

The impact of the German policy mix on technological and structural change in renewable power generation technologies

# Beyond patents: renewable energy innovation in Germany

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Presentation at IRENA's Innovation Week, Deep Dive Session "From Science to Innovation"  
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# Agenda

- ① Rapid technological change
- ② Policy mix for stimulating innovation
- ③ Importance of credible political will for innovation
- ④ Conclusions

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# RAPID TECHNOLOGICAL CHANGE IN RENEWABLE POWER GENERATION TECHNOLOGIES OVER LAST FEW DECADES

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# Multiple indicators for measuring innovation & technological change

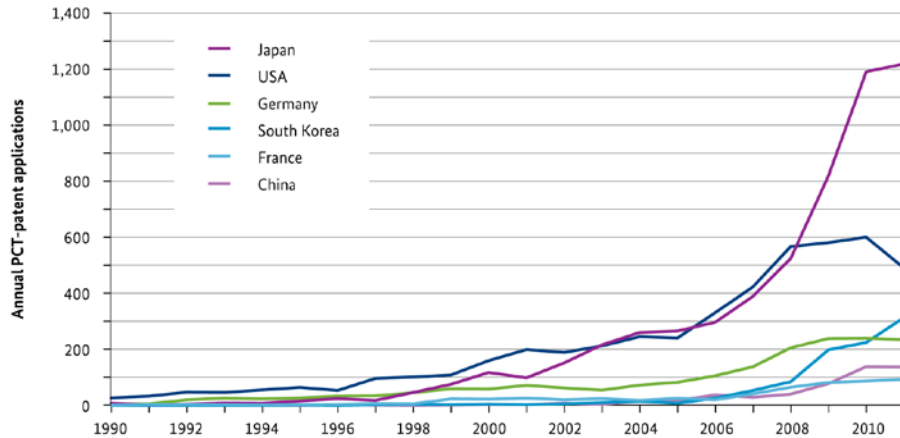
- Scientific publications
- Patents
- Innovation expenditures
- Product and process innovations
- Cost development
- Diffusion
- ...
- Innovation system (actors, networks, institutions)
- System innovation (socio-technical change)

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# Patent applications...

... strong increase for PV and wind, but recent slow down;  
German patents developed above the general patenting trend

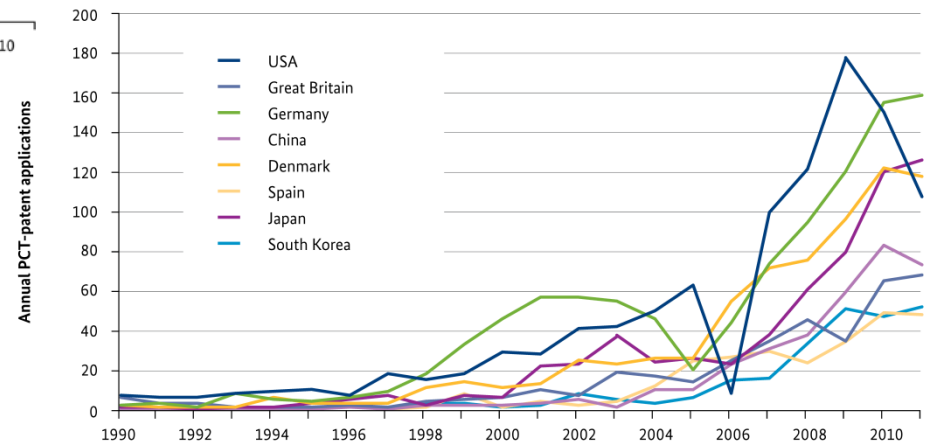
## Photovoltaics



- DE no 1 (top 4 include US, DK, CN)
- Strong increase of Asian countries (CN, JP, SK)

- DE no. 4 (after JP, US, SK)
- Catching up of Asian countries (SK, CN)

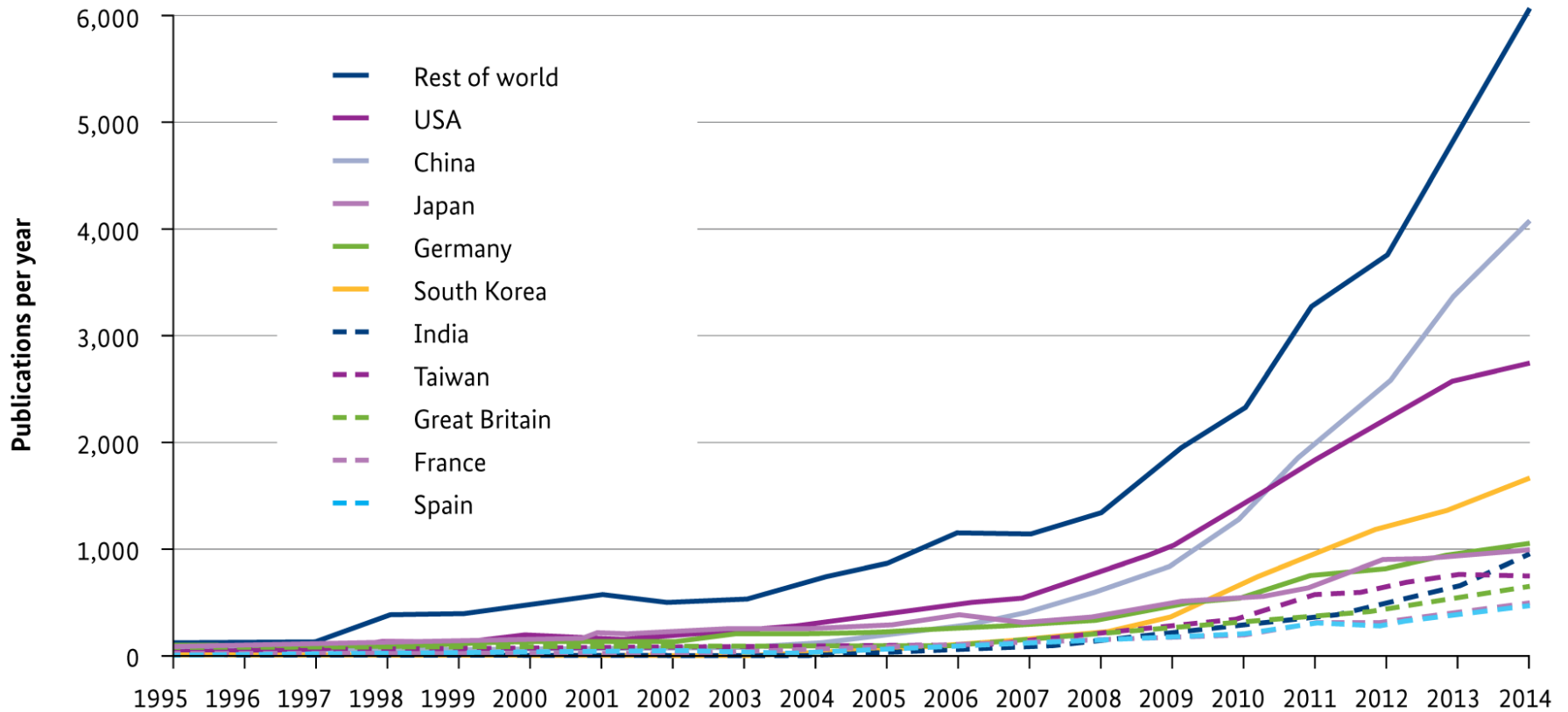
## Wind power



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# Scientific publications...

... risen sharply for photovoltaics: China, USA and South Korea leading, Germany among top 5 (with JP)



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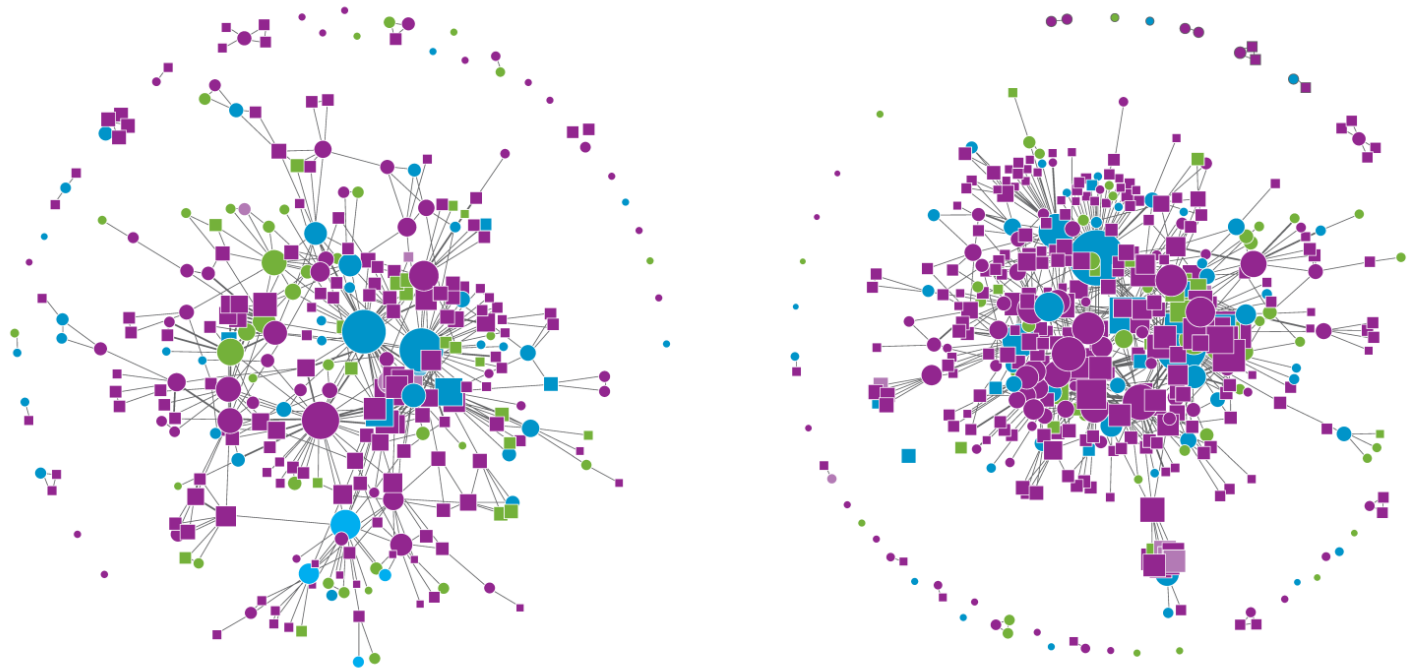
# Cooperation in innovation system...

... between various actors has increased greatly and supports innovation through resulting intensive knowledge exchange

1999–2001

2004–2006

## Photovoltaics



- Universities
- Companies
- German actor
- Research institutes
- Other actors
- Foreign actor

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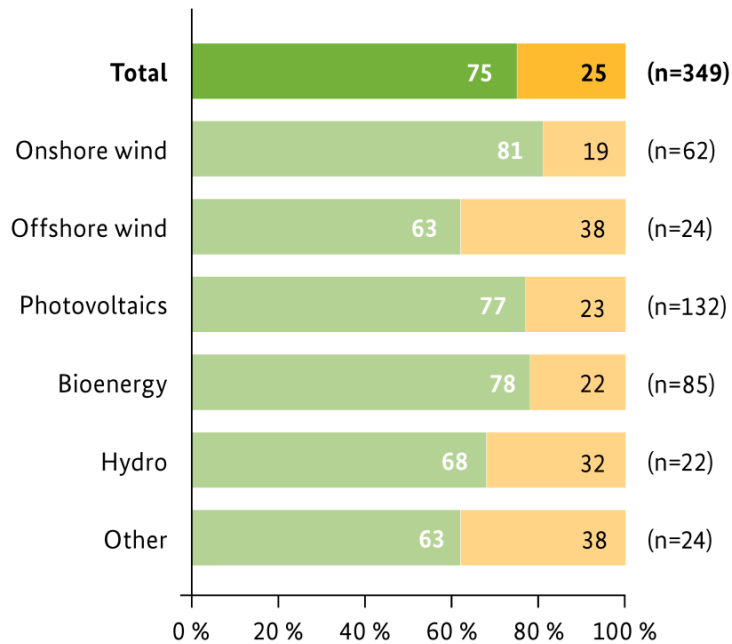


# Product and process innovations...

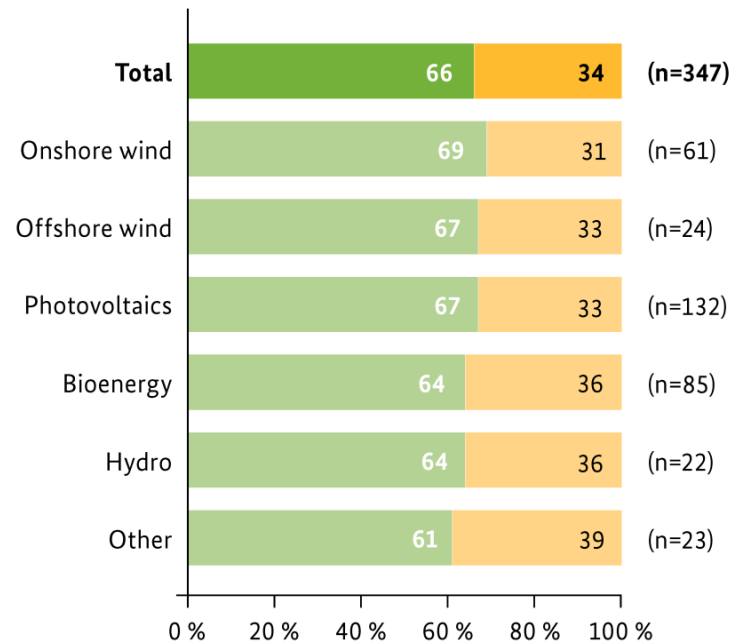
... in 2011-13 many German manufactures introduced product and process innovations, innovation expenditures in 2014 -30%

During the three years 2011 to 2013, did your company introduce new or significantly improved products or processes in the renewable energy branch?

## Product innovations



## Process innovations



■ Yes ■ No

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# POLICY MIX FOR STIMULATING RENEWABLE ENERGY INNOVATION

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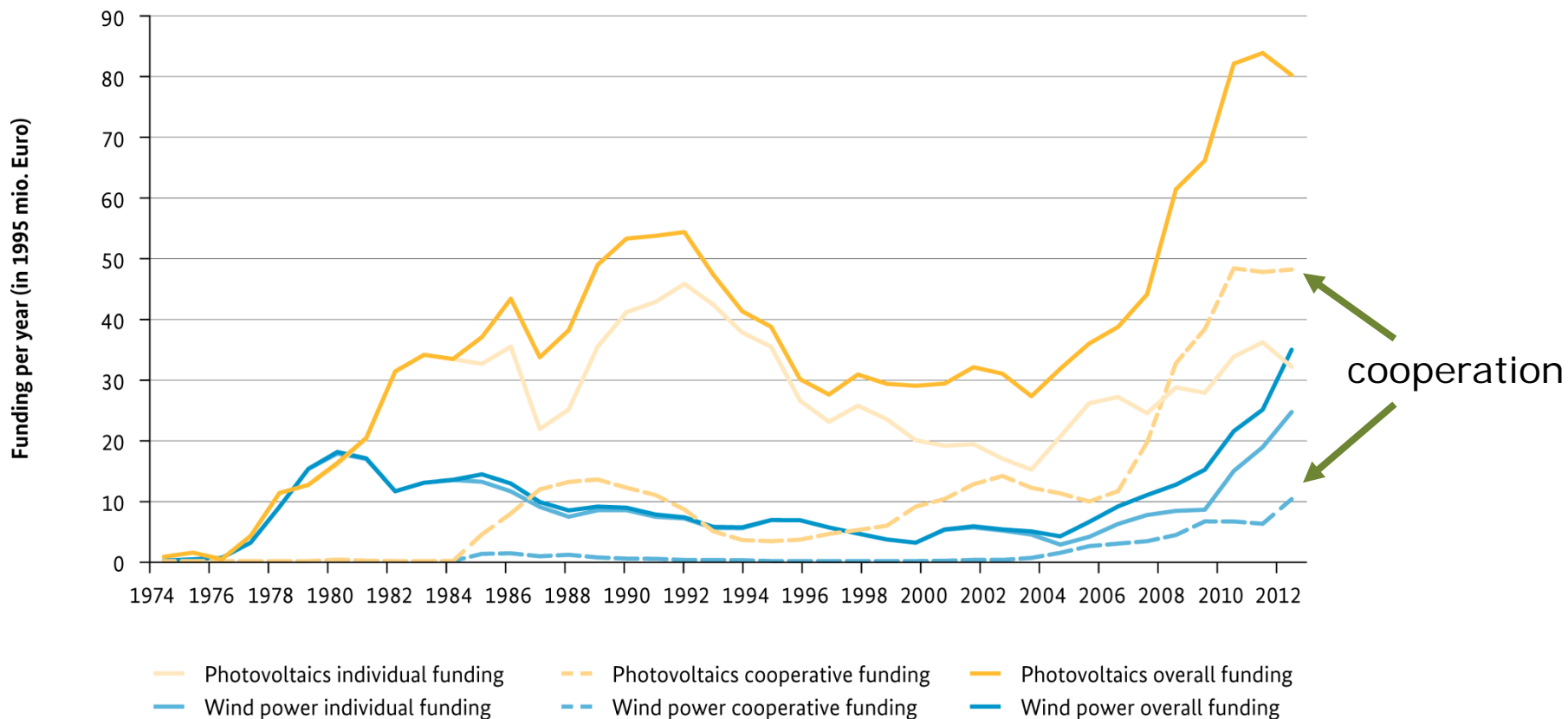
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# Public R&D funding ("tech push")...

... helps explain only part of Germany's success with renewable energy innovation: long history, strong increase in past 10 years



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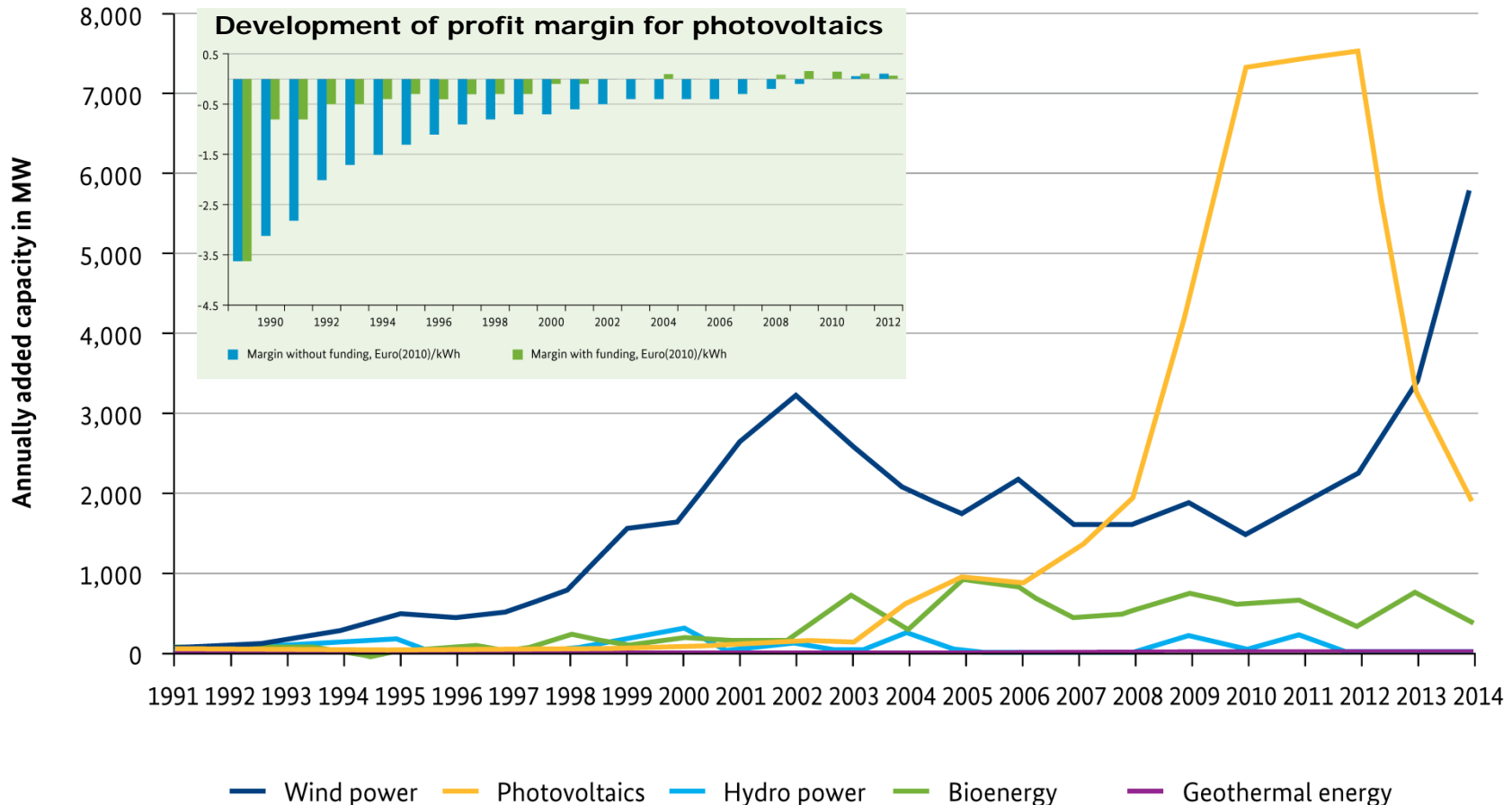
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# Market formation! ("demand pull")...

... EEG from 2000 with its predictable, technology-specific incentives & foreign equivalents, investment  $\leftrightarrow$  cost reductions

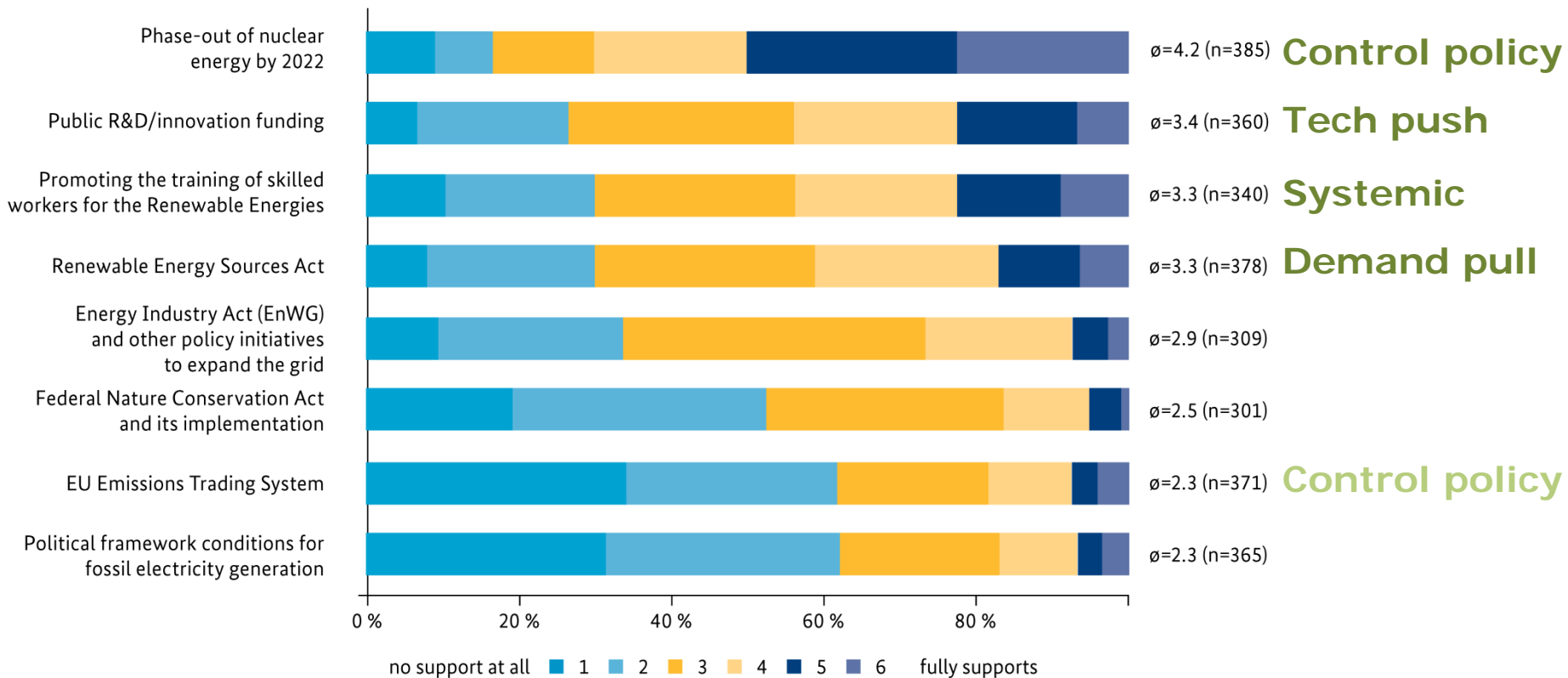


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# Consistent instrument mix matters...

...manufacturers see strongest support through nuclear phase-out, followed by combination of R&D funding, training & EEG

Please state how much you think these political instruments and measures support the expansion of renewable electricity generation in their current form?



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# IMPORTANCE OF CREDIBLE POLITICAL WILL FOR RENEWABLE ENERGY INNOVATION

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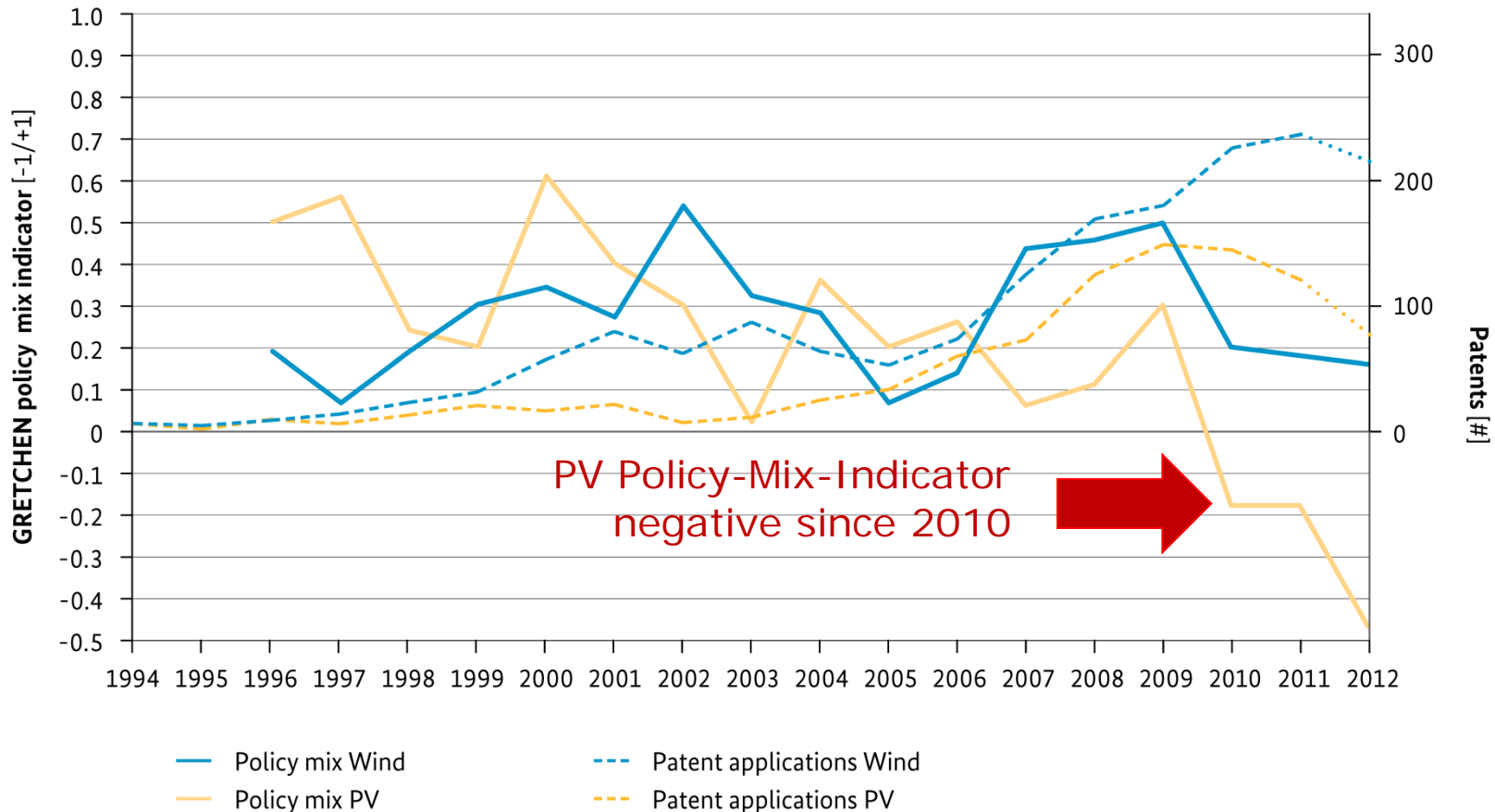
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# Early warning signs...

... declining patent applications in wind and PV: correspond to reduction in attractiveness of policy mix *(Photon & Wind Power Monthly)*

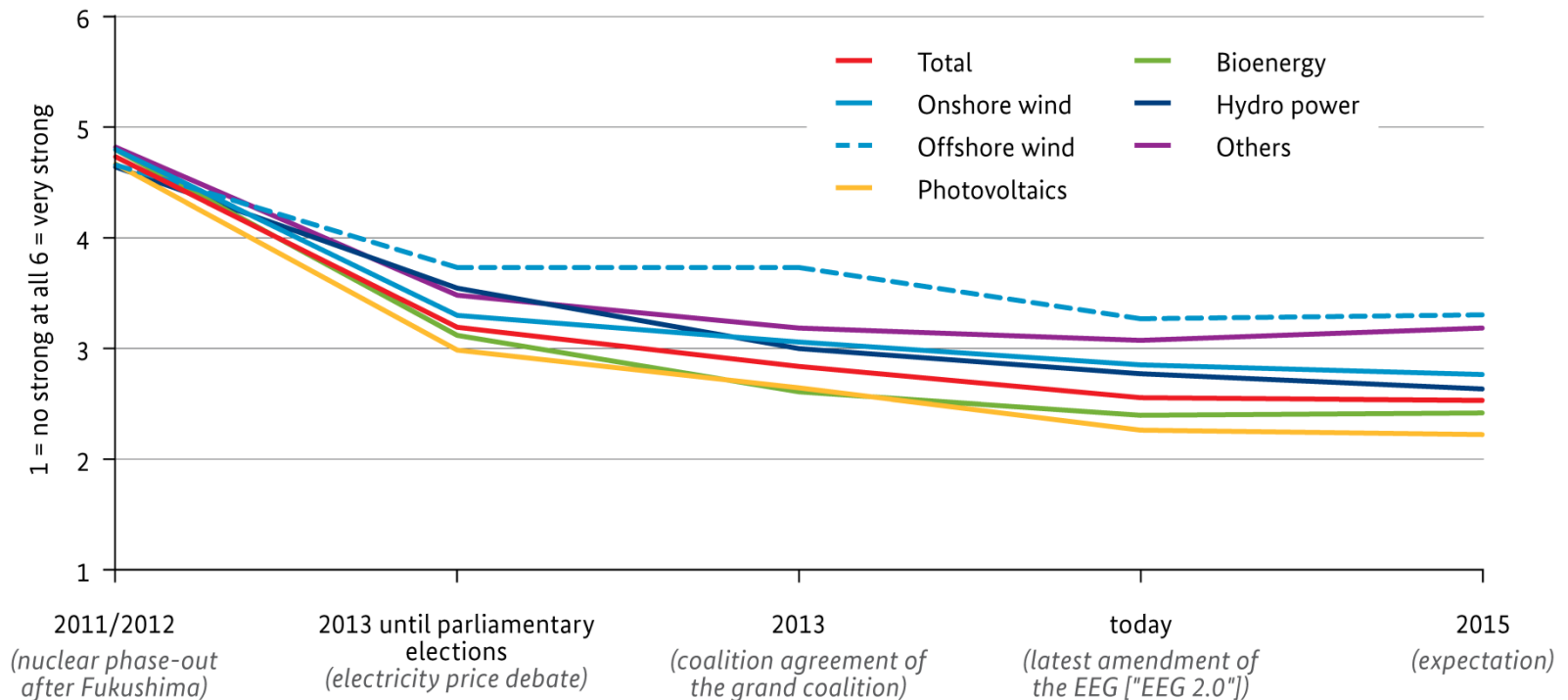


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# Credible political commitment! ...

... declining innovation expenditures by manufacturers:  
correspond to reduction of political will between 2012-14

How strong do you think the political will was/is of the respective German government at the following points in time regarding the promotion of renewable electricity generation?



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# CONCLUSIONS

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# Policy implications for stimulating renewable energy innovation

- Understand and design **policy mix as a whole** - backing only one instrument will not achieve desired result
- Aim for **credible and internally consistent** policy mix - strong political will for green transformation clarifies future market developments needed for long-term investments in innovation
- Work towards **greater supranational coordination** of policy mix as green change increasingly global process
- Orient political discussion towards **benefits** – such as export opportunities, jobs, international climate protection, sustainable development

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# Interested in finding out more?

- GRETCHEN report with all figures and further references available at project website:

„Green change: renewable energies, policy mix and innovation“

- Further information available online:  
[www.project-gretchen.de](http://www.project-gretchen.de)



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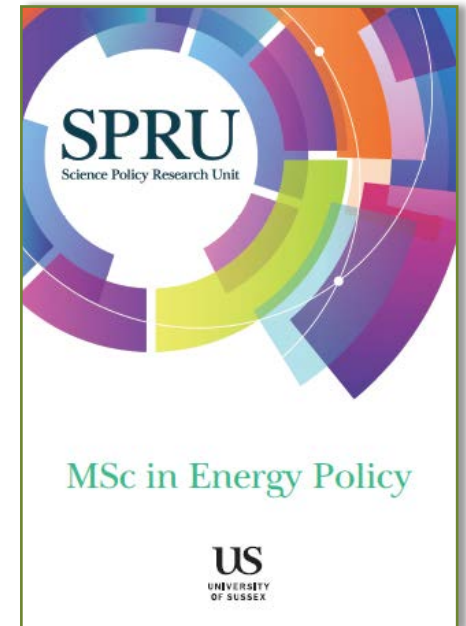
# Thank you!

Looking forward to your  
comments and questions!

Contact: [k.rogge@sussex.ac.uk](mailto:k.rogge@sussex.ac.uk)



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