

Climate Change Mitigation Technologies: Policy Drivers and Technology Transfer

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at

OECD High-Level Parliamentary Seminar
Thursday, 2 October 2008



Principles of Innovation-Inducing Environmental Policy Design

- *Stringency* – is the environmental policy target constraining (i.e. is there a shadow price)
- *Depth* – are there incentives to innovate throughout the range of potential objectives
- *Incidence* – is the point of incidence of the policy directly on the externality or is it on a ‘proxy’ for the pollutant
- *Uncertainty* – does the policy measure provide a consistent signal to investors
- *Flexibility* – does it let the innovator figure out the best way to meet the objective

On-Going Work: Evidence Based on Patent Data

(Working Party on National Environmental Policies)

- Use of PATSTAT database – allows for rich ‘search strategies’ in all environmental spheres, including climate change mitigation
- Worldwide coverage (data from 80 national and regional patent offices – i.e. all OECD countries, BRICs, etc.)
- Possible to develop accurate indicators of eco-innovation using keyword searches
- Also - possibility to develop indicators of technology transfer (international patent families)
- Links with other sources of data feasible (i.e. PRTRs and financial data from ORBIS)

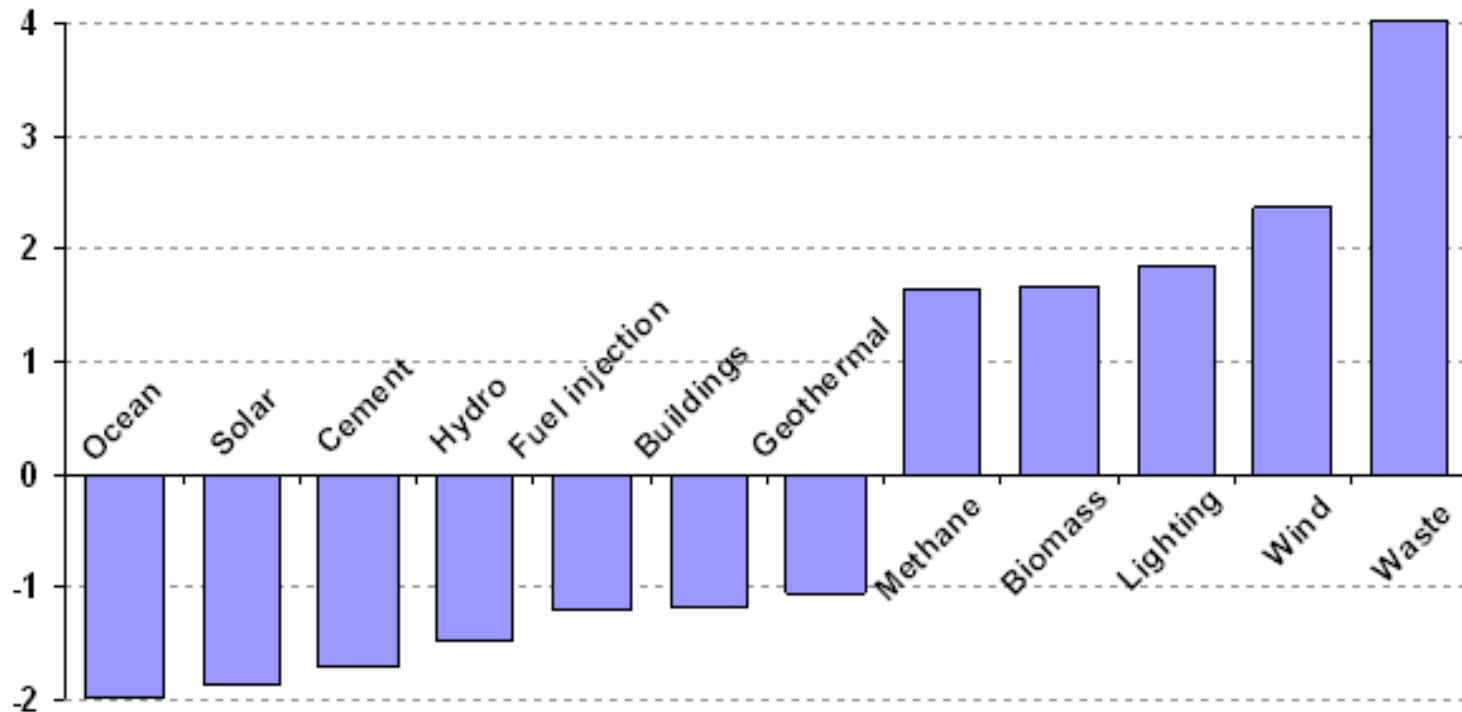
‘Environmental’ Patent Application – An Example

PCT		WORLD INTELLECTUAL PROPERTY ORGANIZATION International Bureau	
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)			
(2) International Patent Classification ⁷ :		(1) International Publication Number: WO 94/04820	
B01D 7/04		A1	
(3) International Application Number: PCT/DK93/00279		(4) International Publication Date: 3 March 1994 (93.03.94)	
(2) International Filing Date: 26 August 1993 (26.08.93)			
(8) Priority Data: 1835/92 26 August 1992 (26.08.92) DK			
(7) Applicant and Inventor: ULLERSTED, Hans (DK/ DK); Kantstovvej 65, DK-4500 Møllebøen (DK)		(9) Designated States: AT, AU, BE, BG, BR, BY, CA, CH, CE, DE, DK, ES, FI, GB, GR, JP, KP, KR, KZ, LI, LU, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, US, VN. European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), GAPP patent (EP, BG, CT, CG, CL, CM, GA, GN, NL, MR, NE, SN, TD, TG).	
(7) Inventor: and (7) Inventor/Applicant (for US only): HANSEN, Per (DK/ DK); Erntevænget 3, DK-5656 Rydager (DK); NIELSEN, Arne (DK/US); P.O. Box 1872, Palm Springs, CA 92263 (US)			
(7) Agent: K. SKOTT-JENSEN PATENTINGENØRER A/S; Lønningsvej 225, DK-4361 Hassinger (DK)		Published <i>With international search report. In English translation (filed in Danish).</i>	
(54) Title: WINDMILL, WIND FOR SUCH A MILL, AND ADD-ON ELEMENT TO BE MOUNTED ON A MILL WING			
(57) Abstract			
<p>Generally speaking, multi-regulated mill blades have a lower pre-pubertive effect at higher than at lower temperatures because the air density at any given wind velocity is lower, the higher the temperature is. This condition is critical at the stall-wind velocity where the mill produces the maximum effect at which it is designed to perform. If the wings are regulated for maximum performance at high temperatures, then overload will occur at low temperature stall-wind velocity conditions. In consequence, the wings are normally adjusted to low temperature conditions, in return for which it becomes necessary to relinquish the maximum effect at high temperatures. With the invention, an air temperature sensor (10, 16, 22, 34) is provided which by means of connected actuator means (14, 20, 23) can change the wing structure such that the wing becomes generally less efficient at decreasing temperatures. Herby it is possible to increase the effect of the mill, so that it will be able to better exploit the high wind velocity at high temperatures without incurring problems at low temperatures in terms of overload.</p>			

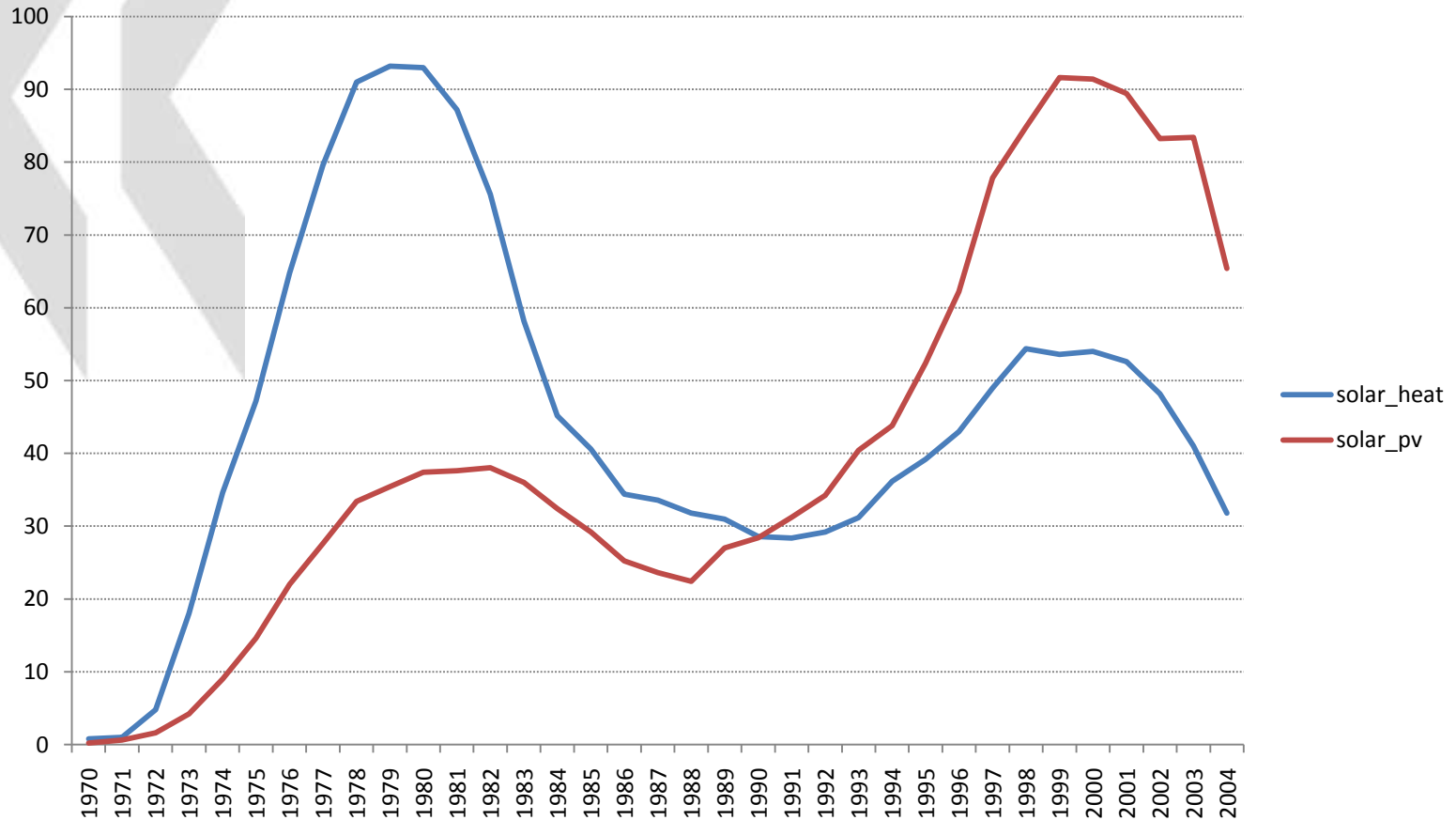
Areas Examined of Relevance for Climate Change

- Renewable energy (biomass, geothermal, hydro, ocean/tide, solar, waste-to-energy, wind)
- Energy efficiency of buildings, building materials, and lighting
- Motor vehicle fuel efficiency and alternative-fuelled vehicles (hybrid and electric)
- Methane destruction and carbon capture and storage
- Energy efficiency in manufacturing (cement)

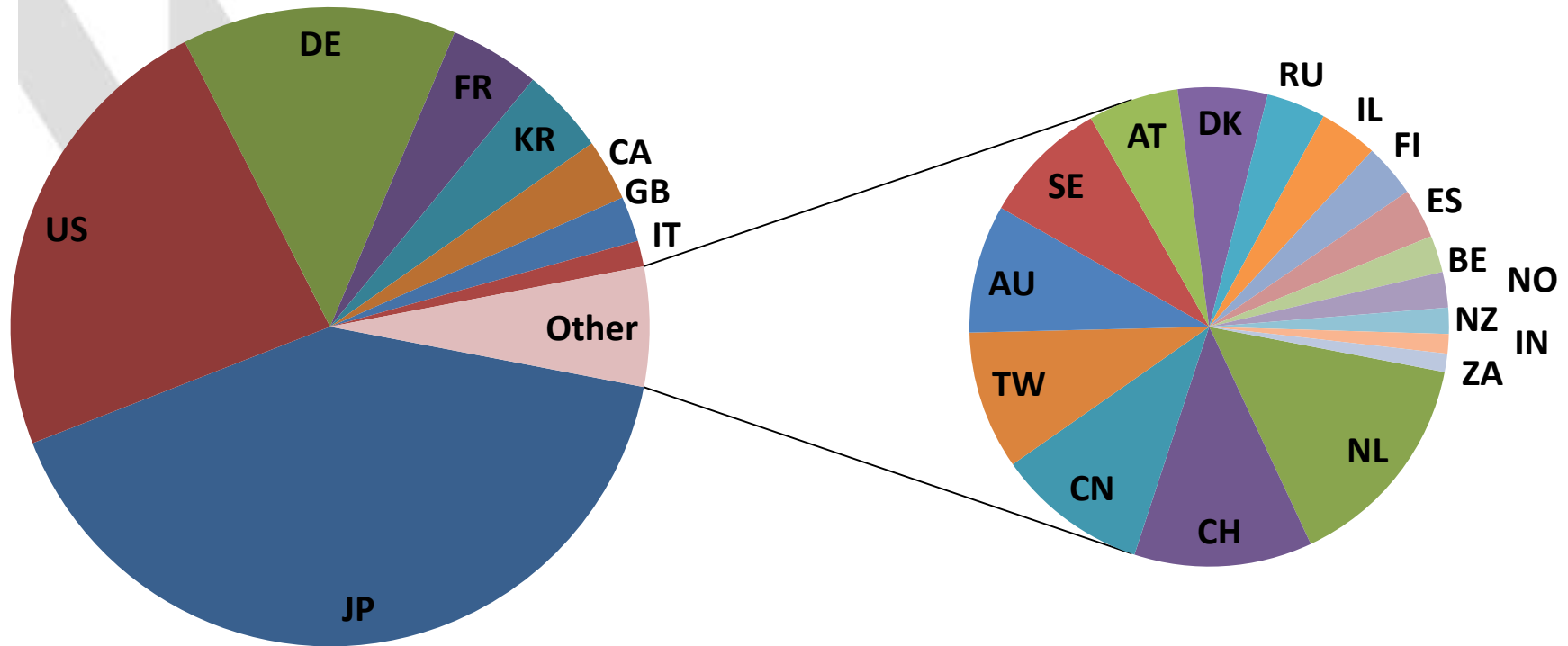
Growth rate in patenting relative to 'baselines'



Technological 'Generations': The Case of Solar Power



Who Innovates? Hybrid Vehicles Patents (2000-2004)



Assignees of Carbon Capture Patents (1990-2004)

<i>Assignee</i>	<i>Country</i>	<i>Share</i>
MITSUBISHI CORP	JP	14.9%
KANSAI ELECTRIC POWER CO	JP	9.0%
MARINE DESALINATION SYSTEMS	US	2.8%
PILKINGTON GLASS LTD	GB	2.1%
TOKYO SHIBAURA ELECTRIC CO	JP	2.1%
UNITED TECHNOLOGIES CORP	US	2.1%
AGENCY IND SCIENCE TECHN	JP	2.1%
ADVANCED ELECTRON BEAMS INC	US	1.7%
SHELL INT RESEARCH	NL	1.7%
AIR LIQUIDE	FR, US	1.4%
TOSHIBA KK	JP	1.4%
INST FRANCAIS DU PETROL	FR	1.4%
BOC GROUP PLC	GB	1.4%
PRAXAIR TECHNOLOGY INC	US	1.0%
TNO	NL	1.0%
GLOBAL RES TECHNOLOGIES LLC	US	1.0%
CANADA NATURAL RESOURCES	CA	1.0%
NORSK HYDRO AS	NO	0.7%

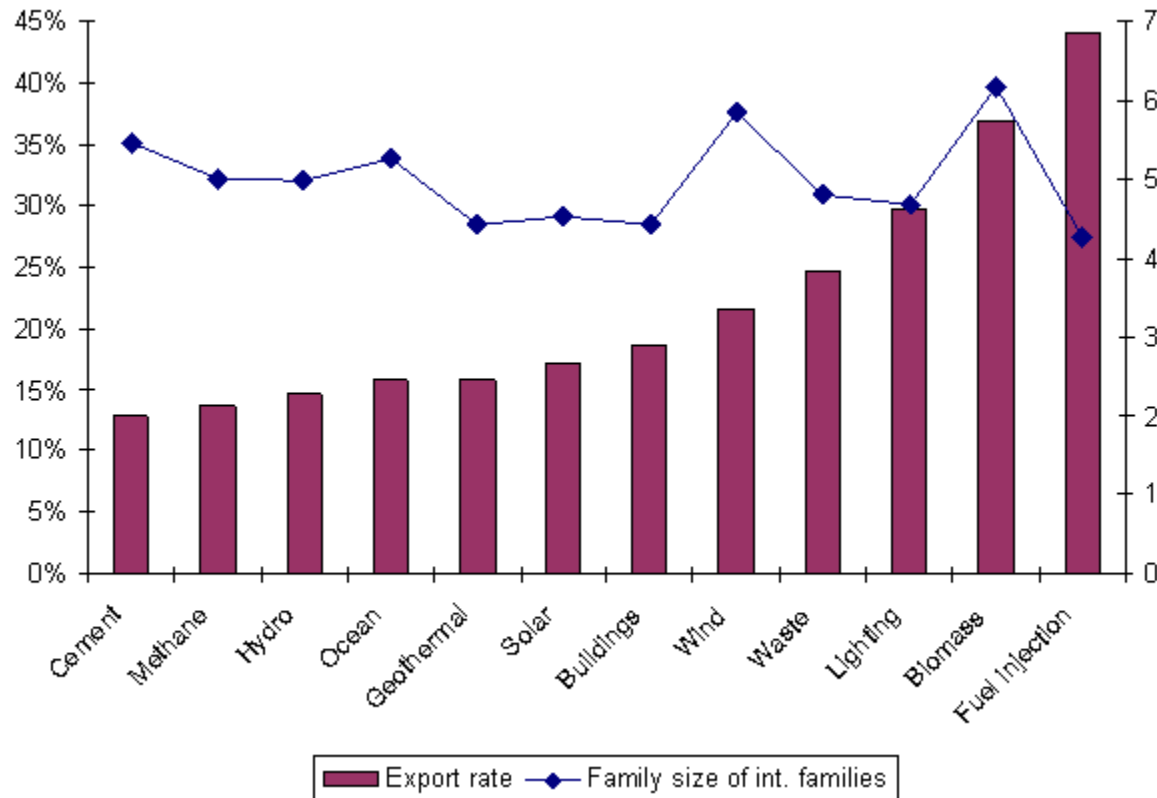
What Encourages Innovation? Preliminary Evidence Based on Renewable Energy and Alternative-Fuelled Vehicles

- Prices matter – i.e. barrel of oil for renewable energy generation and fuel price for motor vehicles
- But for technologies which are less mature (e.g. solar concentrating power or electric vehicles) public expenditures on R&D are important
- In addition – less mature technologies require ‘certainty’ in policy incentives in order to induce innovation
- Finally, general scientific capacity in all areas is the biggest ‘driver’ of innovation
- On-going work in different areas and further model refinement

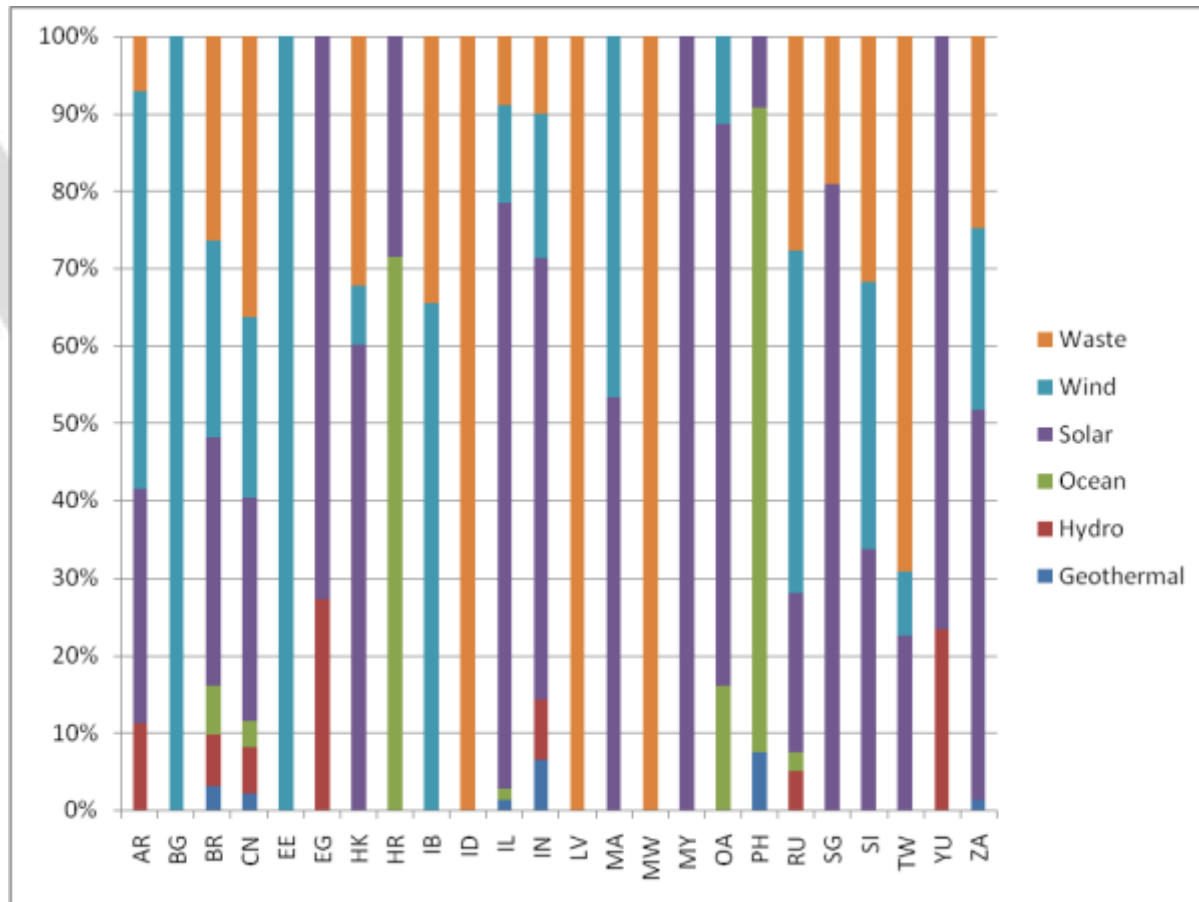
International Transfer of Climate Change Mitigation Technologies

- New work on ‘globalisation’ of eco-innovation, with focus on technology transfer related to climate change mitigation
- Assessed via spatial patterns of ‘priority office’ and ‘duplicate office’ patent claims
 - who are sources;
 - who are recipients;
 - and why?
- Assessment of role of policy design (source and recipient), absorptive capacity, market factors and Kyoto mechanisms

Globalisation of Climate Change Mitigation Technologies



'Duplicate' Patent Applications for Renewable Energy Technologies in non-OECD Countries



Example: Solar Photovoltaics to/from Israel



Climate Change Innovation and Absorptive Capacity

