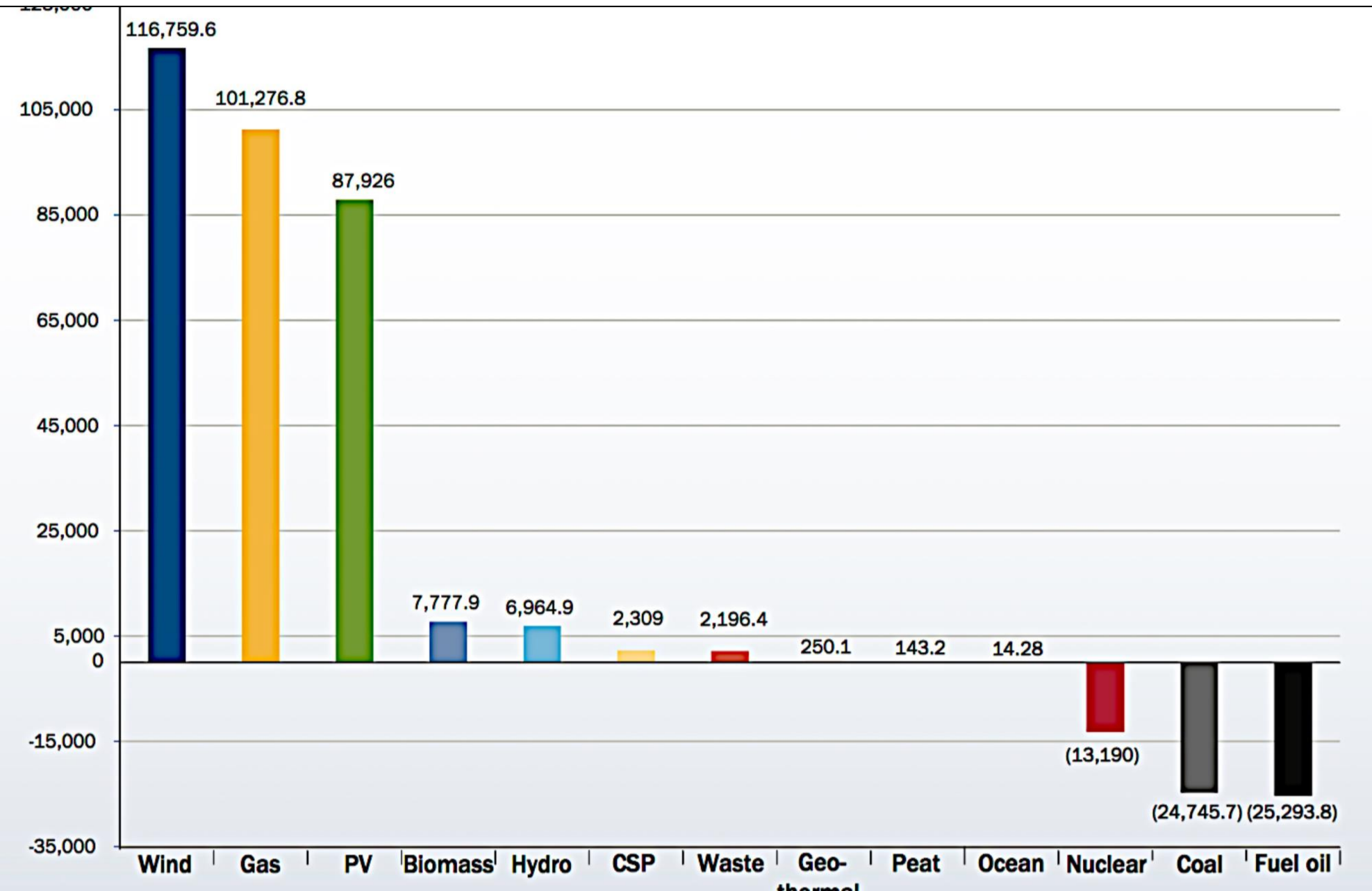
by Tom Randall
tsrandall

April 14, 2015 – 10:27 PM CEST

The battle is over ?

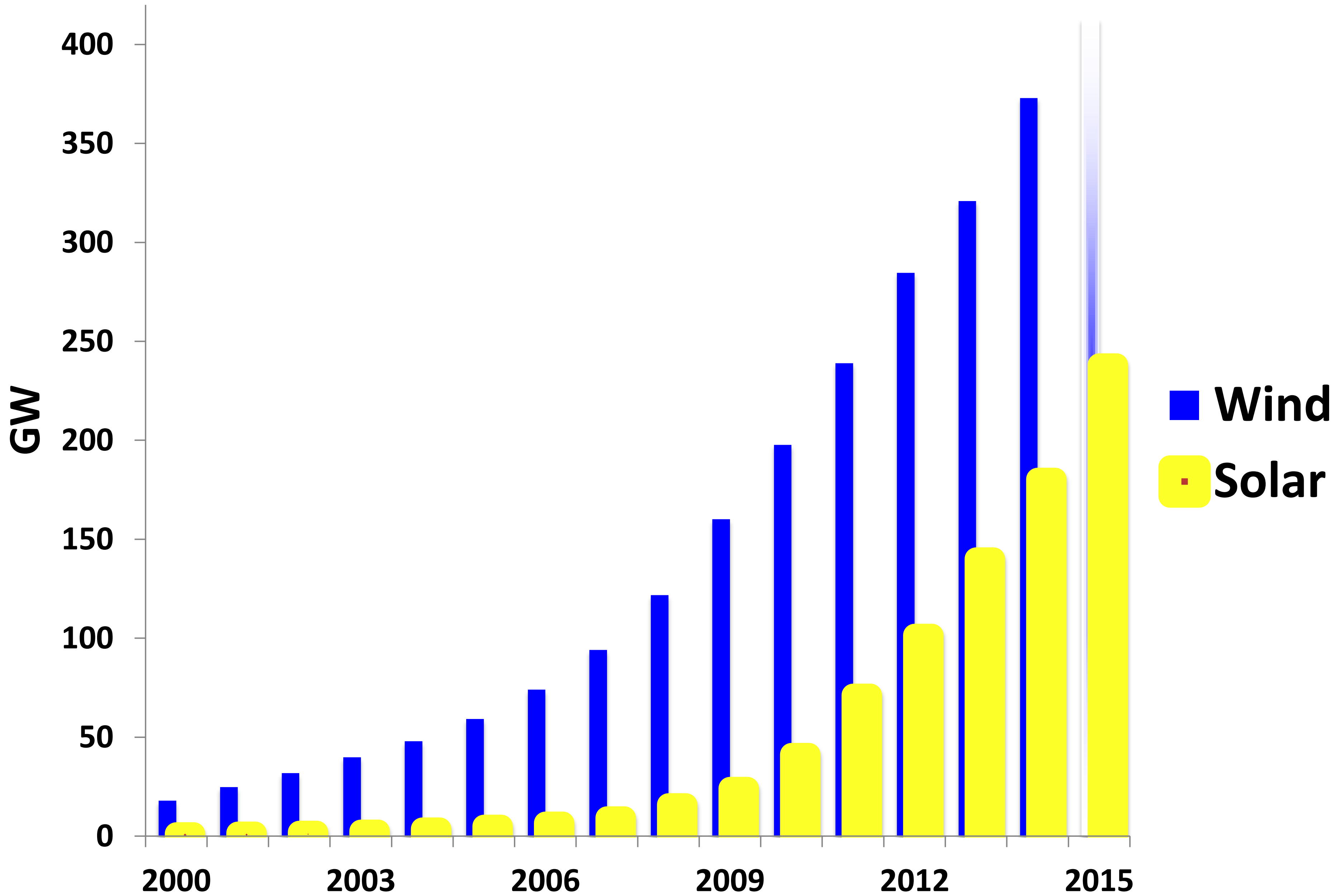


Net electricity generating installations in the EU, 2000-2014

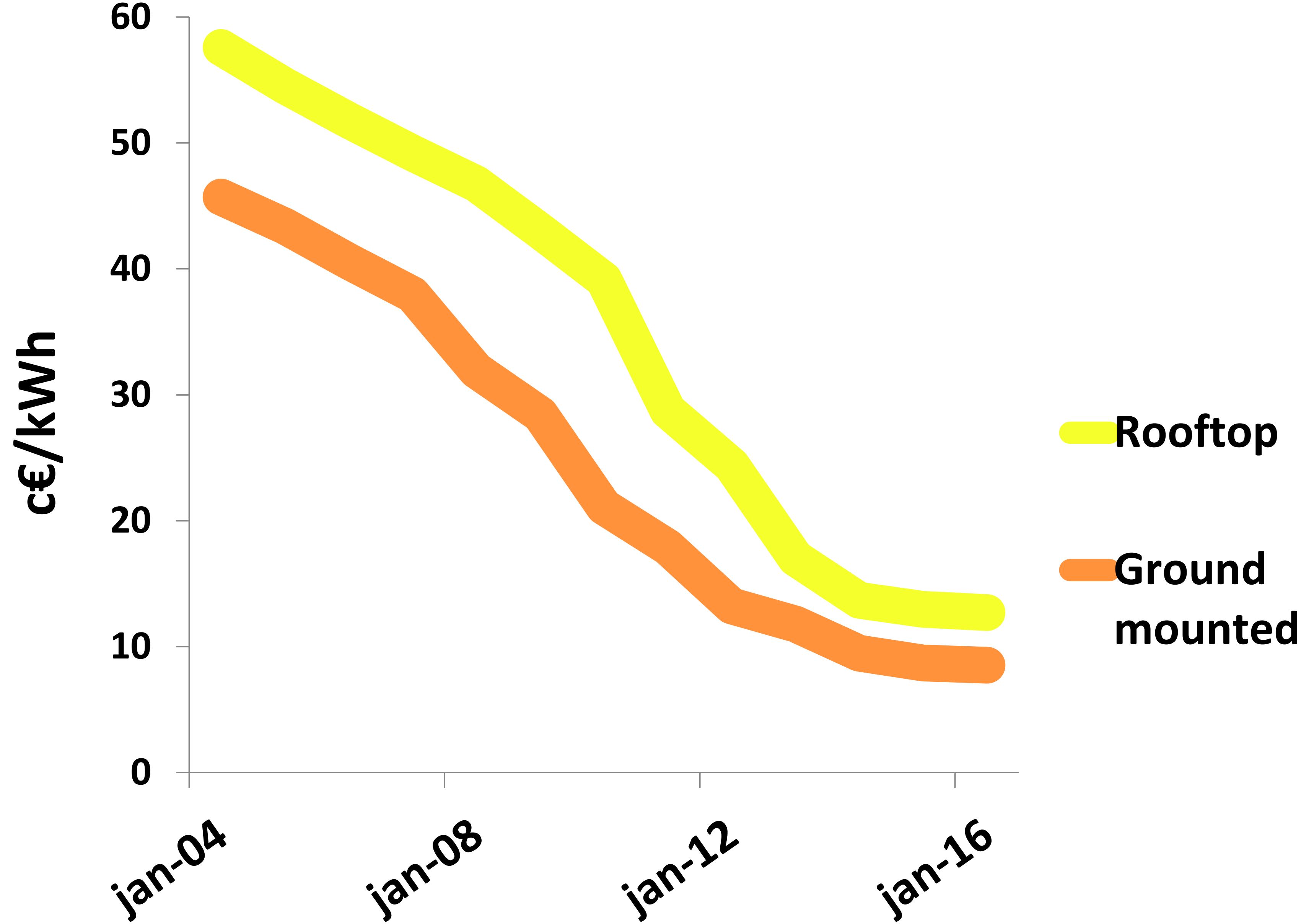


Finow Tower I&II, Tyskland

Global solar and wind capacity



Solar PV tariffs in Germany

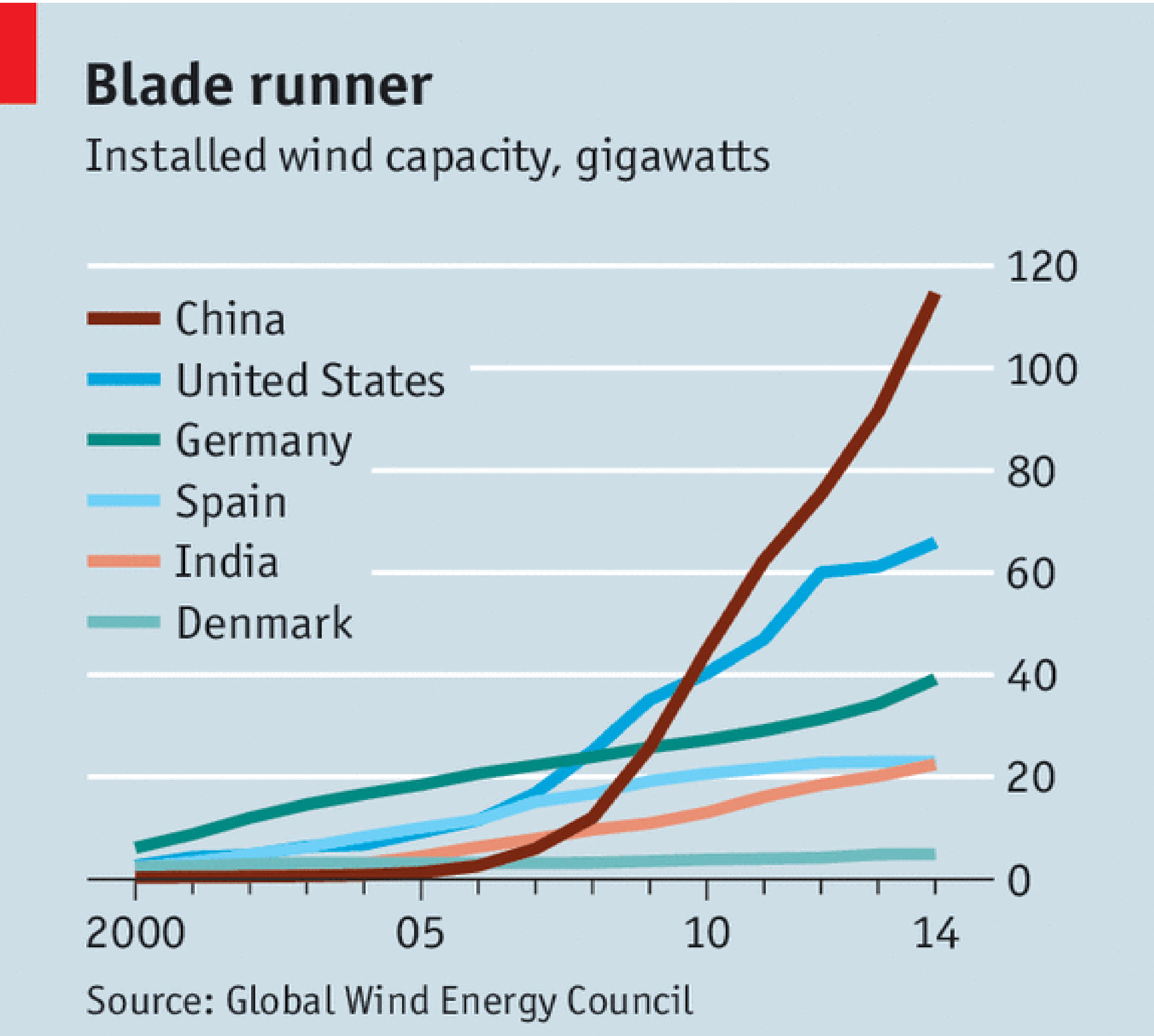


BnetzA

Shares of Electricity production

- Wind 42 % Denmark
- Solar 8% Germany

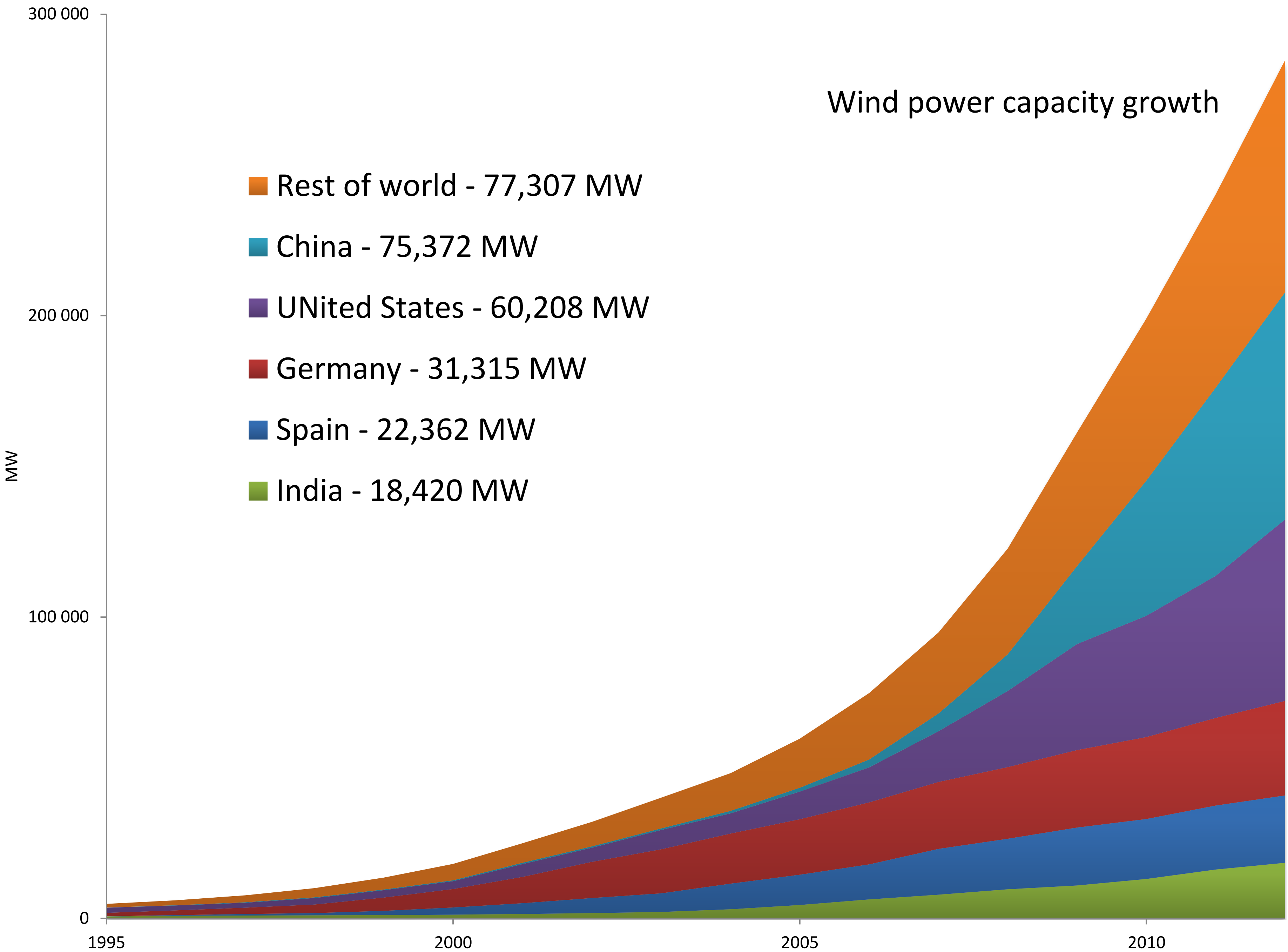
- Vindkraft Danmark 42% 2015 (ca 20% 2012)
- **July 25th PM renewable 78% German demand**



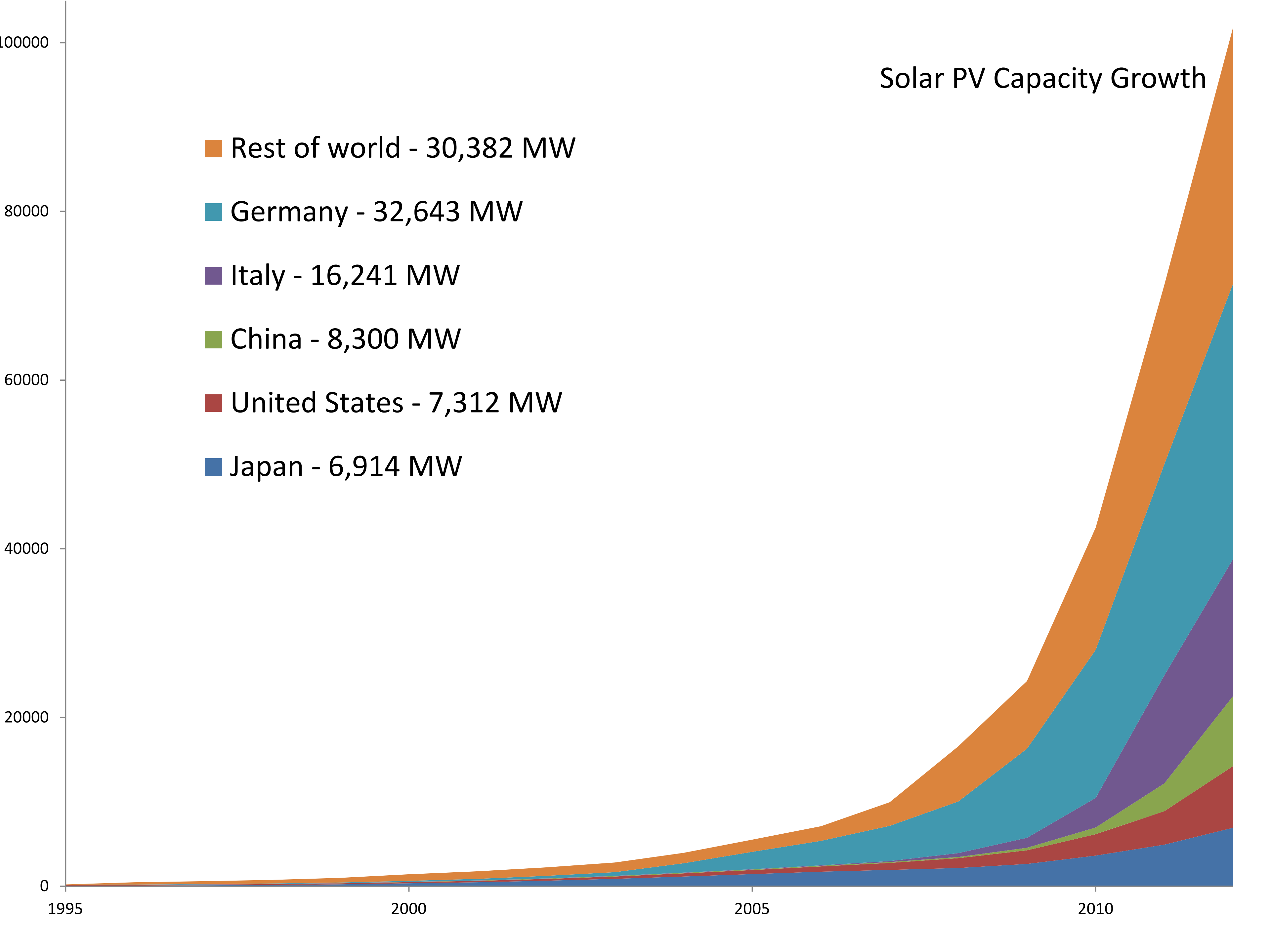
Economist.com

Symbols: Solar airplanes, Superbowl?

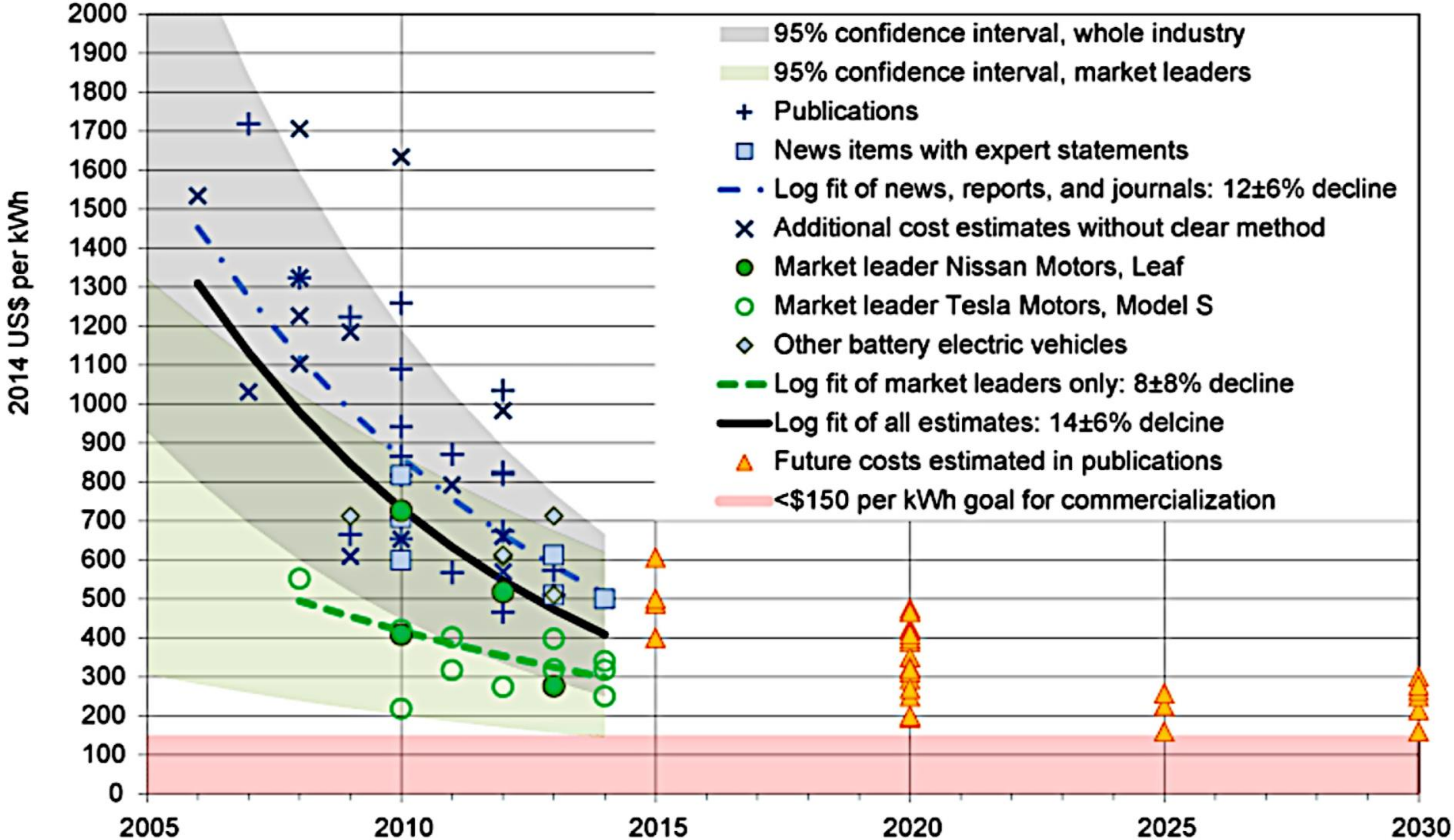
Solar bids now within range of Coal fired in India.



Wind power capacity growth
Rest of world - 77,307 MW
China - 75,372 MW
UNited States - 60,208 MW
Germany - 31,315 MW
Spain - 22,362 MW
India - 18,420 MW
MW
300 000
200 000
100 000
0
1995
2000
2005
2010


Solar PV Capacity Growth
Rest of world - 30,382 MW
Germany - 32,643 MW
Italy - 16,241 MW
China - 8,300 MW
United States - 7,312 MW
Japan - 6,914 MW
100000
80000
60000
40000
20000
0
1995
2000
2005
2010

Estimates of cost of lithium-ion batteries for use in electric vehicles



Björn Nykvist and Måns Nilsson, 2015

Instruments

Fischer Make instr. as direct as possible. Subsidy for technology motivated by techn spillover & incomplete intellectual property rights. But Pr of Carbon still wins.

Table 1. Incentives from alternative policies

	Emissions price	Tradable emissions perform. std.	Output tax on fossil generation	Renewables portfolio standard	Renewables production subsidy	Renewables research subsidy
Reduce emissions intensity of fossil fuels	Yes	Yes	No	No	No	No
Energy conservation (via electricity price increase)	Yes	It depends	Yes	It depends	No	No
Subsidy for renewable energy output	No	Yes (implicit)	No	Yes (implicit)	Yes	No
Subsidy for R&D	No	No	No	No	No	Yes

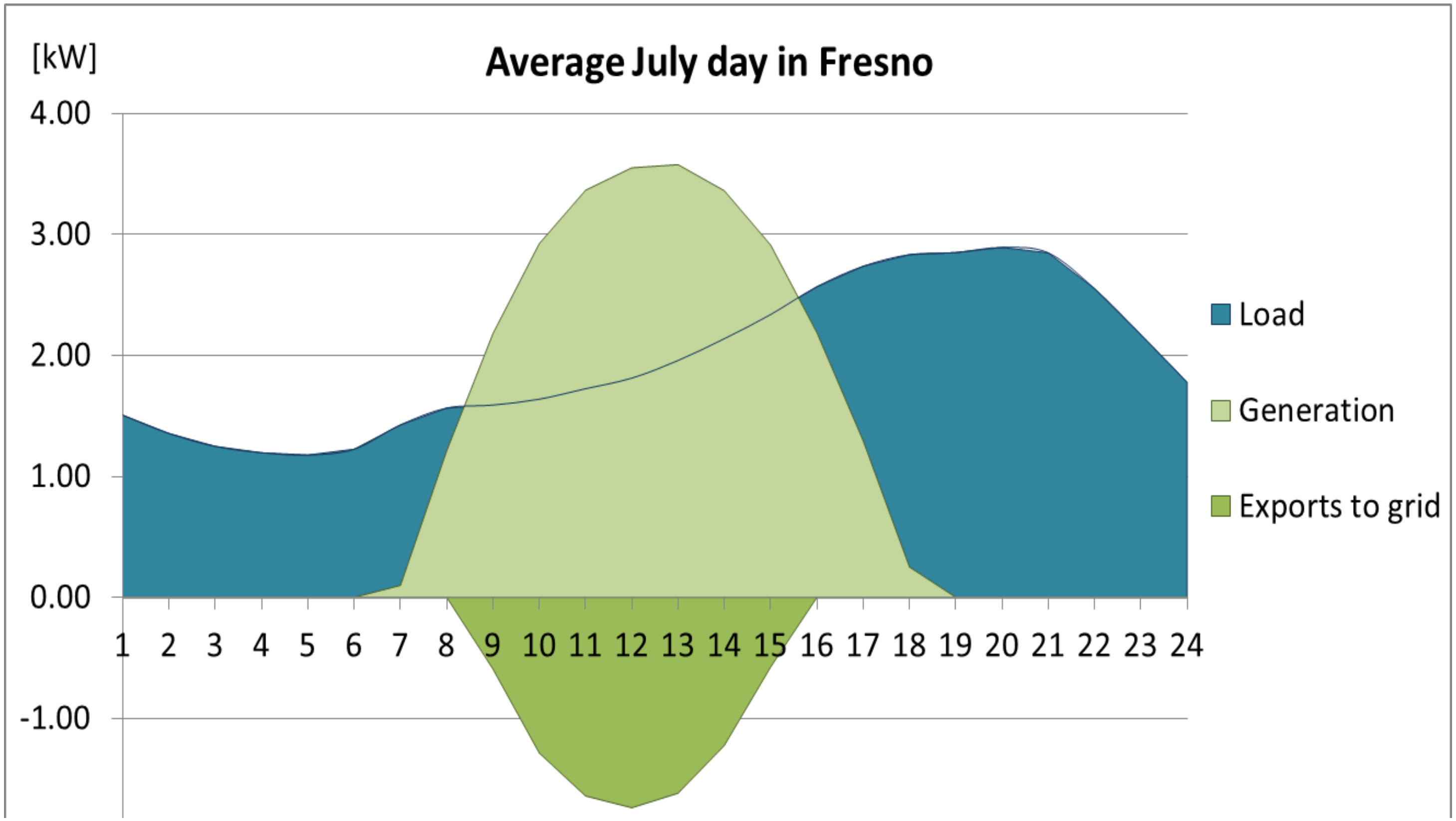
Dong FIT vs. RPS

- The more market the better … RPS
- The Weitzman PvsQ MC flat so RPS better
- FIT reduces uncertainty much more for wind producer. Certificates not accepted by banks …
- Dong finds more wind cap with FIT (2GW)
- Yes this was CSTS with 50 + countries.

Most Important PV Incentives

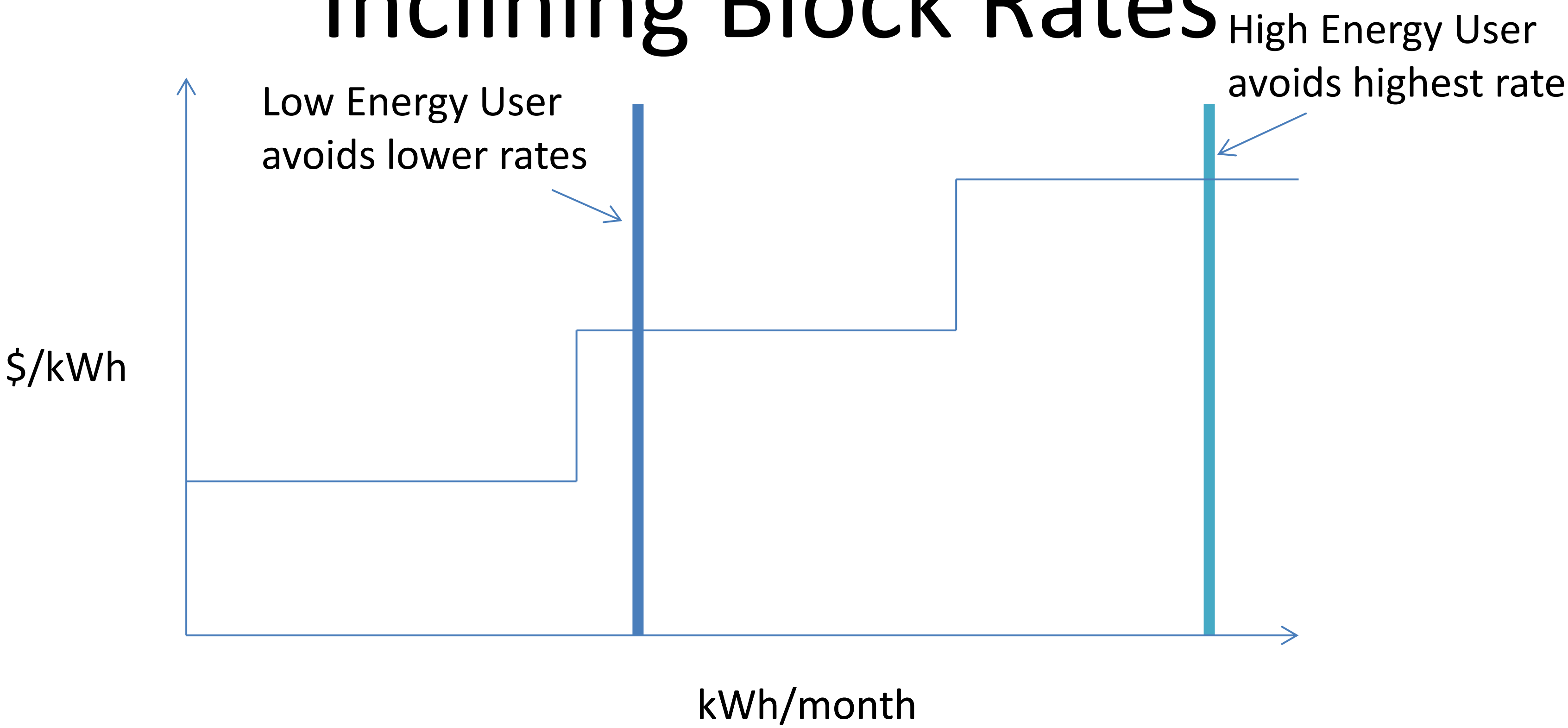
- Upfront costs:
  - Government rebates of 30% upfront cost - down to 10% starting in 2016
  - State and local incentives
- Solar generation:
  - *Net Energy Metering:* Utilities pay customers retail rates for their solar generation in excess of their consumption - “run the meter backwards”

Net Energy Metering (NEM)



- Pay for net load (blue area), receive retail prices for excess generation (dark green area)

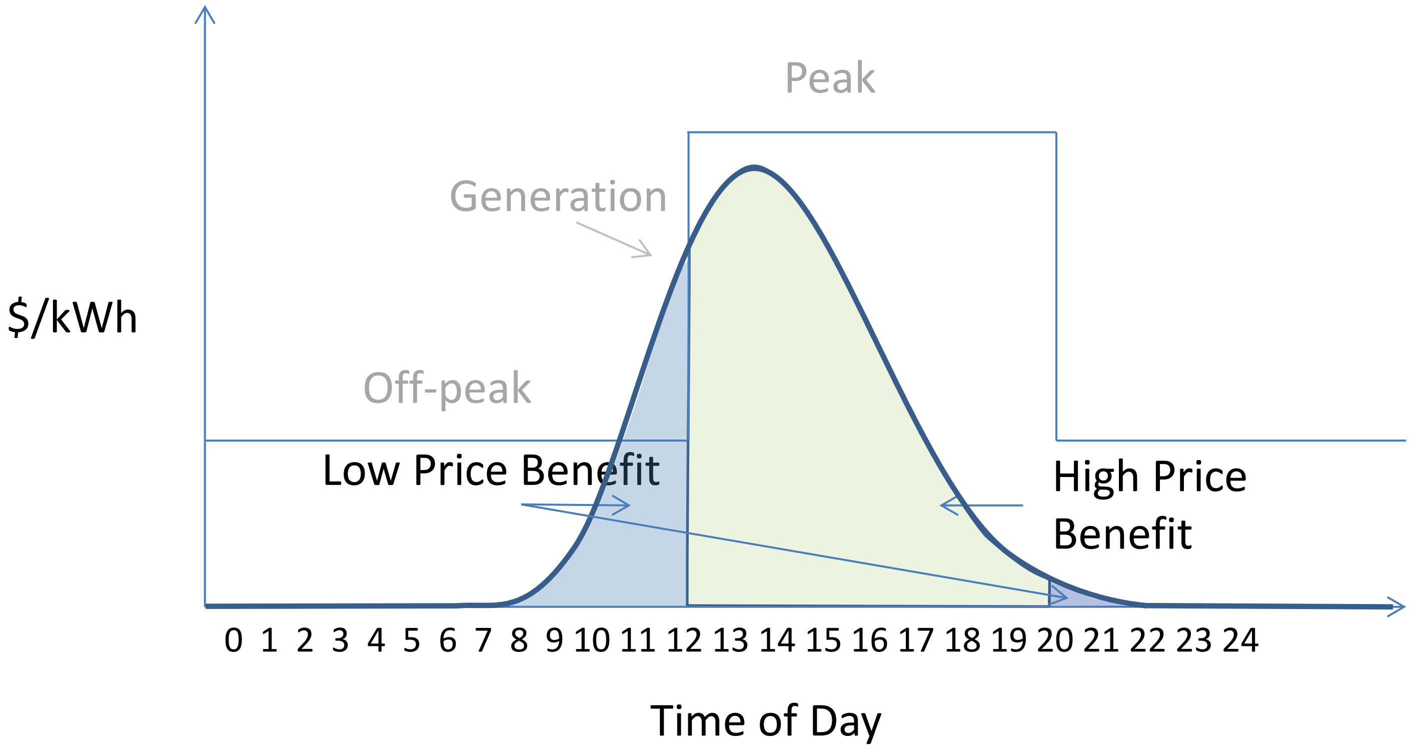
Inclining Block Rates



- Paid for excess generation at marginal block rates

➢ *High energy users benefit most from NEM*

Time of Use Rates



Benefit = avoided rate + payment for excess

- *Highest benefit when solar generated at peak times*

PV at Odds with Utilities

- NEM allows customers to reduce their contribution to fixed cost recovery
- Shifts costs to non-NEM customers

➢ *Utilities are beginning to worry about the impacts of NEM as PV shares increase*

What are utilities proposing?

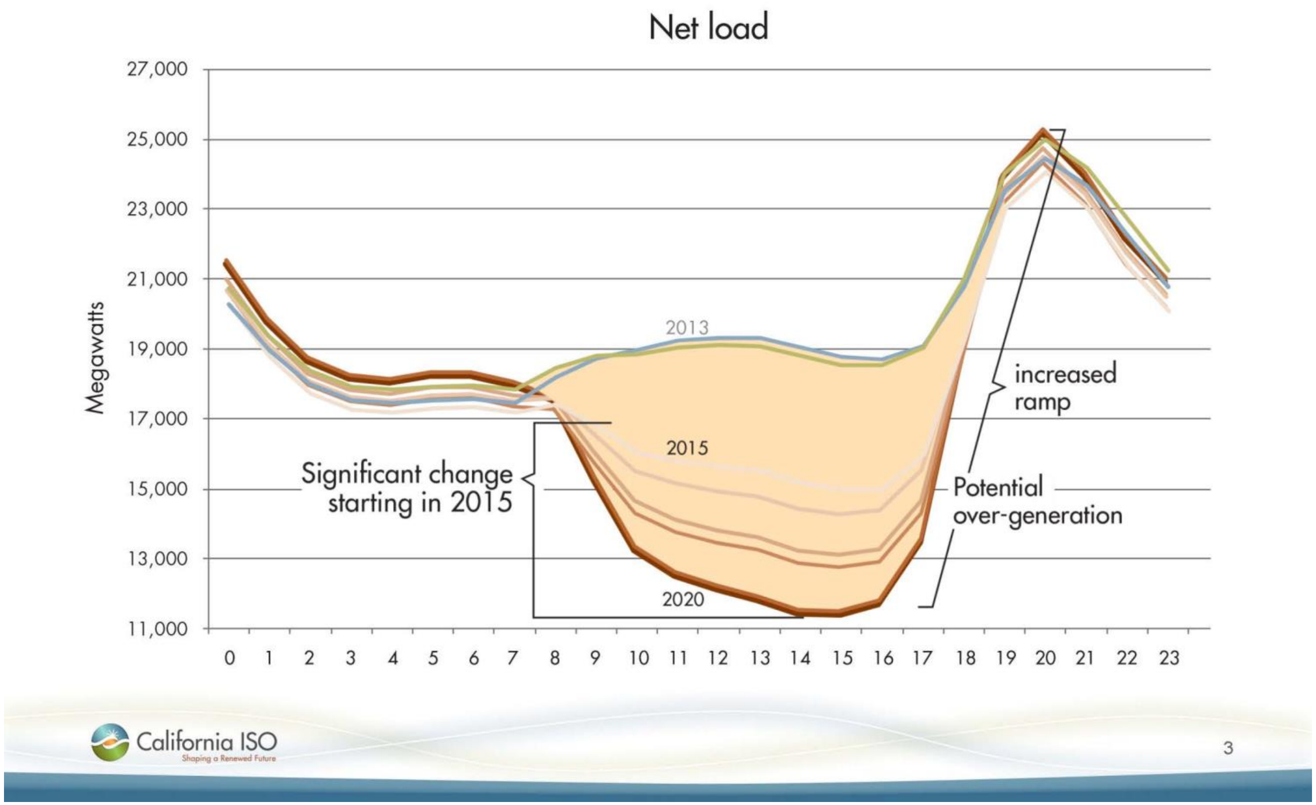
- Higher fixed charges
- Solar-specific fixed charges
  - Arizona Public Service: monthly \$0.70/kW of installed capacity
- Minimum bill charges
  - Massachusetts (not passed by legislature), Virginia (passed)
- Value of Solar Tariff
  - Minnesota: proposed a method for each utility to calculate true value of solar to replace NEM
  - Austin Energy Value of Solar Tariff: \$0.11/kWh

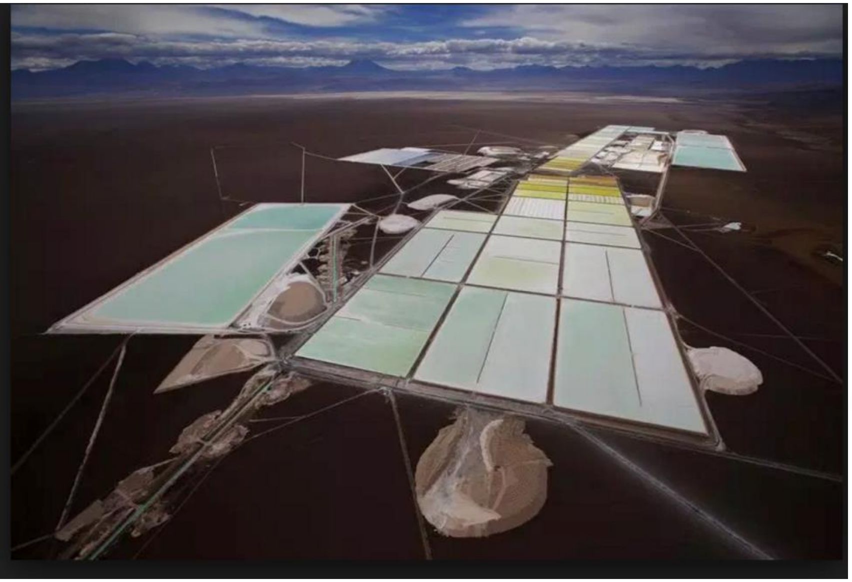
Value of Solar Tariff

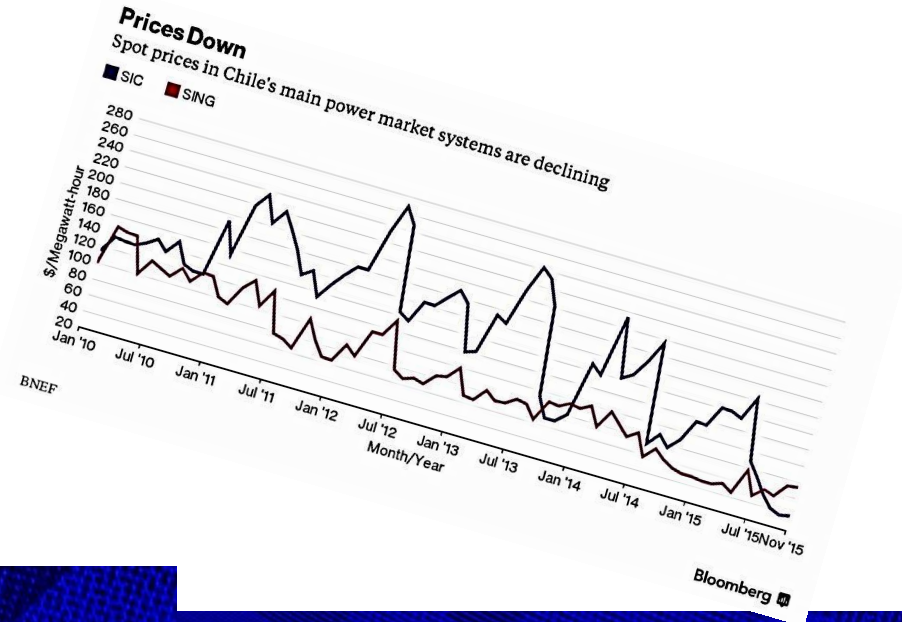
- Alternative compensation mechanism for generation
  - Fixed payment per kWh generated over the lifetime of the system
- Intended to reflect the average value of each kWh to system and environment
  - May decrease as more PV comes online
- Customer pays for what she consumes
  - Conservation signal maintained
  - Contribution to utility fixed cost recovery may be higher

Why do utilities care about DG expansion?

- With an expansion of solar, peak may shift into evening







Solar Energy Is Cheapest Source of Power in Chile, Deutsche Says

by Vanessa Dezem

November 4, 2015 – 10:13 PM CET

Green Energy Boom Helps Chile Contain Surging Power Prices

by Philip Sanders and Vanessa Dezem

January 28, 2016 – 10:00 AM CET

- Chile leads Latin America in installation of solar power
- Success achieved without the help of government incentives

Piyush Goyal @
Internation
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sation of 121 Cou
ce will be t
pib.nic.in/newsite/
218
280

Piyush Goyal @PiyushGoyal · Jan 19
Through transparent auctions with ready provision of land, transmission etc., solar tariffs have reduced below thermal power cost

RETWEETS 90 LIKES 94

9:48 PM - 19 Jan 2016 · Details

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@PiyushGoyal
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Delighted that an all time low solar tariff of Rs 4.63 has been achieved during reverse e-auction conducted by NTPC

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6:45 PM - 3 Nov 2015

Solar Power Costs Drop to Record in Rajasthan Auction in India

by Anindya Upadhyay

January 19, 2016 – 12:23 PM CET

- Prices in sunny province approach cost of fossil fuels
- Winning bids range from 4.34 to 4.36 rupees/kilowat

Piyush Goyal Retweeted
Narendra Modi @narendramodi · Jan 25
International Solar Alliance will benefit humankind, give the world energy & place emphasis on innovation. nm-4.com/fm7c

993 2.3K