CMCC WEBINAR

November 27, 2018 - h.12:30 pm CET

"Low-carbon energy finance – new research results and their implications for modelers and policy makers"

Tobias S Schmidt - *Presenter*
Energy Politics Group (ETH Zurich)

Bjarne Steffen - *Presenter*
Energy Politics Group (ETH Zurich)

Elena Verdolini - *Moderator*
RFF-CMCC European Institute on Economics and the Environment (EIEE)

cmcc

www.cmcc.it

MISSION

To investigate and model our **climate system** and its interactions with **society** to provide reliable, rigorous, and timely **scientific results**, which will in turn stimulate sustainable growth, protect the **environment**, and **develop science driven** adaptation and **mitigation policies** in a **changing climate**

cmcc
Centro Euro-Mediterraneo sui Cambiamenti Climatici

NETWORK

RESEARCH DIVISIONS

Advanced Scientific Computing (ASC)

Climate Simulation and Prediction (CSP)

Economic analysis of Climate Impacts and Policy (ECIP)

Impacts on Agriculture, Forests and Ecosystem Services (IAFES)

Ocean modeling and Data Assimilation (ODA)

Ocean Predictions and Applications (OPA)

Risk Assessment and Adaptation Strategies (RAAS)

REgional Models and geo-Hydrological Impacts (REMHI)

Sustainable Earth Modelling Economics (SEME)

TOPICS


Modelling
Policy
Adaptation
Agriculture
Society
Predictions
Impacts
Hydrogeology
Forests
Simulations
Oceans
Ecosystems
Computing
Services

OUTREACH

Publications

Events

Education

Communication

Q&A session

To participate in the Q&A Session, please use the “Questions” menu provided by the Go-to-Webinar system

ETH zürich

CMCC webinar, Zurich, Nov 12, 2018

Prof. Tobias Schmidt, Dr. Bjarne Steffen, Energy Politics Group, ETH Zurich, www.epg.ethz.ch

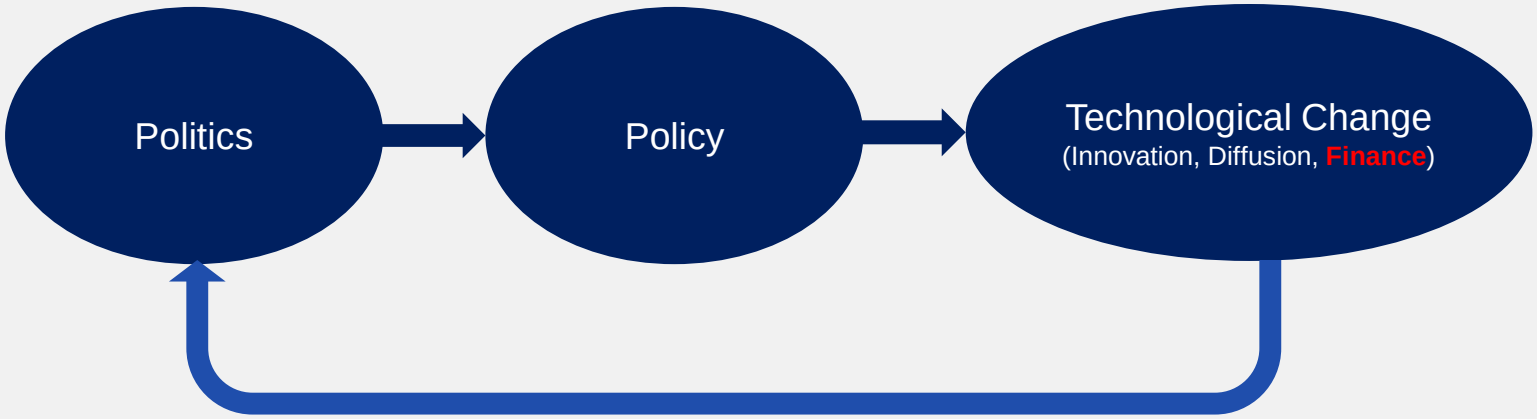
Low-carbon energy finance

new research results and their implications for modelers and policy makers

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730403, as well as from the European Research Council under grant number 313553. It has also received funding by the Swiss State Secretariat for Education, Research and Innovation (SERI) [contract number 16.0222] and ETH Foundation. The opinions expressed & arguments employed herein do not necessarily reflect the official views of the Swiss Government. The project was also supported by a seed grant from ETH Zurich foundation.

EPG's research framework: Analyzing the co-evolution of policy with technological change

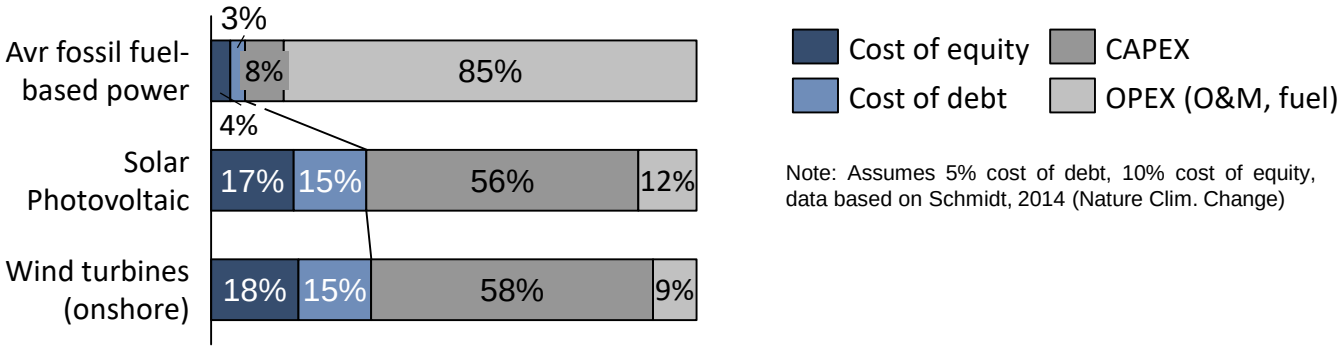
Energy sector



We are an interdisciplinary team of engineers, economists, and political scientists

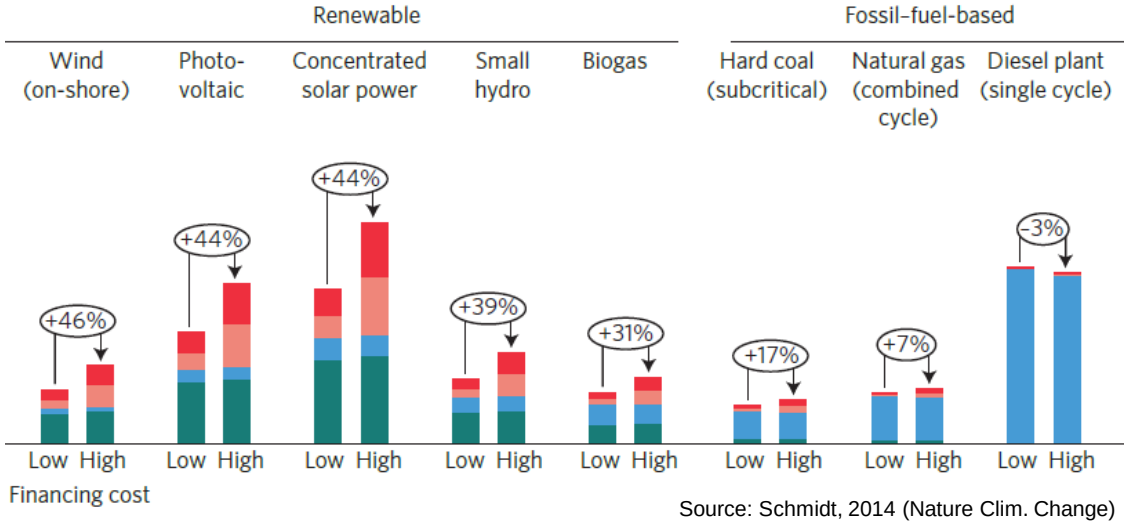
Financing is more relevant for low-carbon energy technologies, due to their higher capital intensity

Percentage of different cost components in LCOE



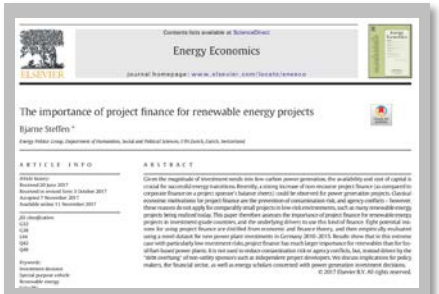
Note: Assumes 5% cost of debt, 10% cost of equity, data based on Schmidt, 2014 (Nature Clim. Change)

Impact of increased cost of capital on LCOE



Source: Schmidt, 2014 (Nature Clim. Change)

The four papers of this talk and their key messages

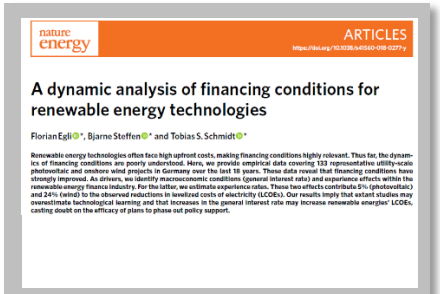

Energy Economics

The importance of project finance for renewable energy projects

Bjarne Steffen *

Main messages

- Renewable energy assets heavily rely on non-recourse project finance (vs. corporate finance for conventional plants)
- Key driver is debt overhang of fast-growing new entrants

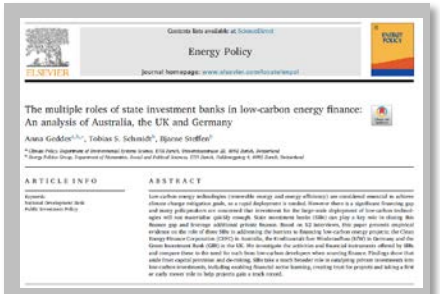

nature energy ARTICLES

A dynamic analysis of financing conditions for renewable energy technologies

Florian Egli*, Bjarne Steffen* and Tobias S. Schmidt*

Main messages

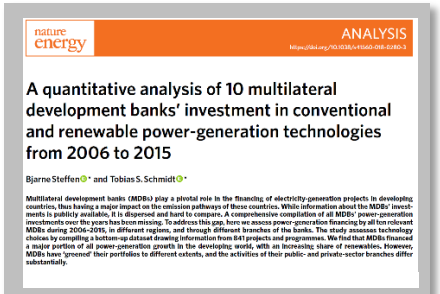
- The cost of capital for project-financed renewable energy assets has fallen substantially over the last 15 years
- We detect a financing experience curve (investors also learn)


Energy Policy

The multiple roles of state investment banks in low-carbon energy finance: An analysis of Australia, the UK and Germany

Main messages

- "Green" state investment banks (SIBs) help in overcoming investors' aversion against new energy assets
- SIBs found to crowd-in private finance rather than crowd-out


nature energy ANALYSIS

A quantitative analysis of 10 multilateral development banks' investment in conventional and renewable power-generation technologies from 2006 to 2015

Bjarne Steffen* and Tobias S. Schmidt*

Main messages

- Multilateral development banks (MDBs) have "greened" their power generation portfolios to very different extents
- MDBs' public sector branches are typically less "green" than their private sector branches

Project finance: A niche of capital markets, but not for RE

Corporate Finance (CF)

Financing of new project on the balance sheet of the sponsor

- Using assets and cash flows from existing firm to guarantee additional credit provided by lenders
- Cost of capital determined by sponsor solidity

Project Finance (PF)

Creating a special purpose vehicle (SPV) to incorporate new project

- No guarantee from sponsor's assets, lenders depend on cash flows of new project alone
- Cost of capital cost determined by project cash flows and risks

Very often used for wind & solar

Classical economic motivations for PF do not hold for renewables in OECD countries

Thus study addresses research questions:

1. ***How important is project finance for renewable energy projects in developed, low-risk countries?***
2. ***What are the drivers and underlying reasons to use project finance in such settings?***

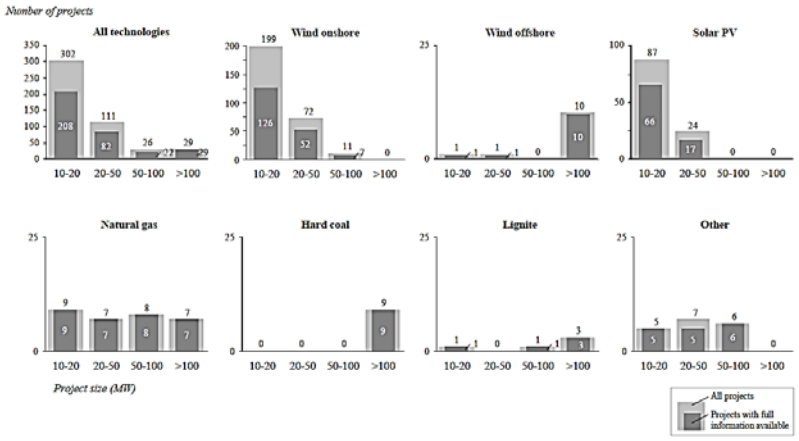
Steffen, B. (2018), The importance of project finance for renewable energy projects, *Energy Economics* (69), 280–294.

Quantitative analysis of extreme low-risk case DE

Case selection: Germany

Polar type sampling: DE as extreme example of low-risk environment for renewables

- «Best-in-class» as per UNDP
- Well-developed capital markets



Data: Utility-scale projects 2010–2015

Analysis of new dataset, combining asset list from grid regulator with financial info from trade register

- Showing finance structure in population
- Regression analysis to identify drivers

		A (all sponsors)	B (all sponsors)	C (all sponsors)	D (all sponsors)	E (all sponsors)	F (only RegMun[a])
Project size	Installed capacity	2.271 (2.175)	2.758 (2.483)	1.944 (2.636)	4.051* (2.436)	3.631 (3.370)	0.458 (3.090)
	Installed capacity squared	-1.038 (0.854)	-1.804 (1.157)	-1.299 (0.916)	-1.618* (0.969)	-1.633 (1.322)	0.296 (1.047)
Project risk	Merchant risk (no feed-in tariff)	-2.559*** (0.771)	-2.190*** (0.803)	-2.702*** (0.886)	-4.824*** (0.642)	-0.935 (1.438)	-3.827 (3.513)
	Renew. tech. risk[b] (wind offshore)	-2.391* (1.268)	-2.596* (1.394)	-2.012 (1.898)	-3.347** (1.422)	-2.663 (1.907)	-1.607 (1.811)
Technology controls	Hard coal		2.396 (2.786)				
	Solar PV		2.673*** (1.026)				
Free CF pot.[c]	CAPEX to OPEX ratio					4.049*** (1.478)	4.724* (2.473)
Sponsor type	Big four utility	-0.810 (0.876)	-0.458 (0.903)	-0.787 (0.869)		-0.662 (1.016)	
	Regional/municipal utility	-0.425 (0.833)	-0.555 (0.874)	-0.393 (0.852)		-0.474 (0.962)	
	Foreign utility/IPP	0.948 (1.038)	1.073 (1.039)	0.940 (1.025)		1.250 (1.208)	
	Project developer	2.371*** (0.812)	2.024** (0.926)	2.409*** (0.839)		2.297** (0.933)	
	Industry	-0.620 (1.017)	-0.913 (0.987)	-0.573 (1.046)		-1.057 (1.152)	
	Cooperative/individuals	3.604*** (1.259)	3.541*** (1.283)	3.623*** (1.263)		3.638*** (1.348)	
	Horizontal joint venture	1.381* (0.722)	1.889** (0.803)	1.368* (0.715)	0.147 (0.835)	2.239** (0.974)	1.749 (1.264)
Interaction terms	Installed capacity × Merchant risk			0.194 (0.560)			
	Big four utility × No merchant risk				-2.313*** (0.761)		
	Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
	Pseudo-R^2	0.522	0.534	0.523	0.429	0.578	0.347
	Observations	292	287	292	341	276	64

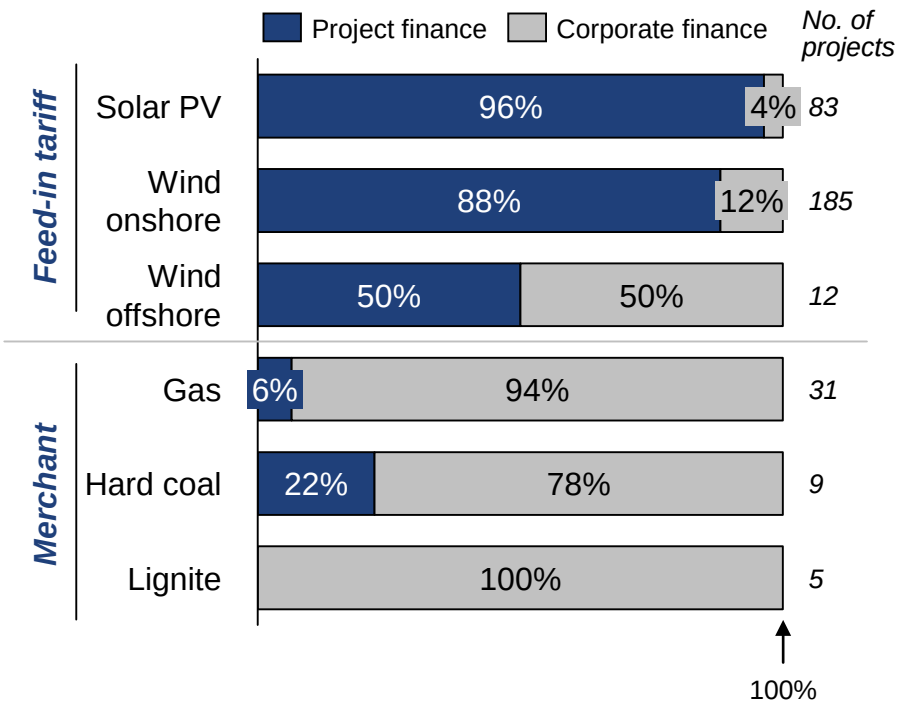
Standard errors in parentheses
[a]RegMun = Regional/municipal utility [b]Renew. tech. risk = Renewables technology risk [c]Free CF pot. = Free cash flow potential
*statistically significant at 10%; **significant at 5%; ***significant at 1%

Steffen, B. (2018), The importance of project finance for renewable energy projects, *Energy Economics* (69), 280–294.

Results: High share of PF for RE, driven by new players

Renewables with much lower risk than fossil fuels – still, use more project finance

German power generation projects 2010–2015



Key reason: small balance sheets of new players in industry

Results from regression analysis on rationales to use project finance

Negative financial synergies with existing business

~~1. Contamination risk~~

2. Debt overhang

~~3. Securitization~~

(Further) market imperfections

~~4. Information asymmetry~~ btw. sponsor & lender

5. Agency owners & mgrs

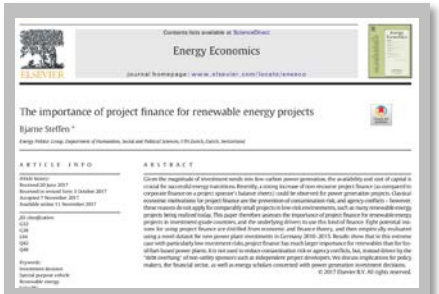
Considerations regarding org. structure

~~6. Horizontal joint ventures~~

7. Independence civic prjcts

Steffen, B. (2018), The importance of project finance for renewable energy projects, *Energy Economics* (69), 280–294.

The four papers of this talk and their key messages

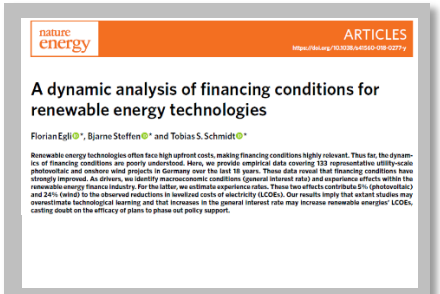

Energy Economics

The importance of project finance for renewable energy projects

Bjarne Steffen *

Main messages

- Renewable energy assets heavily rely on non-recourse project finance (vs. corporate finance for conventional plants)
- Key driver is debt overhang of fast-growing new entrants

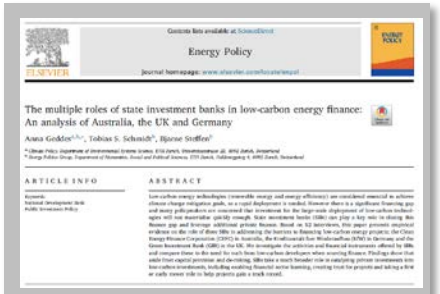

nature energy ARTICLES

A dynamic analysis of financing conditions for renewable energy technologies

Florian Egli*, Bjarne Steffen* and Tobias S. Schmidt*

Main messages

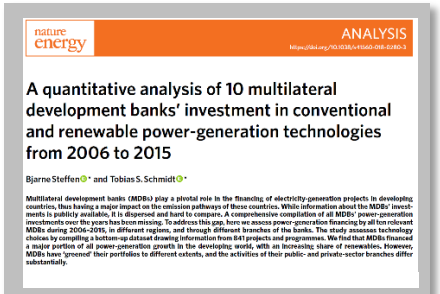
- The cost of capital for project-financed renewable energy assets has fallen substantially over the last 15 years
- We detect a financing experience curve (investors also learn)


Energy Policy

The multiple roles of state investment banks in low-carbon energy finance: An analysis of Australia, the UK and Germany

Main messages

- "Green" state investment banks (SIBs) help in overcoming investors' aversion against new energy assets
- SIBs found to crowd-in private finance rather than crowd-out


nature energy ANALYSIS

A quantitative analysis of 10 multilateral development banks' investment in conventional and renewable power-generation technologies from 2006 to 2015

Bjarne Steffen* and Tobias S. Schmidt*

Main messages

- Multilateral development banks (MDBs) have "greened" their power generation portfolios to very different extents
- MDBs' public sector branches are typically less "green" than their private sector branches

Literature lacked an analysis of the financing cost dynamics of renewables

Our research questions

1. How and why did solar PV and wind onshore financing conditions in DE change over time?
2. What is the effect of these changes on their generation costs (LCOE)?

Challenges:

- *Scarce data, as financial details of project finance deals not disclosed*
- *For "why" part: Interest rate levels affected by multitude of drivers*

We focus on Germany and use a mixed-method approach, taking four steps

1. **Descriptive: Elicitation and mapping of project finance data**
   - Cost of equity, cost of debt/debt margin
   - Leverage, loan tenor, debt service coverage ratio

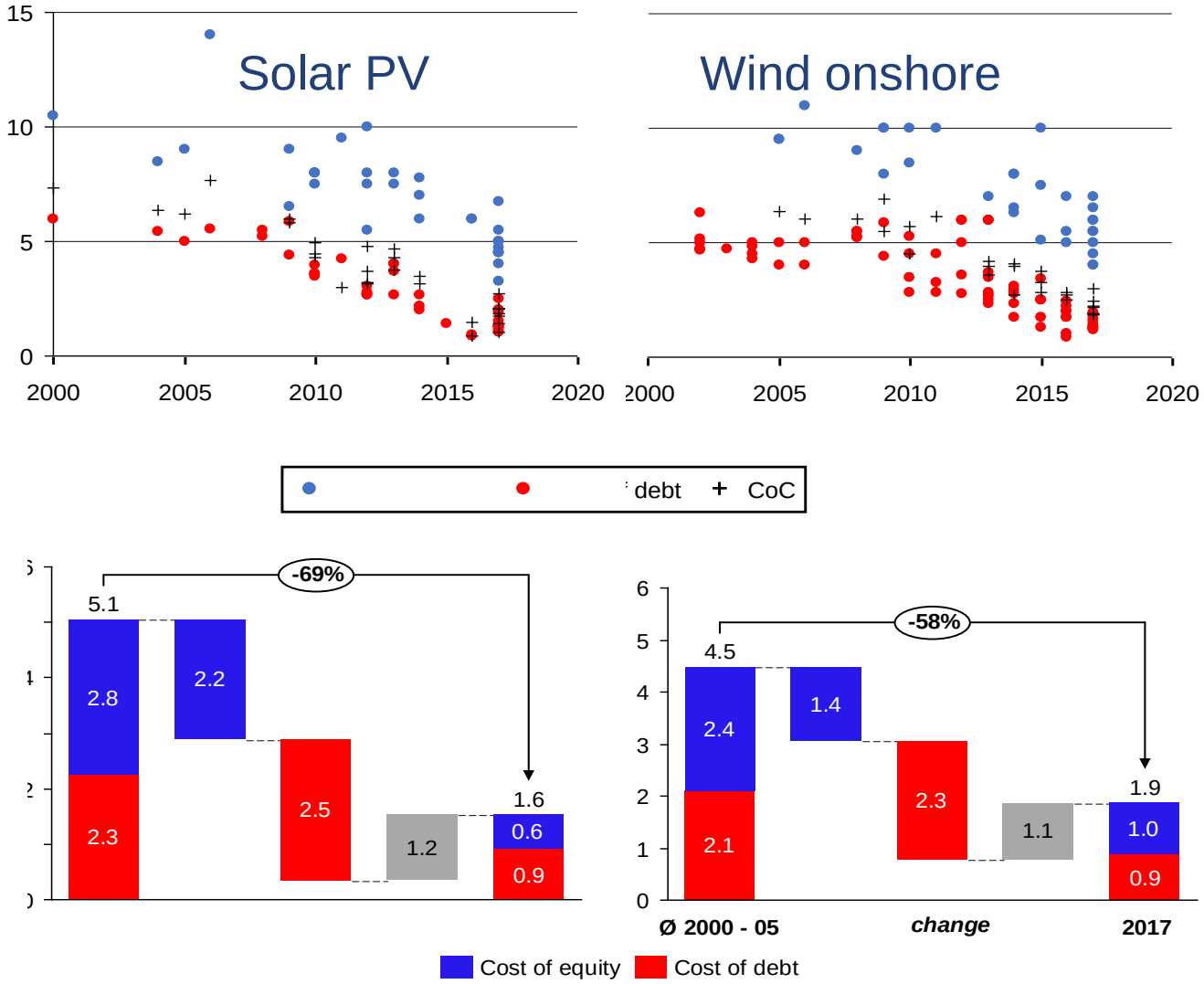
2. **Qualitative: Investor interviews to identify drivers for changes**
   - Semi-structured interviews, grounded theory-type coding of arguments

3. **Quantitative: Regression analysis for experience curves**
   - Various specifications of dependent and independent variables

4. **Model-based: Split-up of LCOE into technology cost effects**
   - Calibration of levelized cost of electricity (LCOE) in different settings

Egli, F., Steffen, B., Schmidt, T. S. (2018). A dynamic analysis of financing conditions for renewable energy technologies. Nature Energy, available online

Step 1: Historic development of the cost of capital



Egli, F., Steffen, B., Schmidt, T. S. (2018). A dynamic analysis of financing conditions for renewable energy technologies. Nature Energy, available online

Step 2: We detect drivers on 3 levels

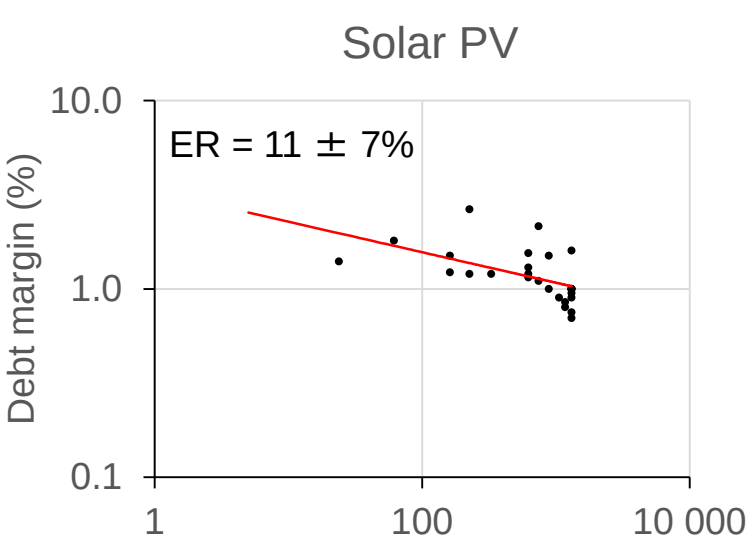
Level	Drivers of changes in financing conditions	
Economy	▪ **Capital markets:** Low-cost liquidity, few investment alternatives, low return expectations ▪ **Banks:** Low-cost refinancing, low bank fees, preference for project finance	*Drivers related to general economic development*
Renewable energy sector	▪ **Availability of performance data:** Accumulated operation experience of RET assets ▪ **Technology reliability:** Proven track record of technology, low default rates of projects ▪ **Support policies:** Regulatory environment, e.g. introduction of exposure to market risks	*Drivers specific to RET deployment and financing*
Renewable energy financing industry	▪ **Learning by doing:** In-house RET knowledge, better risk assessment and due diligence processes ▪ **Investment ecosystem:** Standardised investment structures, frame contracts, partner networks ▪ **Market entry of investors:** New investor types (e.g., large banks, insurers, pension funds), increasing investor competition	

Egli, F., Steffen, B., Schmidt, T. S. (2018). A dynamic analysis of financing conditions for renewable energy technologies. Nature Energy, available online

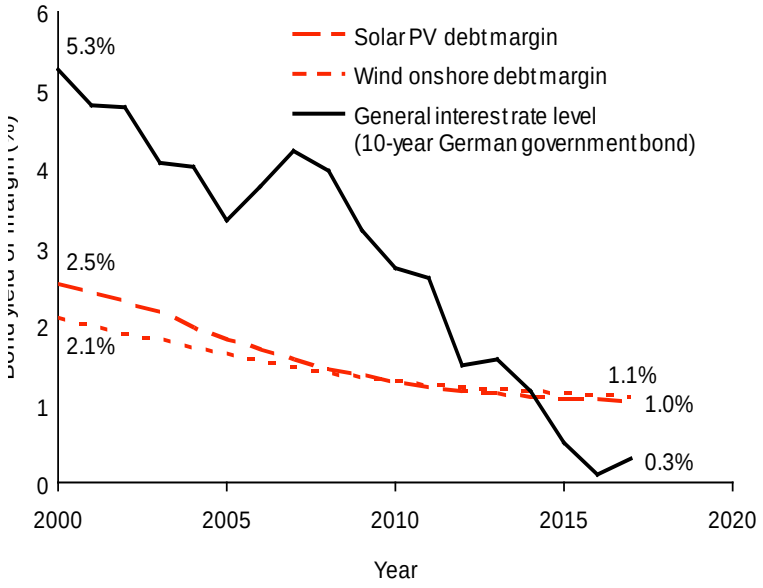
Step 3: We estimate the experience and general interest rate effects

Identification of experience effect:

$$DebtMARGIN(I_t) = DebtMARGIN(I_0)\left(\frac{I_t}{I_0}\right)^{-b_1}$$



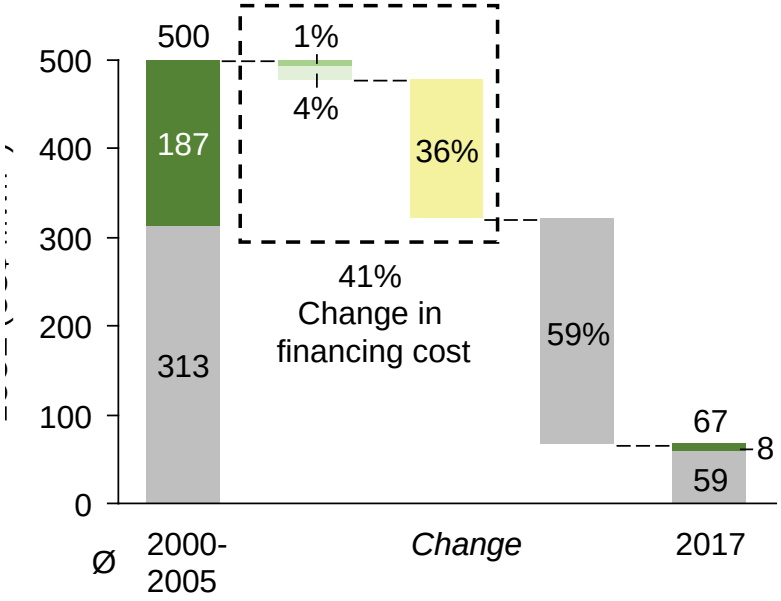
Comparison of experience effect and general interest rate level



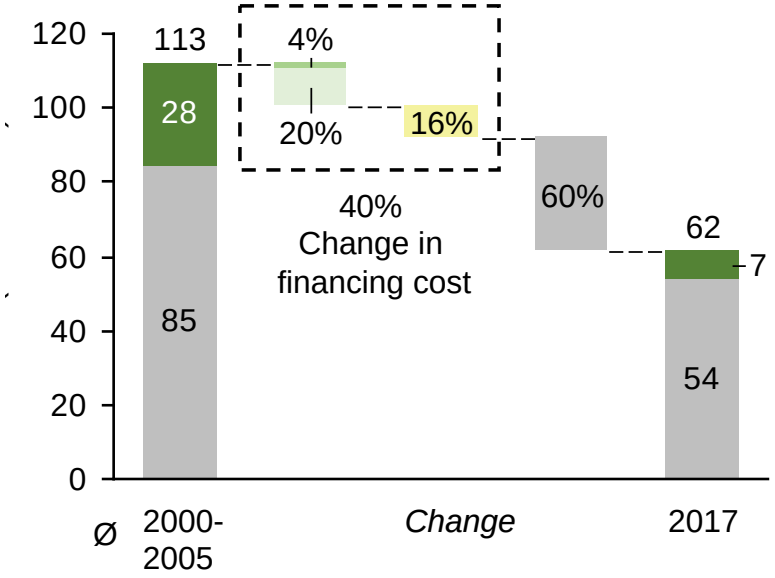
Egli, F., Steffen, B., Schmidt, T. S. (2018). A dynamic analysis of financing conditions for renewable energy technologies. Nature Energy, available online

Step 4: We identify the effect of the CoC dynamics on the LCOE

Solar PV



Wind onshore

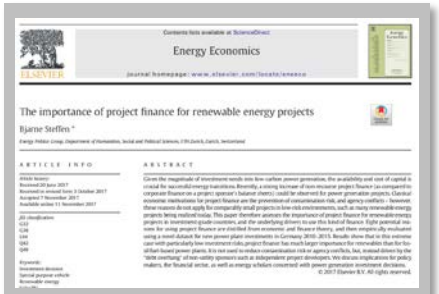


Change in financing cost from

- Experience effect
- General interest rate effect
- Lower capital expenditures

Egli, F., Steffen, B., Schmidt, T. S. (2018). A dynamic analysis of financing conditions for renewable energy technologies. Nature Energy, available online

The four papers of this talk and their key messages

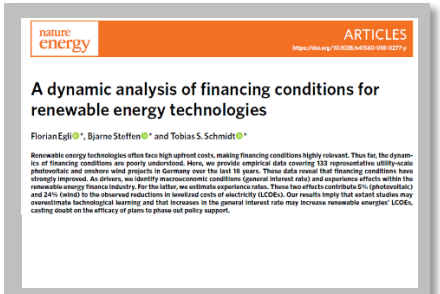

Energy Economics

The importance of project finance for renewable energy projects

Bjarne Steffen *

Main messages

- Renewable energy assets heavily rely on non-recourse project finance (vs. corporate finance for conventional plants)
- Key driver is debt overhang of fast-growing new entrants

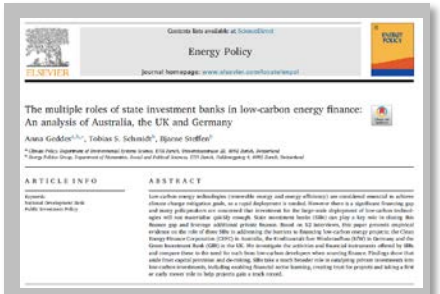

nature energy ARTICLES

A dynamic analysis of financing conditions for renewable energy technologies

Florian Egli*, Bjarne Steffen* and Tobias S. Schmidt*

Main messages

- The cost of capital for project-financed renewable energy assets has fallen substantially over the last 15 years
- We detect a financing experience curve (investors also learn)

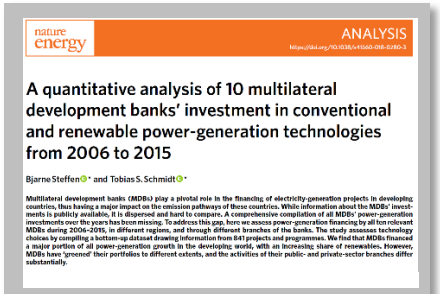

Energy Policy

The multiple roles of state investment banks in low-carbon energy finance: An analysis of Australia, the UK and Germany

Ana Geddes*, Tobias S. Schmidt*, Bjarne Steffen*

Main messages

- "Green" state investment banks (SIBs) help in overcoming investors' aversion against new energy assets
- SIBs found to crowd-in private finance rather than crowd-out


nature energy ANALYSIS

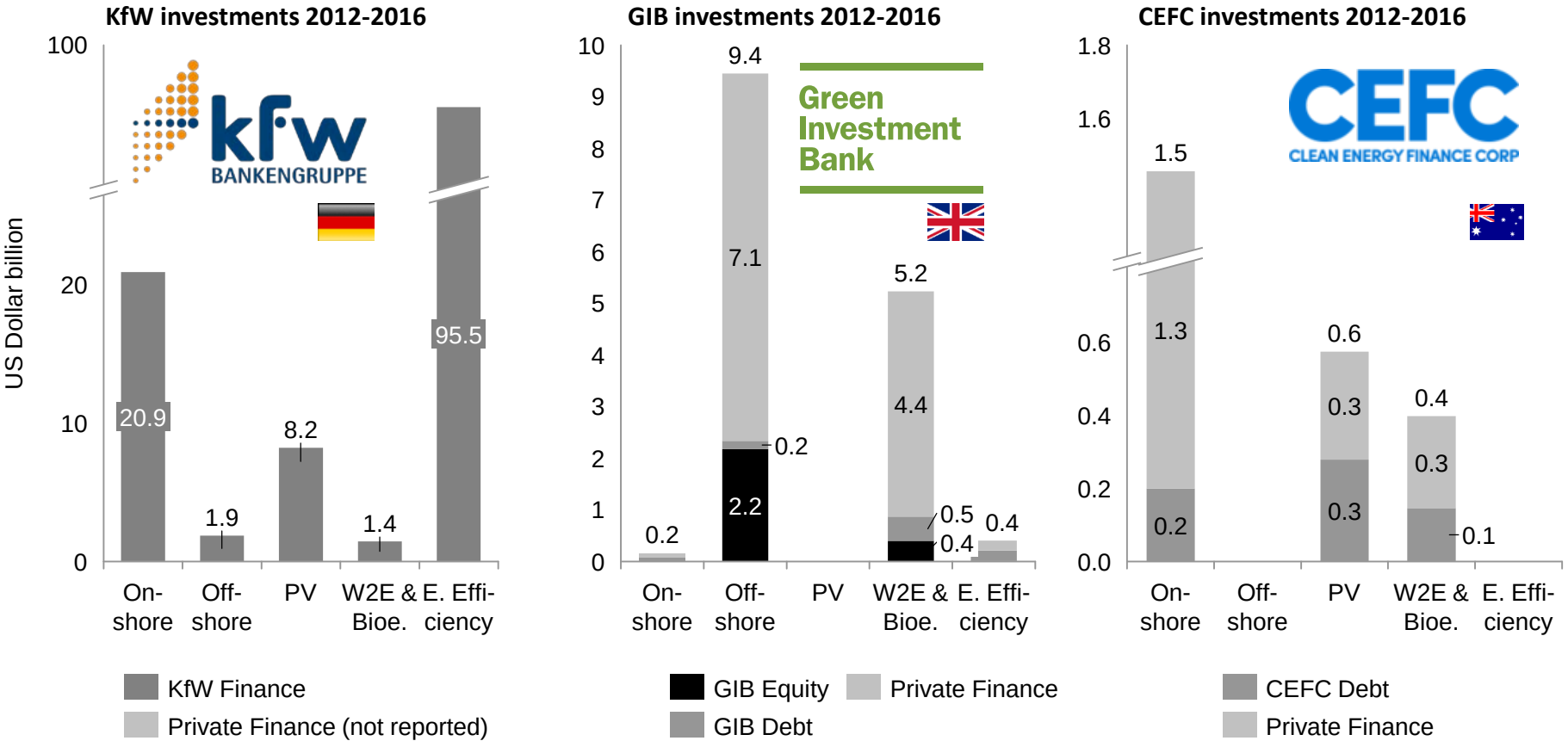
A quantitative analysis of 10 multilateral development banks' investment in conventional and renewable power-generation technologies from 2006 to 2015

Bjarne Steffen* and Tobias S. Schmidt*

Main messages

- Multilateral development banks (MDBs) have "greened" their power generation portfolios to very different extents
- MDBs' public sector branches are typically less "green" than their private sector branches

SIB: We compare three state investment banks in DE, UK, AU



Geddes, A., Schmidt, T.S., Steffen, B. (2018), The multiple roles of state investment banks in low-carbon energy finance: An analysis of Australia, the UK and Germany, *Energy Policy* 115, 158–170.

Qualitative case study allows to identify effective mechanisms

Case selection and method

Comparative study of 3 cases

- Industrialized countries w/ SIB heavily involved in RE finance
- GIB in UK, and CEFC in AU: Green SIB on national level, with 5 years track record
- KfW in DE: Not exclusively green SIB, but largest RE investor

Data iteratively analyzed

- Semi-structured interviews with 56 interviews from investors (SIB and others) and developers
- Qualitative content analysis to identify key themes by mapping developer demands to bank offerings

Category		Organisation[a]	Technology Focus[b]	Country[c]	Interviewee's Role
Developer	1	Project Developer	Wind, Solar PV	AU	Head of Business Development
	2	Project Developer	WtE	AU	Chief Executive Officer
	3	Project Developer	WtE	AU	Managing Director
	4	Project Developer	WtE	AU	Managing Director
	5	Project Developer	Bioenergy, WtE	GB	Independent developer
	6	Project Developer	Wind, Bioenergy	GB	Managing Director
	7	Project Developer	WtE	GB	Managing Director
	8	EPC, OEM	Wind, Solar PV	AU	Business Development Manager
	9	IPP	Wind	AU	Executive General Manager
	10	IPP	Wind, Hydro	AU	Executive Manager, Development
	11	IPP	Renewables	AU, GB, DE	Chief Financial Officer
	12	IPP	Solar PV	DE	Project Developer
	13	IPP	Bioenergy	GB, DE	Independent developer
	14	IPP	Wind, Solar PV	GB, DE	Manager, ESG
	15	IPP	Wind, Solar PV	GB, DE	Executive General Manager
	16	IPP	WtE, Bioenergy	GB, DE	Head of Origination
	17	OEM	Wind, Solar PV	AU	Head Structured Finance
	18	OEM	Small-scale wind	AU, GB, DE	General Manager
	19	OEM	Renewables	AU, GB, DE	Sales Manager, Renewables
	20	OEM	Renewables	AU, GB, DE	Senior VP Project Development
	21	OEM	Wind	GB, DE	Senior Investment Manager
	22	Utility	Renewables, FFs	DE	Managing Director
	23	Utility	Renewables, FFs	DE	Head Business Development
	24	Utility	Wind, Solar PV	GB, DE	Business Development Manager
	25	Utility	Wind, Solar PV	GB, DE	Managing Director
Investor	26	Commercial Bank	Renewables, FFs	AU	Executive General Manager
	27	Commercial Bank	Renewables, FFs	AU	Senior Consultant
	28	Commercial Bank	Renewables, FFs	AU, GB, DE	Director Corporate Clients
	29	Commercial Bank	Renewables, FFs	AU, GB, DE	Consultant, Green Banking Expert
	30	Commercial Bank	Renewables, FFs	GB, DE	Consultant, Innovative Finance
	31	Gov't funding entity	Renewables	AU	Transactions and Development
	32	Green Bank	Renewables	GB, DE	Relationship Manager, Arranger
	33	Invest. Advisors	Renewables	AU	Principal Financial Advisor
	34	OEM investors	Renewables, FFs	AU, GB, DE	Managing Director
	35	Invest. platform	Renewables	GB	Managing Director
	36	SIB	Renewables, EE	AU	Division Director
	37	SIB	Renewables, EE	AU	Researcher
	38	SIB	Renewables, EE	AU	Department Director
	39	SIB	Renewables, EE	AU	Associate Director
	40	SIB	Renewables, FFs	DE	Department Director
	41	SIB	Renewables, EE	GB	Department Head
	42	SIB	Renewables, FFs	GB, DE	Investment Officer
	43	SIB	Renewables, FFs	GB, DE	Project Assessor
	44	SIB	Wind, Renewables	GB, DE	Team Head, Wind Power
	45	Sustainable Bank	Renewables	GB, DE	Chief Financial Officer
	46	VC Investor	Renewables, FFs	AU, GB, DE	Director
Expert[d]	47	Consultancy	Renewables	AU, GB, DE	Arranger, Due Diligence
	48	Consultancy	Renewables, FFs	GB, DE	Associate Principal, Energy
	49	Consultancy	Wind	GB, DE	Senior Consultant, Power Market
	50	Consultancy	Wind	GB, DE	Partner, Energy and Resources
	51	Energy Think-tank	Renewables	GB	Director, Finance, Energy Policy
	52	Envir. Consultancy	Renewables, FFs	GB, DE	Principal Consultant
	53	Envir. NGO	Renewables, FFs	AU, GB, DE	Director of Strategy and Finance
	54	Legal Consultancy	Renewables	AU	Partner, Project Finance, Energy
	55	Legal Consultancy	Renewables	AU	Senior Associate, Project Finance
	56	Legal Consultancy	Renewables	AU, GB, DE	Partner, Arranger

Geddes, A., Schmidt, T.S., Steffen, B. (2018), The multiple roles of state investment banks in low-carbon energy finance: An analysis of Australia, the UK and Germany, *Energy Policy* 115, 158–170.

Results: SIBs take four key roles, well beyond capital provision

A. Capital Provision and De-risking Roles

- Direct funding for crucial gaps, concessional or commercial terms
- De-risking instruments (e.g., guarantees)

C. Signaling Role

- SIB reputation crowding-in private equity and debt
- "SIB participation signal" with effect on financing cost

B. Educational Role

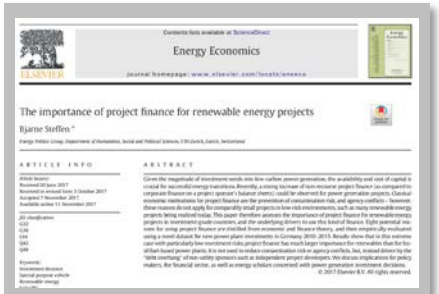
- Specialist internal expertise (e.g. accurately assessing risks)
- Financial innovation and standardization

D. First or Early Mover

- Early movers with respect to new technologies (in the country), new deal structures, new manufacturers and developers

Geddes, A., Schmidt, T.S., Steffen, B. (2018), The multiple roles of state investment banks in low-carbon energy finance: An analysis of Australia, the UK and Germany, *Energy Policy* 115, 158–170.

The four papers of this talk and their key messages

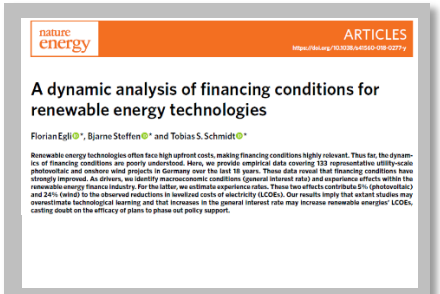

Energy Economics

The importance of project finance for renewable energy projects

Bjarne Steffen *

Main messages

- Renewable energy assets heavily rely on non-recourse project finance (vs. corporate finance for conventional plants)
- Key driver is debt overhang of fast-growing new entrants


nature energy

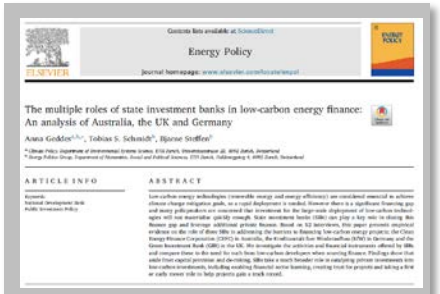
ARTICLES

A dynamic analysis of financing conditions for renewable energy technologies

Florian Egli*, Bjarne Steffen* and Tobias S. Schmidt*

Main messages

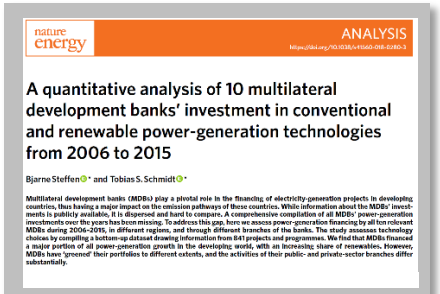
- The cost of capital for project-financed renewable energy assets has fallen substantially over the last 15 years
- We detect a financing experience curve (investors also learn)


Energy Policy

The multiple roles of state investment banks in low-carbon energy finance: An analysis of Australia, the UK and Germany

Main messages

- "Green" state investment banks (SIBs) help in overcoming investors' aversion against new energy assets
- SIBs found to crowd-in private finance rather than crowd-out


nature energy

ANALYSIS

A quantitative analysis of 10 multilateral development banks' investment in conventional and renewable power-generation technologies from 2006 to 2015

Bjarne Steffen* and Tobias S. Schmidt*

Main messages

- Multilateral development banks (MDBs) have "greened" their power generation portfolios to very different extents
- MDBs' public sector branches are typically less "green" than their private sector branches

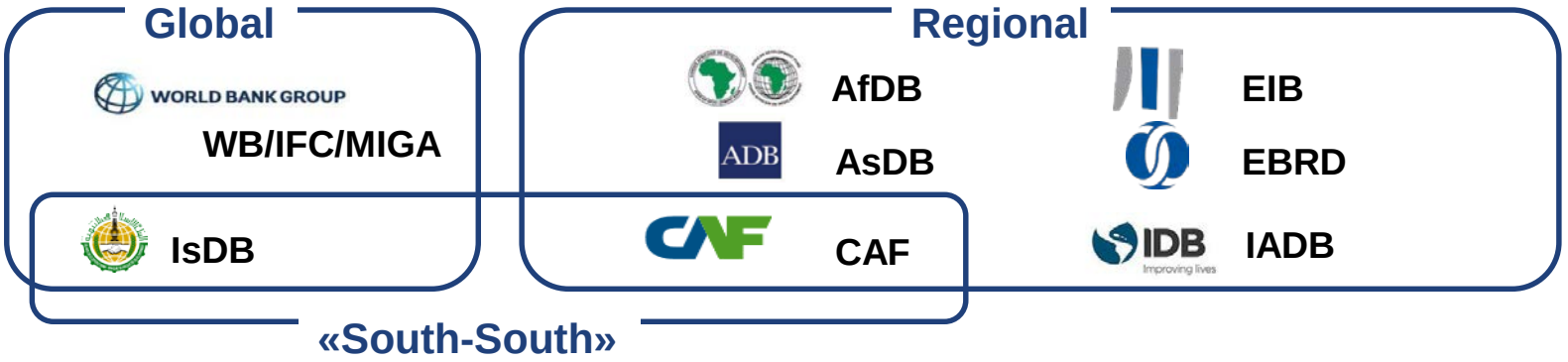
MDB: Multilateral dev. banks are major investors in power plants

Power generation pathway of developing countries crucial for climate change

Could multilateral development banks (MDB) take the role of SIB in dev. countries?

- Long track record in power generation financing, and toolbox with de-risking and invest instruments
- Ambitious goals for climate finance – yet also competing policy areas and interest
- The role of MDB in financing high- and low-carbon assets is poorly understood

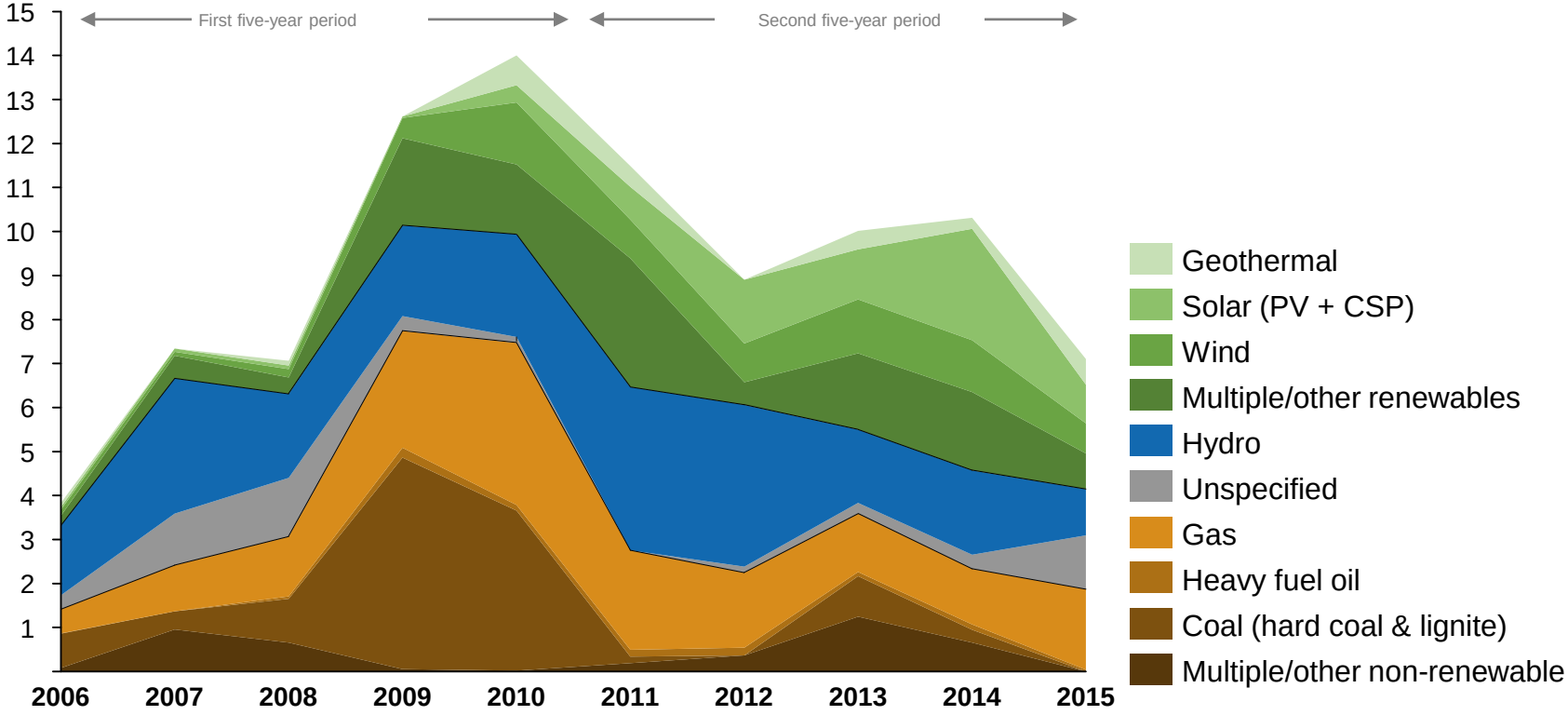
We conduct bottom-up analysis of 857 projects and programs 2005–15 + complementary interviews with 12 experts form 6 MDBs



Source: Steffen, B.; Schmidt, T.S. (2018). A quantitative analysis of 10 multilateral development banks' investment in conventional and renewable power-generation technologies from 2006 to 2015. *Nature Energy*.

New RE investment rose from ~10% to ~50% of all MDB power generation invest

Total financial commitments (excluding guarantees)
(USD_{2015} billion)

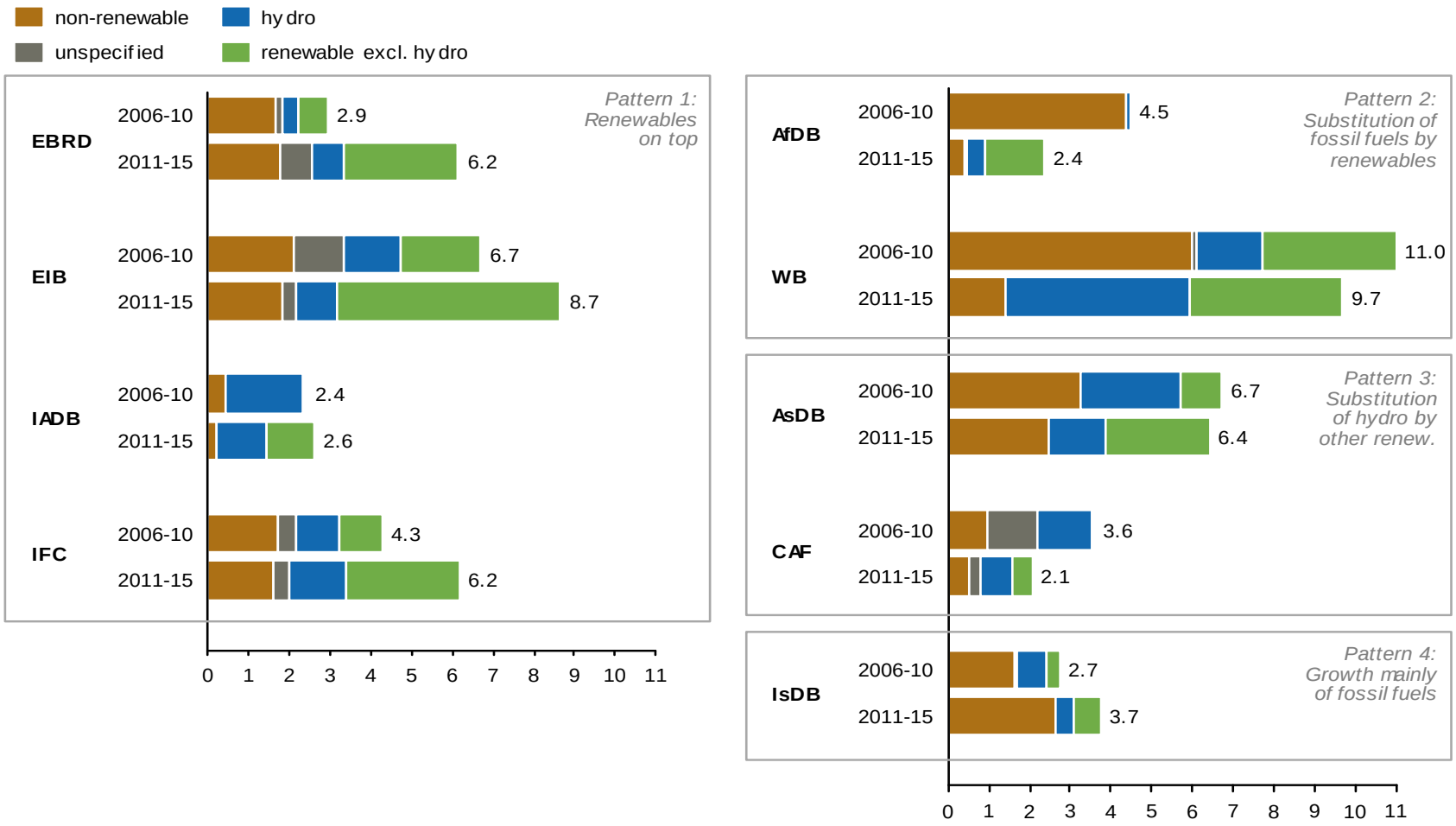


Share (%)	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Renewables	55%	51%	38%	36%	46%	76%	73%	62%	74%	56%
Renewables excl. hydro	13%	9%	11%	20%	29%	44%	32%	45%	56%	42%

Source: Steffen, B.; Schmidt, T.S. (2018). A quantitative analysis of 10 multilateral development banks' investment in conventional and renewable power-generation technologies from 2006 to 2015. *Nature Energy*.

Different patterns – often RE invest "on top" of conventionals

Total commitment for power generation projects by MDB
USD_{2015} billion, based on bottom-up analysis of project data

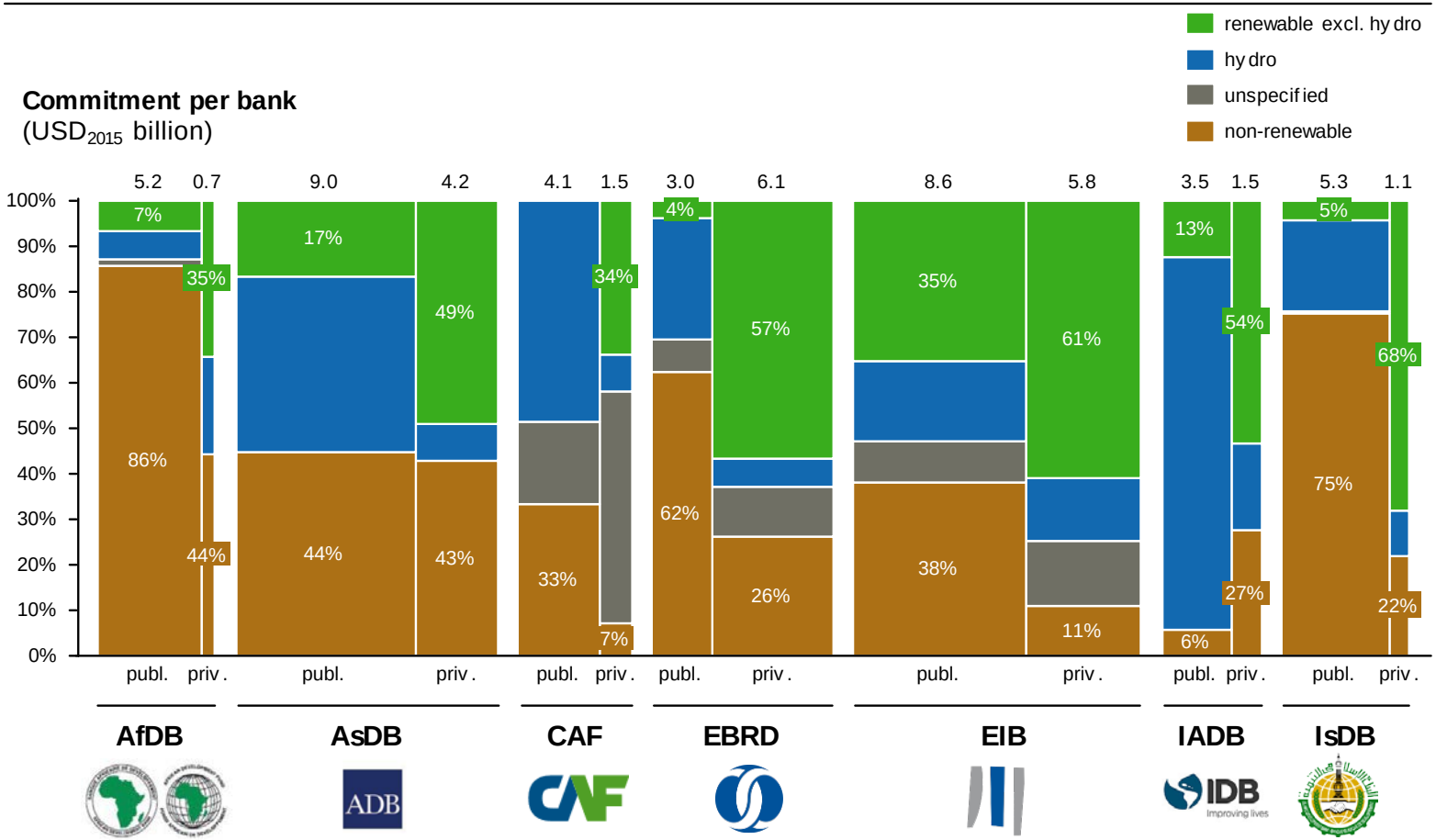


Source: Steffen, B.; Schmidt, T.S. (2018). A quantitative analysis of 10 multilateral development banks' investment in conventional and renewable power-generation technologies from 2006 to 2015. *Nature Energy*.

Stark differences between public and private sector branches

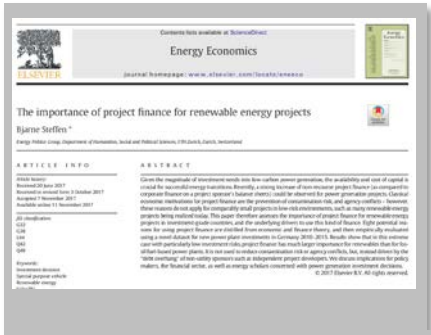
Financial commitments to power-generation technologies by branches of regional MDBs

10 years 2006–15



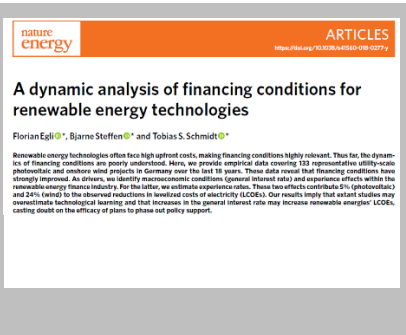
Source: Steffen, B.; Schmidt, T.S. (2018). A quantitative analysis of 10 multilateral development banks' investment in conventional and renewable power-generation technologies from 2006 to 2015. *Nature Energy*.

Wrap-up: Key implications for modelers and policymakers


Energy Economics

The importance of project finance for renewable energy projects

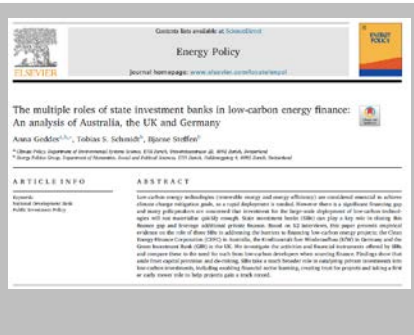
Bjarne Steffen *


nature energy

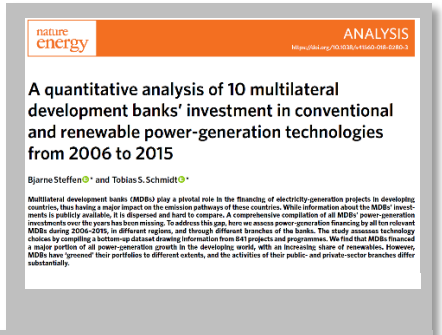
ARTICLES

A dynamic analysis of financing conditions for renewable energy technologies

Florian Egli, Bjarne Steffen and Tobias S. Schmidt


Energy Policy

The multiple roles of state investment banks in low-carbon energy finance: An analysis of Australia, the UK and Germany


nature energy

ANALYSIS

A quantitative analysis of 10 multilateral development banks' investment in conventional and renewable power-generation technologies from 2006 to 2015

Bjarne Steffen and Tobias S. Schmidt

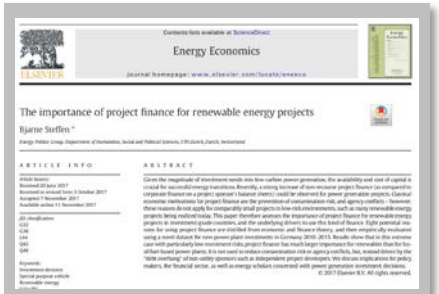
Key implications for policymakers

- Renewables rely on project finance, hence *banks* are important actors in financing decisions, and cost of capital (interest payments & dividends) are project-specific
- Reductions in cost of capital have been a key driver for the lower LCOE of renewables that are observed globally, driven both by financing experience and the general interest rate level
- Public banks (such as SIB and MDBs) can be a powerful policy instrument to enhance financing conditions and lower cost of capital for new technologies

Key implications for modelers

- For comparably new, capital-intense technologies such as renewables, technology- and time-specific cost of capital need to be considered (times of a uniform discount rate should be over)

Further details – and underlying data – are freely available


Energy Economics

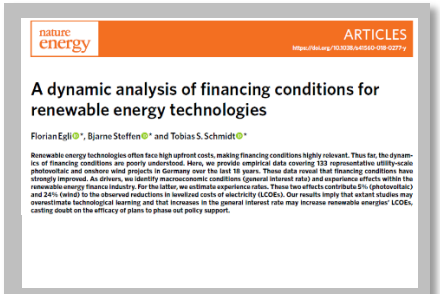
The importance of project finance for renewable energy projects

Bjarne Steffen *

Steffen, B. (2018), The importance of project finance for renewable energy projects, *Energy Economics* (69), 280–294.

Free pre-print version

Project level data available

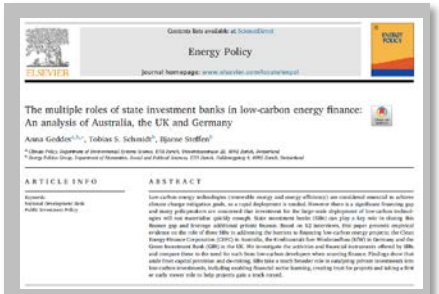

nature energy ARTICLES

A dynamic analysis of financing conditions for renewable energy technologies

Florian Egli*, Bjarne Steffen* and Tobias S. Schmidt*

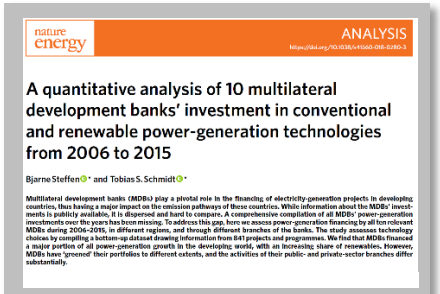
Egli F, Steffen B, Schmidt TS (2018), A dynamic analysis of financing conditions for renewable energy technologies, *Nature Energy*

Free read-only access


Energy Policy

The multiple roles of state investment banks in low-carbon energy finance: An analysis of Australia, the UK and Germany

Geddes, A., Schmidt, T.S., Steffen, B. (2018), The multiple roles of state investment banks in low-carbon energy finance: An analysis of Australia, the UK and Germany, *Energy Policy* 115, 158–170. (free open access)


nature energy ANALYSIS

A quantitative analysis of 10 multilateral development banks' investment in conventional and renewable power-generation technologies from 2006 to 2015

Bjarne Steffen* and Tobias S. Schmidt*

Source: Steffen, B.; Schmidt, T.S. (2018). A quantitative analysis of 10 multilateral development banks' investment in conventional and renewable power-generation technologies from 2006 to 2015. *Nature Energy*.

Free read-only access

Project level data available

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730403, as well as from the European Research Council under grant number 313553. It has also received funding by the Swiss State Secretariat for Education, Research and Innovation (SERI) [contract number 16.0222]. The opinions expressed & arguments employed herein do not necessarily reflect the official views of the Swiss Government. The project was supported by a seed grant from ETH Zurich foundation.

Q&A session

To participate in the Q&A Session, please use the “Questions” menu provided by the Go-to-Webinar system

Forthcoming Webinar

Climate services in the finance sector: insights for users and providers of climate data and information

December 12, 2018 – h. 11.00 am CET

Speaker: **Robin Hamaker-Taylor** – Policy and risk analyst, Acclimatise
Discussant: **Adriaan Perrels** – Finnish Meteorological Institute
Moderator: **Jaroslav Mysiak** – CMCC, RAAS Division

cmcc
Centro Euro-Mediterraneo sui Cambiamenti Climatici

Thank you for attending this CMCC webinar.

This webinar was recorded and will be uploaded on CMCC Youtube Channel: https://www.youtube.com/CMCCvideo and to the CMCC website: www.cmcc.it

If you have any further question about the webinar, please email: webinar@cmcc.it

Centro Euro-Mediterraneo sui Cambiamenti Climatici