A bigger bang for the buck: How to design efficient policies under post-2012 institutions?

COP 17, Durban

November 30, 2011

Agenda

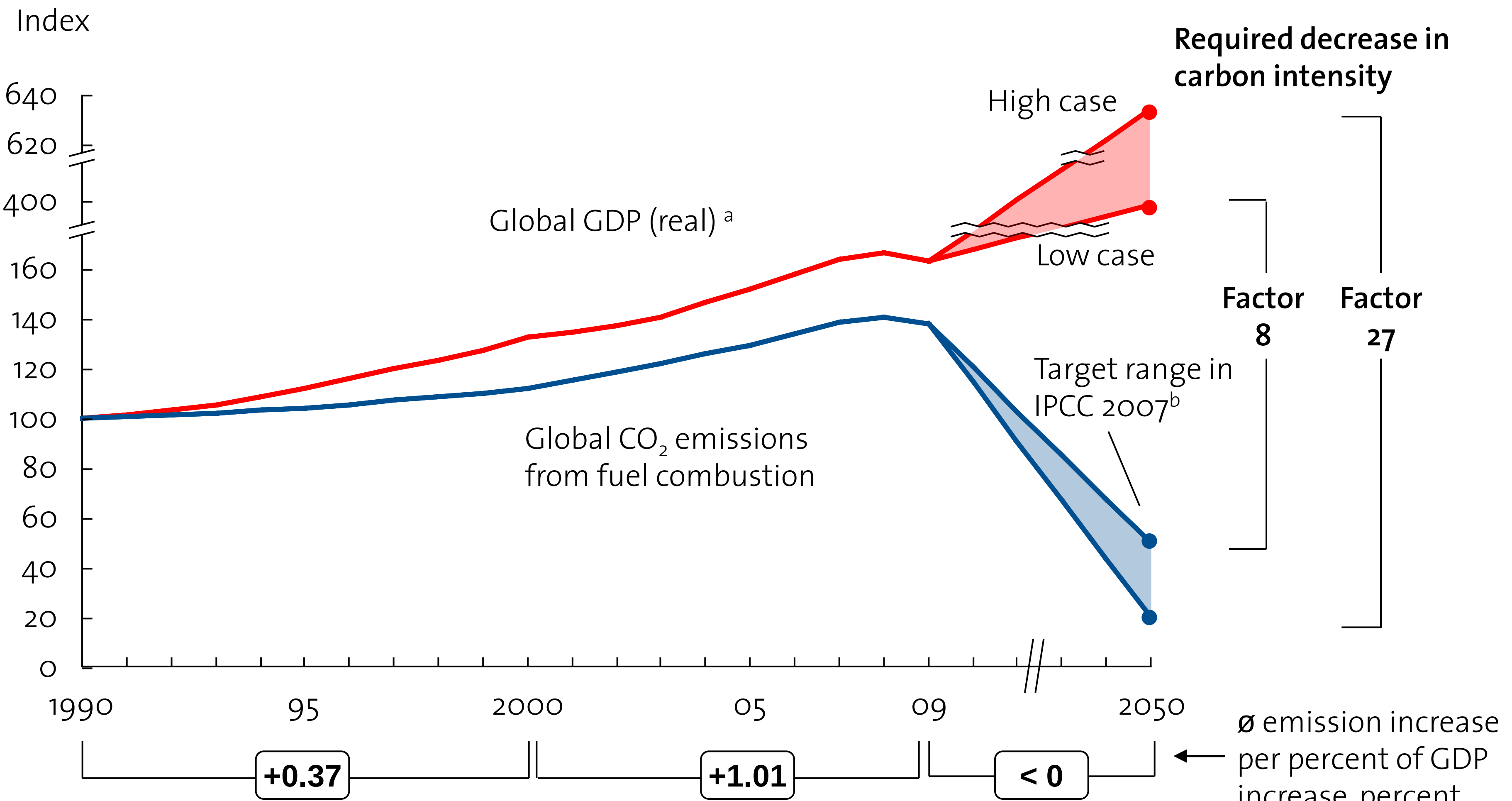
16:45 – 16:50	Introduction to the side event: A bigger bang for the buck: How to design efficient policies under post-2012 institutions?
16:50 – 17:05	Michael Peters (ETH Zurich) will report the results from three new studies on Wind and PV support policy effects in OECD countries
17:05 – 17:20	Dr. Tobias Schmidt (ETH Zurich) presents two studies, one on the effects of the EU ETS and renewable support policies in Europe and one on the economics of renewables in non-OECD countries
17:20 – 17:35	Prof. Dr. Norichika Kanie (Tokyo Institute of Technology and UNU-IAS) will talk on how to enable low-carbon technology governance architectures
17:35-17:50	Dr. Axel Michaelowa (University of Zurich) will report from practical experience of a NAMA in Mexico.
17:50 – 18:15	Questions from the floor and discussion

The Role of Technology Policy in Fostering Technical Change – Lessons from the Cases of Solar and Wind Power

Content

- **Motivation of research**
- Key findings
- Policy implications

Carbon intensity has to decrease by at least an order of magnitude until 2050 to reach IPCC target



a Compound annual growth rate of global GDP 2009 – 2050 in high case 3.4%, in low case 2.2%.
b GHG emissions target applied pro rata to CO2 emissions from fuel combustion.

Source: IEA 2011, PWC 2011, World Bank 2011

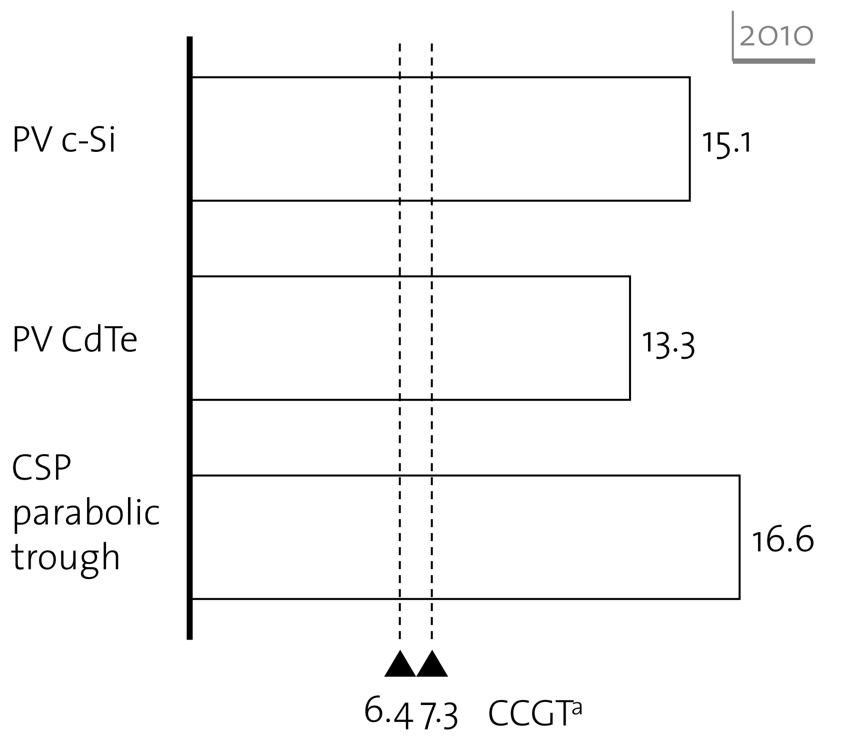
In most settings renewable energies are not yet competitive with conventional sources of power generation – example solar power

Levelized cost of electricity Southern California, EUR $cents_{nominal}$/kWh

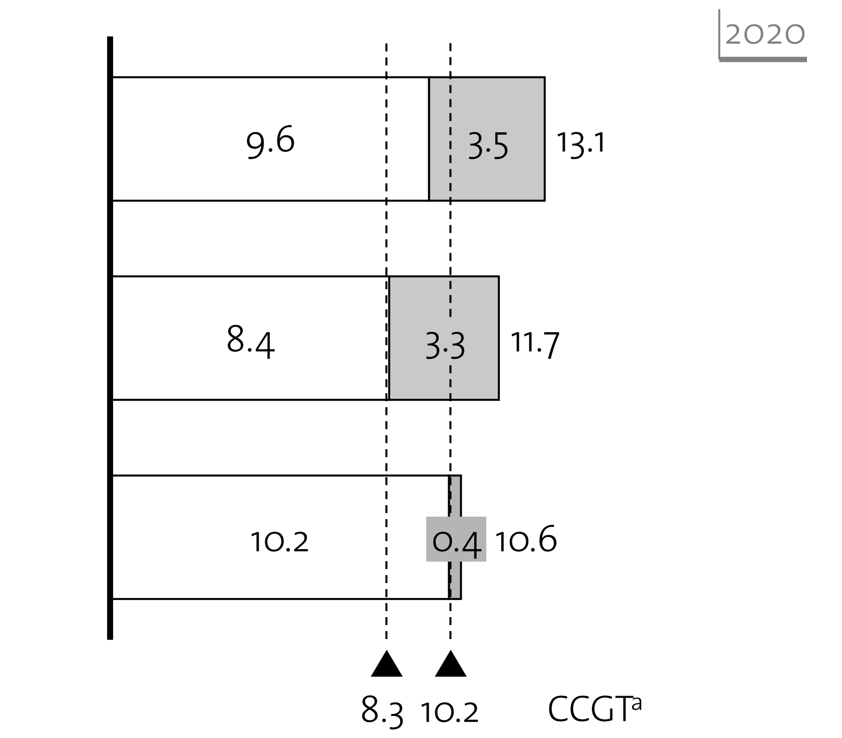
Excl. storage (capacity factors: PV 25%, CSP 26%)

Incl. 6 hours storage (capacity factors: PV and CSP 46%) [a]

Even in favourable locations large-scale solar power is not yet competitive ...



... and is unlikely to approach competitiveness before 2020



a Lower bound: excl. CO_2 price, low gas price; upper bound: incl. CO_2 price, high gas price

b CSP: Molten salt storage; PV: AA CAES

Source: Peters et al. 2011

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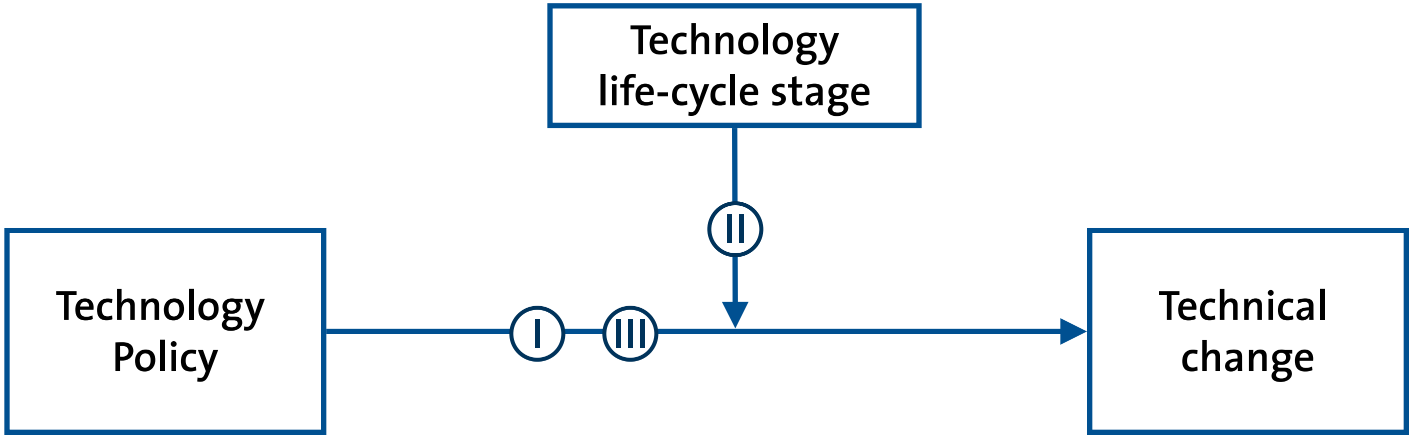
Swiss Federal Institute of Technology Zurich

It is essential to derive recommendations for improved policy support by investigating how technology policy can foster technical change



- (I) Question: How do the innovation effects of domestic and foreign demand-pull and technology-push policies differ?
- (II) How do demand-pull policies impact innovation in different phases of the technology life-cycle?
- (III) How do demand-pull policies affect corporate investments in technological learning?

Content

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I In case of solar PV demand-pull policies cause country-level innovation spillovers

Cornerstones of analysis

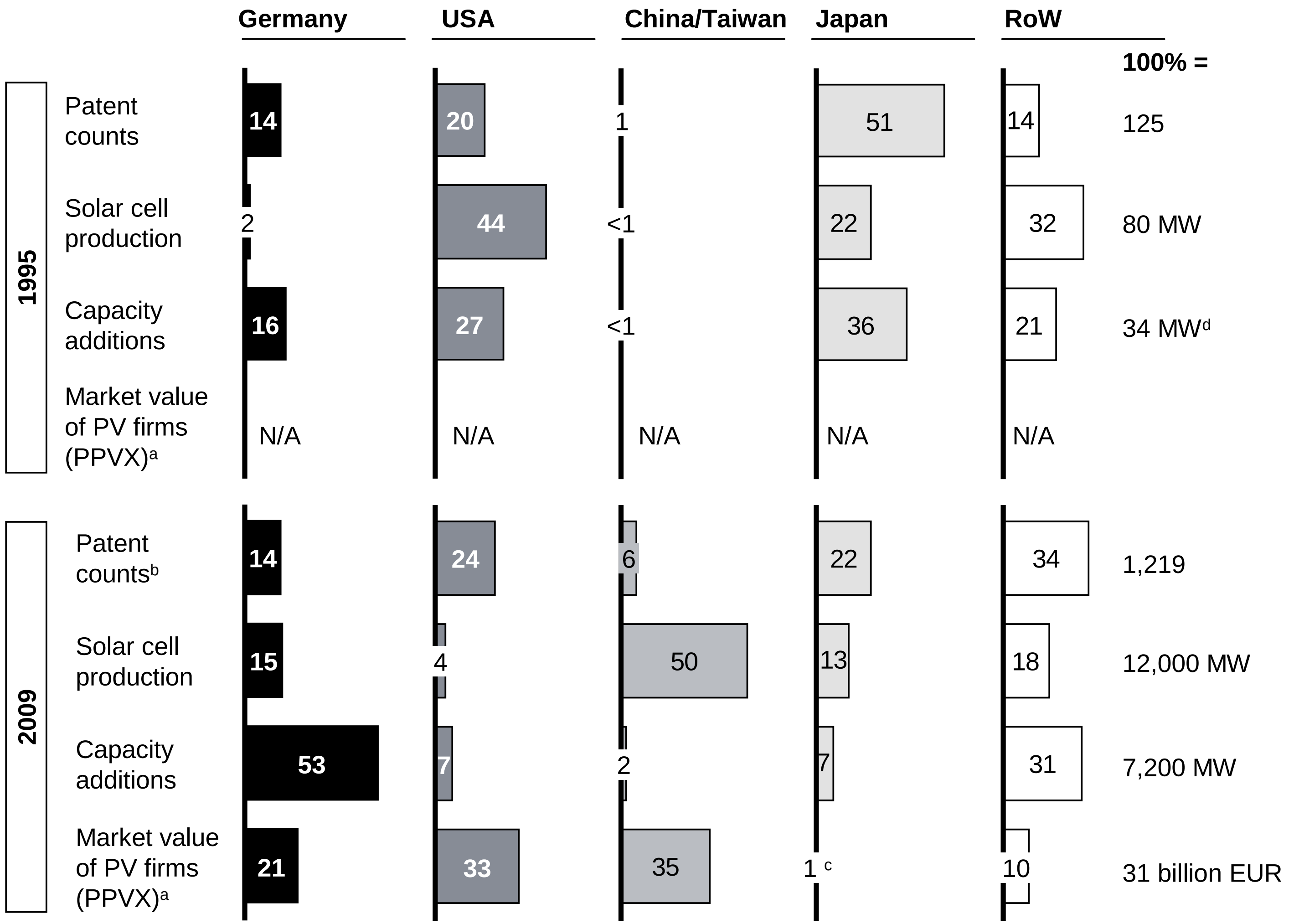
- Question: How do the innovation effects of domestic and foreign demand-pull and technology-push policies differ?
- Research case: solar photovoltaics (PV)
- Econometric panel analysis on 15 OECD countries over the period 1978 through 2005
- Innovation measured based on patent data

Key findings

	Policy locus	
	Domestic	Foreign
Technology-push policies (e.g., public R&D funding)	✓	✗
Demand-pull policies (e.g., feed-in tariffs)	✓	✓

Country-level innovation spillovers of demand-pull policies exist

While Germany has increased its share in solar PV capacity additions between 1995 and 2009 ist share in patent counts has remained constant



a Photon Photovoltaics Stock Index; average market capitalization Jan-Jun 2010; mainly solar cell/module manufacturers b As of 2007, data for 2009 not yet available
c Japanese PV industry largely consists of business units belonging to industry conglomerates. Therefore only one Japanese firm is listed in the PPVX d IEA countries only

II There is not a single, time-invariant causal effect at work between demand-pull policies and innovation

Cornerstones of analysis

- Question: How do demand-pull policies impact innovation in different phases of the technology life-cycle?
- Research case: wind power
- Econometric panel analysis on 15 OECD countries over the period 1978 through 2002
- Innovation measured based on patent data
- Analysis split in phases of high and low technological diversity

Key findings

	Era of competing technological paradigms	Era of a dominant technological paradigm
	1978 – 1989	1989 – 2002
Effect of demand-pull policies on innovation	+ to −	+++

Both eras

- Demand-pull policies trigger innovation through learning mechanisms (e.g., learning by doing)

Era of competing paradigms

- Potentially demand-pull policies have caused a decrease in technological diversity (“selection pressure”)
- This in turn might have reduced innovation

III Strong policy-induced market growth can incentivize firms to focus on investments in production capacity (exploitation)

Cornerstones of analysis

- Question: How do demand-pull policies affect corporate investments in technological learning?
- Case studies with 9 PV module manufacturers in Europe, the US, Japan and China (24 interviews with top and middle management)
- 16 leading industry experts interviewed
- Differentiation of two corporate learning modes
  - Exploration: Investments in R&D
  - Exploitation: Investments in production capacity

Key findings

- Policy-induced market growth serves as an important catalyst for innovative activity as it raises the absolute level of firm investments in technological exploration
- However, strong market growth creates an incentive for firms pursuing more mature technologies to concentrate on technological exploitation
- Firms focusing on less mature technologies cannot tap the potentials of exploitative learning to the same extent as those with more mature technologies
- Therefore, stimulating strong market growth raises the barrier to market entry for less mature technologies

Content

- Motivation of research
- Key findings
- **Policy implications**

Efficient policy support crucial to avoid unnecessary cost to society and to ensure urgently needed technical change in the field of clean energy technologies

- Policy funding is cut back or phased out due to high cost
- Competitiveness might not be reached due to technological lock-ins

Technology policy (essential to foster technical change)

Impact of technology policy in terms of benefits and costs

Policies are not efficient

- Costs are high (e.g., due to excessive growth, suboptimal country-technology combinations, inadequate balance of technology-push and demand-pull policies)
- Benefits and cost are not congruent (country-level innovation spillovers)

Policies are efficient

Further investments in technology policy likely

I Policymakers can address the issue of country-level innovation spillovers through creation of a supranational demand-pull policy scheme

Issue: Disincentive to invest in demand-pull policies

- Country-level innovation spillovers potential disincentive for policymakers to invest in demand-pull policies
- The extent of spillovers likely dependent on technological characteristics (e.g., spillovers in wind power lower than in solar PV)
- If substantial innovation spillovers exist as in the case of solar PV, policymakers may not sufficiently invest in demand-pull policies to ensure continuous market growth, which is essential to exploit the considerable potential of solar PV in the longer term.

Implication: Create a supranational demand-pull policy scheme

- Although policymaking across multiple nations is challenging (cf. slow progress towards a global climate policy), a supranational demand-pull policy scheme (e.g., as planned by the European Union) could indeed balance the effects of innovation spillovers
- Furthermore, such a scheme could include a focus on the most competitive country-technology combinations
- A strategy on the national level to mitigate spillovers involves increased investments in technology-push policies before demand-pull policies are applied

II III Policymakers should prevent excessive policy-induced market growth

Issue: Exploitation focus and technological lock-in

1. **Firms shift their balance between exploitation and exploration towards exploitation,** i.e., they increase their focus on production-related activities to reduce cost and may deprioritize R&D
   - Likely more market volume is required to achieve a certain amount of technical progress

2. **Technological lock-ins.** Demand-pull policies widen competitiveness gap between emerging and commercial technologies
   - Risk to 'select' a commercial design that in the long run may prove inferior to emerging designs and will not reach competitiveness with conventional energy technologies

Implication: Prevent excessive policy-induced market growth

- In general excessive growth should be avoided to prevent strong exploitation focus
- In particular policymakers face a trade-off when using demand-pull policies in times of high diversity
  - Learning and standardization effects such as economies of scale vs. premature technological lock-in
  - Before applying demand-pull policy schemes, policymakers should therefore attempt to gain transparency on the 'option value' of diversity in a technological field

Thank you!

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