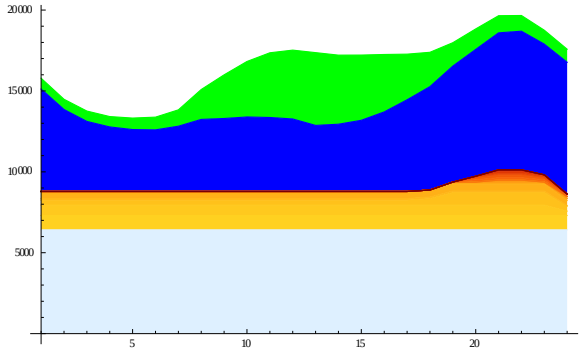
What We Want.

Requirements of Renewable Energy Investors in Emerging Markets.



iidevelopment presentation for GIZ

Tunis – November 2013

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What We Want.

Requirements of Renewable Energy Investors in Emerging Markets.

1. Which types of investors are present in RE?
2. What do these investors want?
3. What can governments do to attract, keep and steer these investors? Examples for typical effects of policy on risk and yield expectations.

1. Which **types of investors** are present in Renewable Energy (RE)?

Institutional investors

i.e. Insurances, pension funds, savings unions, development banks, impact investors

Commercial investors

i.e. venture capital, special funds, structured bonds, electric utilities, independend power producers, ESCOs

Private Investors

i.e. SME, farmers, homeowners, cooperatives

These three types have differing motives and requirements!

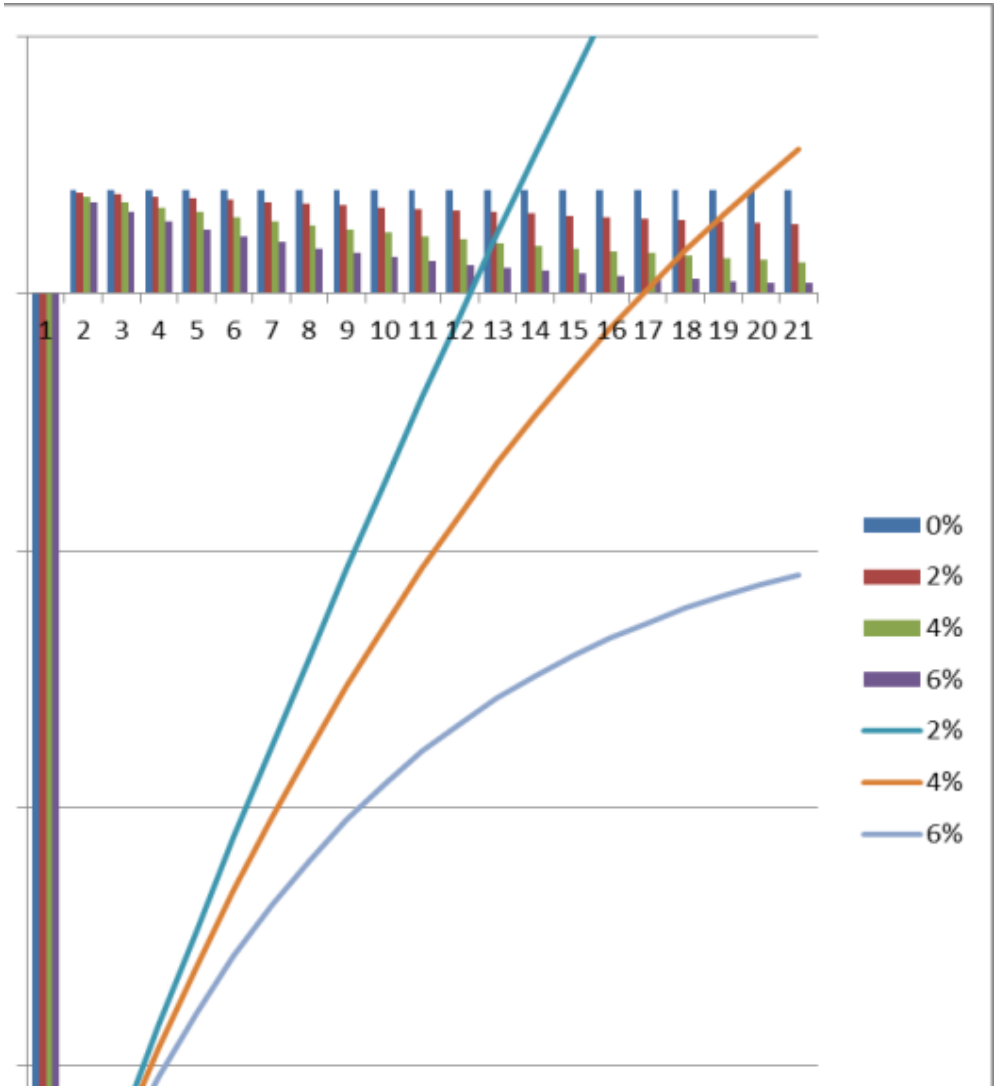
Thus, always 3, instead of 2, indicators:

1. Risik
2. Yield
3. Other criteria

1. Which **types of investors** are present in Renewable Energy (RE)?

Explanation of risk and yield:

- RE are „Front Loaded“, unlike conventional powerplants
- This is why risk ($\Delta t>10a$) is so important for yield expectations (want high ROI = DCF)
- Commercial investors in meerging markets aim to break even after 3-8 years due to high volatilities
- Much less than the 15 years typical for RE feed-in programmes in EU
- PPA >5 years credible?



2. **What do these three investor types want?**

Institutional investors

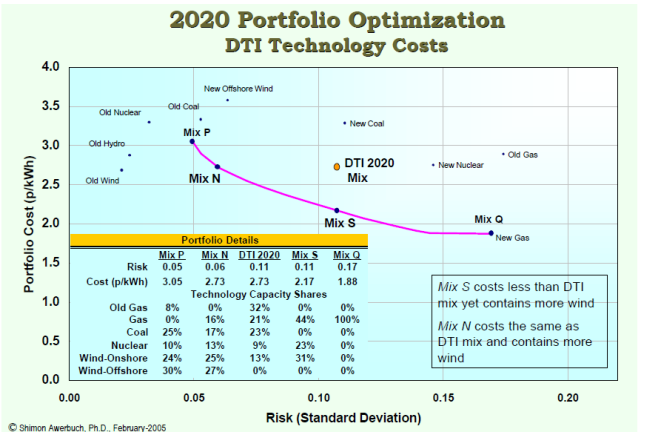
- Important: risk & SPV-Volatility
- Grants until around 2020ca 2020 for EZ-goals= Other Criteria

Commercial investors

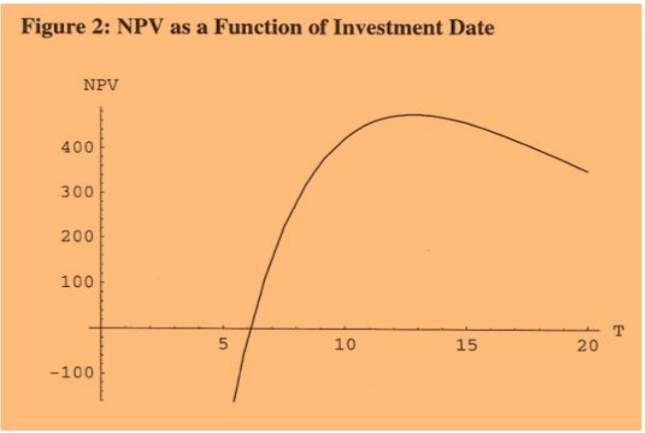
- Maximise F(risk, yield)
- Other criteria less relevant
- Country risk not applicable to local SMB

Private Investors

- Extremely amorphous group and very subjective assessments: self-sustainability, do-gooders, soldiers of fortune, ...
- Risk is underrated (no portfolio). Thus Yield + Other Criteria = liquidity, timing and nimbus



Portfolio Details	Mix P	Mix N	DTI 2020	Mix S	Mix Q
Risk	0.05	0.06	0.11	0.11	0.17
Cost (p/kWh)	3.05	2.73	2.73	2.17	1.88
Technology Capacity Shares					
Old Gas	8%	0%	32%	0%	0%
Gas	0%	16%	21%	44%	100%
Coal	25%	17%	23%	0%	0%
Nuclear	10%	13%	9%	23%	0%
Wind-Onshore	24%	25%	13%	31%	0%
Wind-Offshore	30%	27%	0%	0%	0%



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3. What can **governments** do? Examples.
3.1. Risk determines expected yields

Profit excepted by Investors (3) depends on (1) country risk and (2) PV-specific Risk

	Germany 2011 (BASE CASE)*	Germany 2001	Brasil 2011**	Italy 2011	*remarks*
1. 10a Gov Bond	1.5%	4.5%	11%	6%	** Note that Risk Premium in D went UP in 2013 due to decreasing EEG predictability (NB this is separate from lower yield from lower FIT).* ***Note that Gov bonds went down in BRA from 2011 to 2013*
2. PV Risk Premium	2.5%	5.0%	7%	7%	
3. Required ROI min	**4.0%**	**9.5%**	**18%**	**13%**	

Country risk → Energy ministers can hardly influence it

Subsector risk→ A number of ministries can directly influence this: regulation can lower risk!

Global ranks of our 3 country cases for different indicators

Country Indicator	Brazil	Italy	Germany	source	*PV SPV importance
Starting a Business	121	84	106	*World Bank*	3
Dealing with Construction Permits	131	103	14	*World Bank*	5
Getting Electricity	60	107	2	*World Bank*	5
Registering Property	109	39	81	*World Bank*	3
Getting Credit	104	104	23	*World Bank*	2
Protecting Investors	82	49	100	*World Bank*	5
Paying Taxes	156	131	72	*World Bank*	2
Trading Across Borders	123	55	13	*World Bank*	1
Enforcing Contracts	116	160	5	*World Bank*	4
Resolving Insolvency	143	31	19	*World Bank*	0
Corruption Perceptions	69	72	13	*Transparency*	4
WBG average rank of country	**110**	**86**	**44**	*indicators 1-10 (wbg)*	
Our weighted "PV SPV rank"	**101**	**92**	**42**	*indicators 1-11 weighted with **	

128% WBG ratio Bra/Ita

110% PVSPV ratio Bra/Ita

Subsector risk→ A number of ministries can directly influence this: regulation can lower risk!

	Brazil		Italy		Germany	
	procedure step	duration	procedure step	duration	procedure step	duration
1	Request and obtain proof of land ownership from Real Estate Registry Office	2 days	Obtain nulla osta from the Regional Technical Office (Genio Civile)	30 days	Obtain building permit	25 days
2	Request and obtain proof of land tax payment from Treasury of the Municipality	7 days	Obtain building permit	135 days	Application for approval of static calculation	21 days
3	Register employees with the Social security Office	1 day	Hire an independent engineer to test structure	1 day	Receive inspection from District Chimney Sweeper	1 day
4	Submit proof of payment to Social security	1 day	File Certified Notification of Starting Activity (â€œSCIAâ€)	1 day	Receive inspection of the building shell	1 day
5	Request and obtain Construction Approval Permit and Construction Execution Permit	274 days	Register the building	5 days	Receive inspection after completion of the building ("Foermliche Bauabnahme")	1 day
6	Request and obtain Equipment Operating Permit	60 days	Obtain occupancy certificate	30 days	Apply for water connection	1 day
7	Request and receive frame inspection from Municipality	1 day	Receive on-site inspection by the Fire Department	1 day	Receive inspection by water company	1 day
8	Request and receive inspection of the structures from Municipality	1 day	Apply for water and sewerage connection	1 day	Obtain water connection	45 days
9	Request and receive labor inspection from Labor Public Attorneysâ€™ Office	1 day	Receive on-site inspection and estimation of water and sewerage installation costs	1 day	Obtain telephone line	45 days
10	Request and receive sanitary inspection from Municipality	1 day	Obtain water and sewerage installation	29 days		
11	Request and obtain conclusion approval	60 days	Obtain telephone connection	15 days		
12	Receive final inspection from Municipality	1 day				
13	Request and receive Fire Department Inspection	31 days				
14	Request and obtain operation License	60 days				
15	Request and connect to water and sewage	30 days				
16	Request and connect to telephone	15 days				
17	Register with the Real Estate Registry Office	15 days				
	Total Days (average)	469		234		97
	average months	15		8		3
	average years	1.3		0.6		0.3

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Project risk → Investors themselves can have an influence. For example EPC-Risk

EPC	P: probability that the firm is alive in 2-2014 [% of 100] 1	2	3	4	5	6
A	50	65	70	90	75	95
B	80	90		90	90	90
C		40		50	60	70
D		25				65
E	80					60
F		75	40	60	50	40
G	50	7	30	40	50	40
H	30	60	80	50	30	55
I	65	100	60	90	50	80
J						

P (alive 2014)	rank	N	2σ	EPC	our overall rating
74%	**2**	6	15%	**A**	**Top**
88%	**1**	5	4%	**B**	**Top**
55%	5	4	11%	C	Risky
45%	8	**2**	20%	D	No Go
70%	4	**2**	10%	E	Risky
53%	6	5	13%	F	Risky
36%	9	6	15%	G	No Go
51%	7	6	17%	H	Risky
74%	**2**	6	17%	**I**	**Top**
	10	**0**		J	No Go

3. What can governments do? Examples.
3.2. The LCOE lies

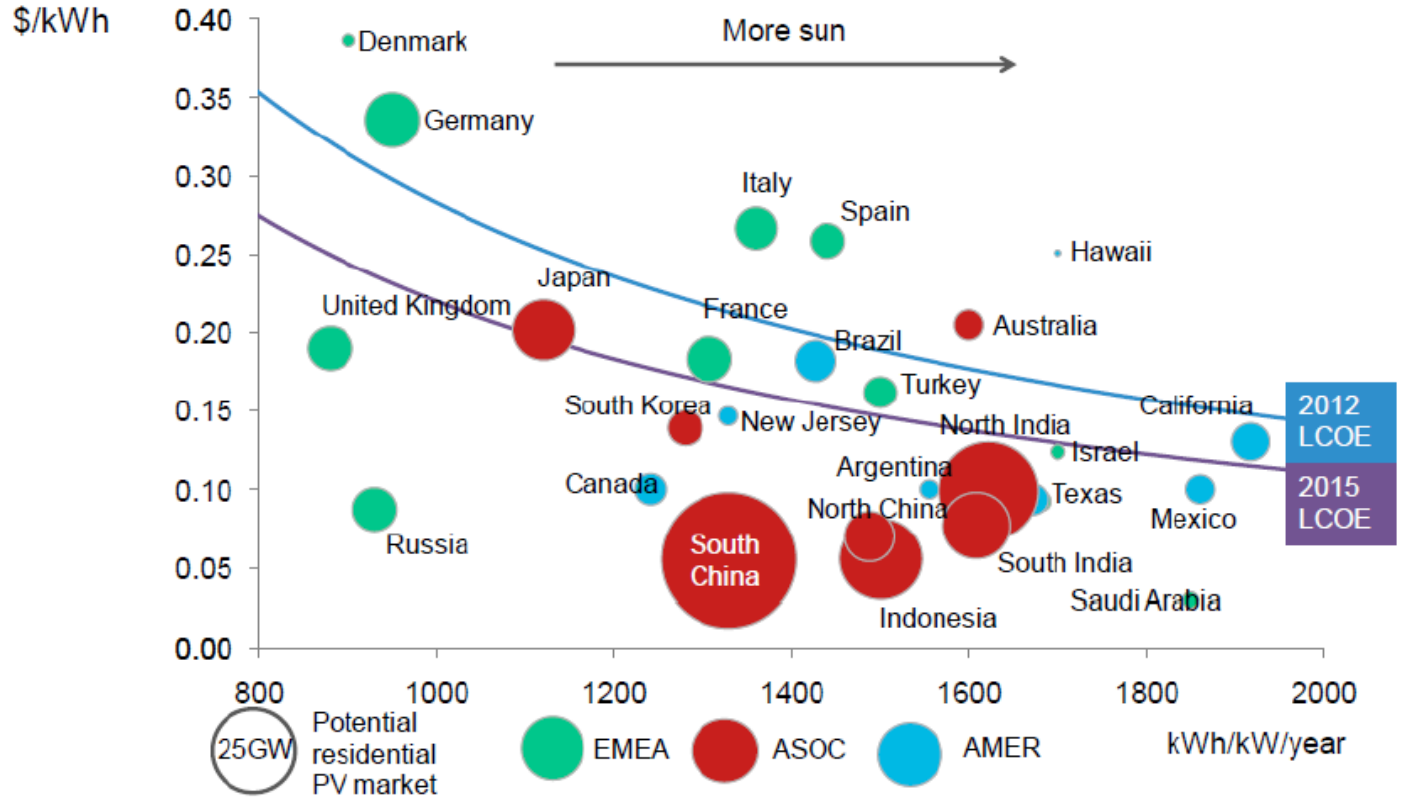

Figure 6: Residential PV price parity (size of bubbles refers to market size) (BNEF, 2012a).
Note: LCOE based on 6% weighted average cost of capital, 0.7%/year module degradation, 1% capex as O&M annually, $3.01/W capex assumed for 2012, $2.00/W for 2015.

Source of graph & caption: Bazilian et al 2012

3. What can governments do? Examples.
3.2. The LCOE lies

	Germany		LAC					
	D end 2012	**D 2013 too low**	**LAC private 2013/4**	**LAC public 2013/4**		**LAC private 2015**	**LAC private 2016**	**LAC private 2017**
yield	1000	1000	2000	2000		2000	2000	2000
FIT $/kWh	**$ 0.20**	**$ 0.15**	**$ 0.15**	**$ 0.10**		**$ 0.14**	**$ 0.12**	**$ 0.11**
yield*FIT p.a.	200,000	150,000	300,000	200,000	90%	$ 270,000	$ 243,000	$ 218,700
O&M	1.5%	1.5%	1.5%	1.5%		1.5%	1.5%	1.5%
	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)		$ (27,000)	$ (24,300)	$ (21,870)
TIR Proj	**6%**	**2%**	**12%**	**6%**		**12%**	**12%**	**12%**
EPC	$ (2,000,000)	$ (2,000,000)	$ (2,000,000)	$ (2,000,000)	**90%**	$ (1,800,000)	$ (1,620,000)	$ (1,458,000)

	EK	**FK**	**TIR**
	1	9	
D 2013 lowest "marginal Insti"	3.5%	4.0%	**4.0%**
	2	8	
D 2012	10.0%	5.0%	**6.0%**
	4	6	
LAC 2013 - low PV Risk	15.0%	10.0%	**12.0%**
	5	5	
LAC 2013 - High PV Risk	25%	15%	**20.0%**

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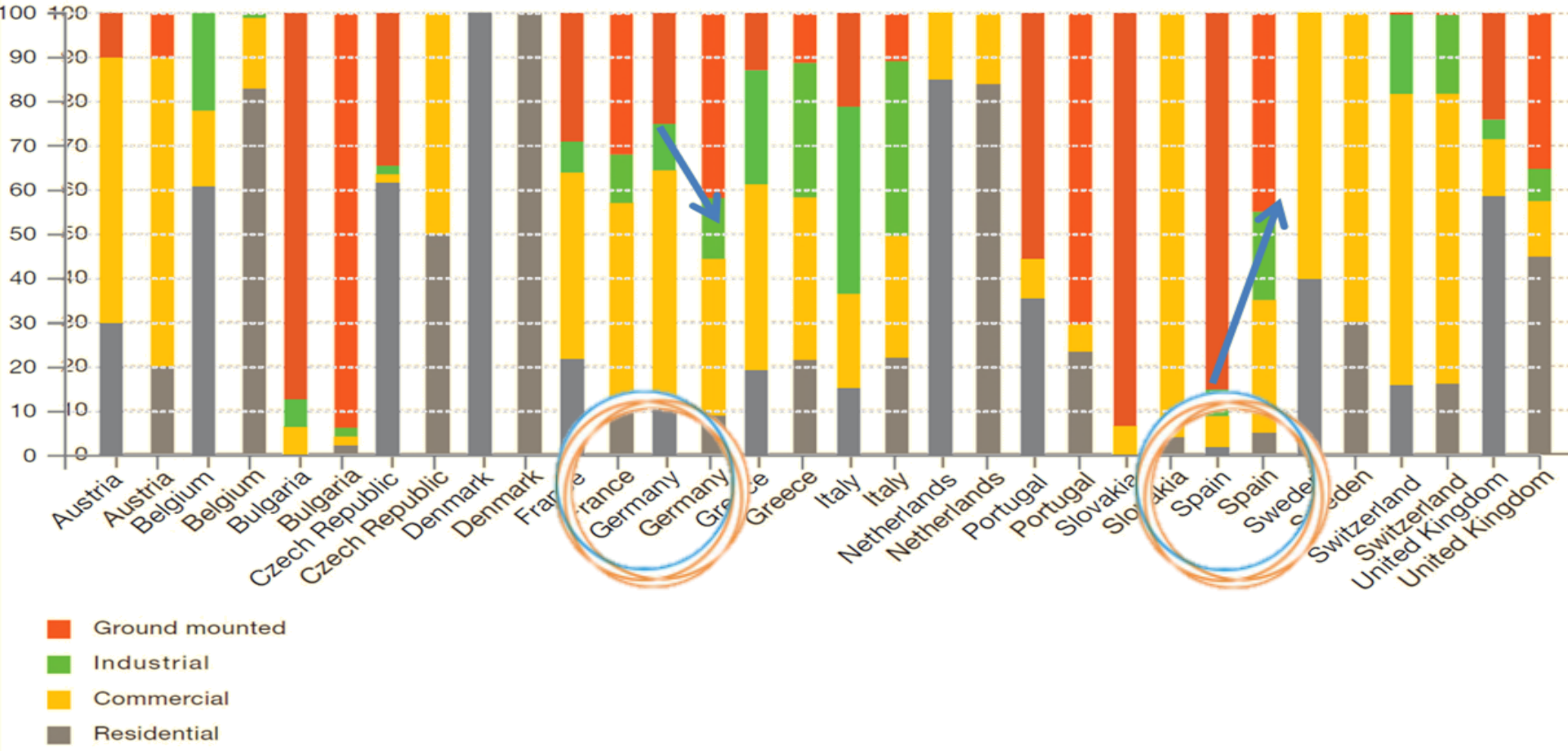
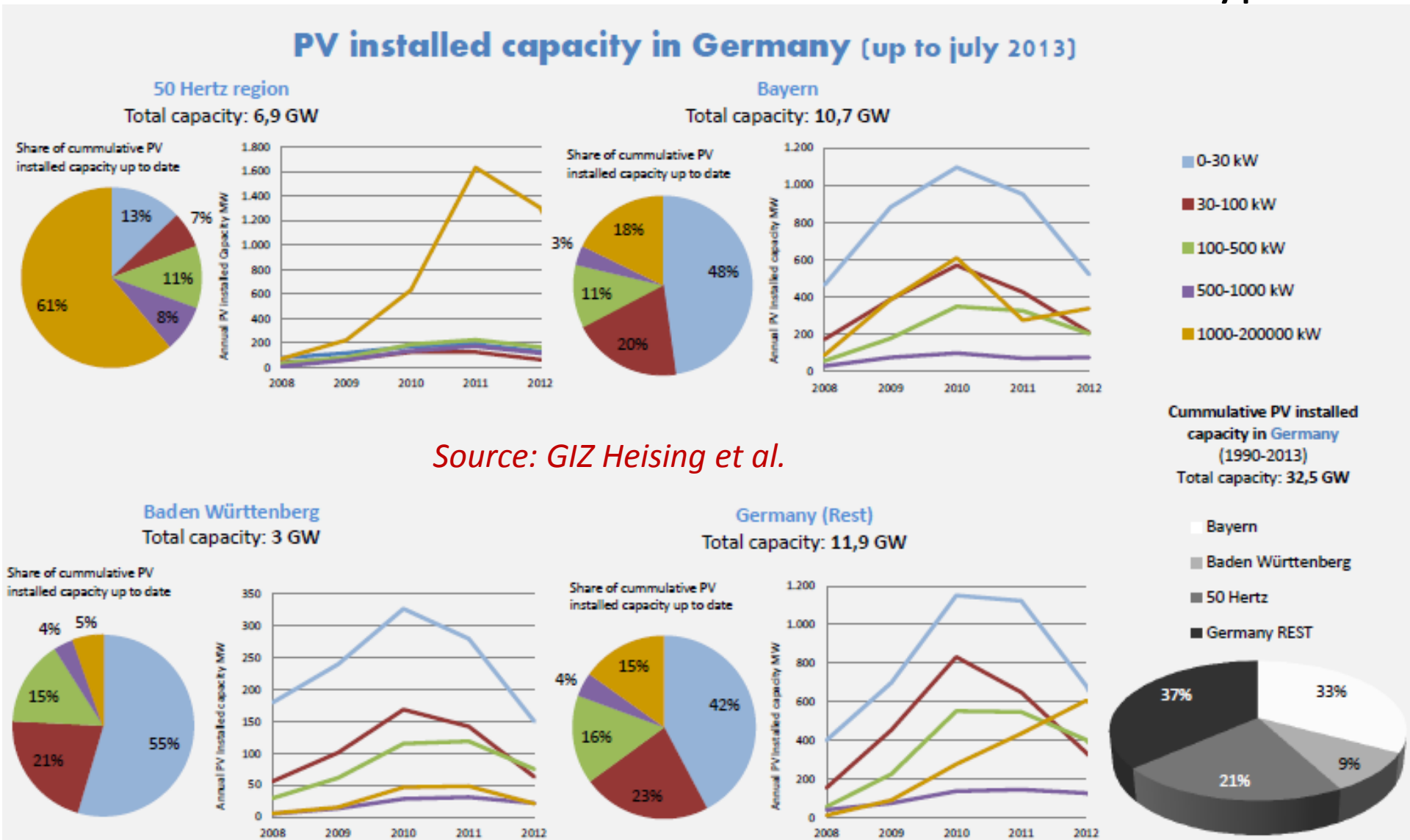
3. What can governments do? Examples.
3.3. Promotion of renewables influences investor types



Source: adapted from EPIA 2012

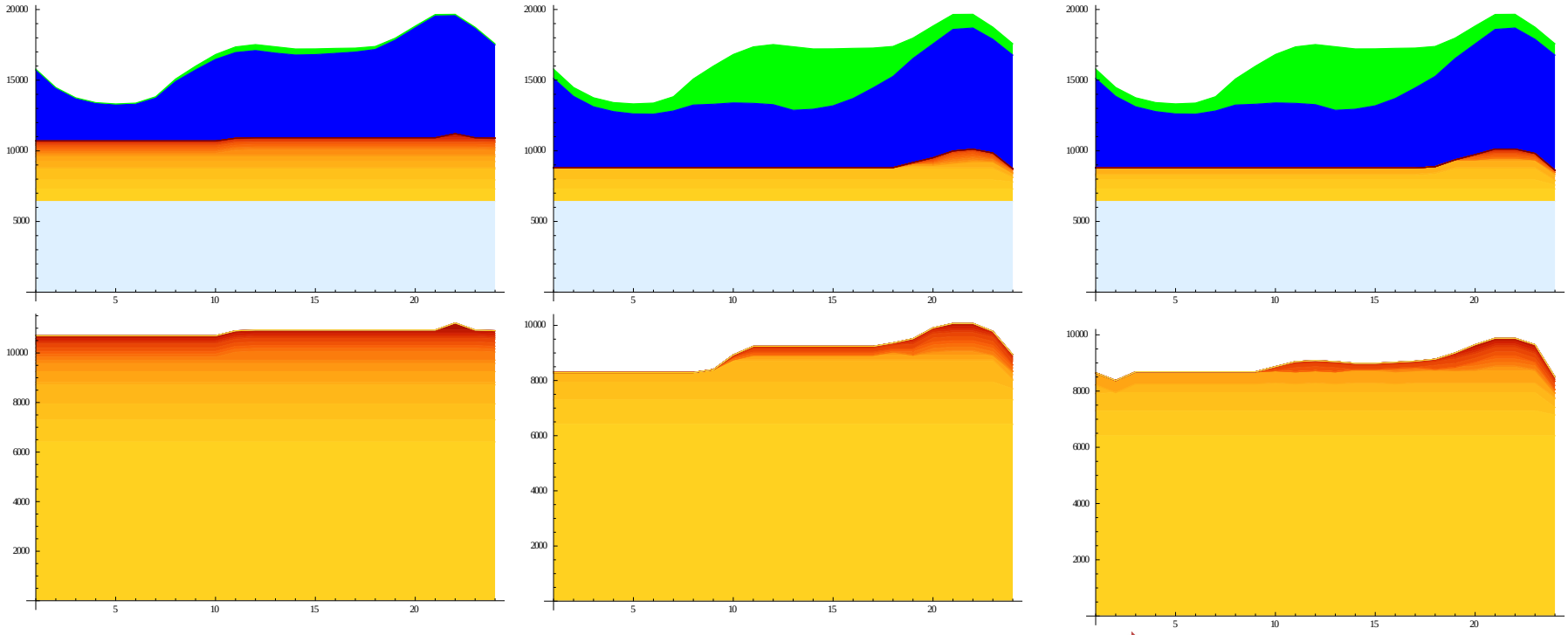
3. What can governments do? Examples.

3.3. Promotion of renewables influences investor types



3. What can governments do? Examples.

3.4. Transparency minimizes risk! In the long-term, prices adjust to the economic optimum.



Δ RE size

Δ Oil price

3. What can governments do? Examples.
3.4. Transparency minimizes risk! In the long-term, prices adjust to the economic optimum.

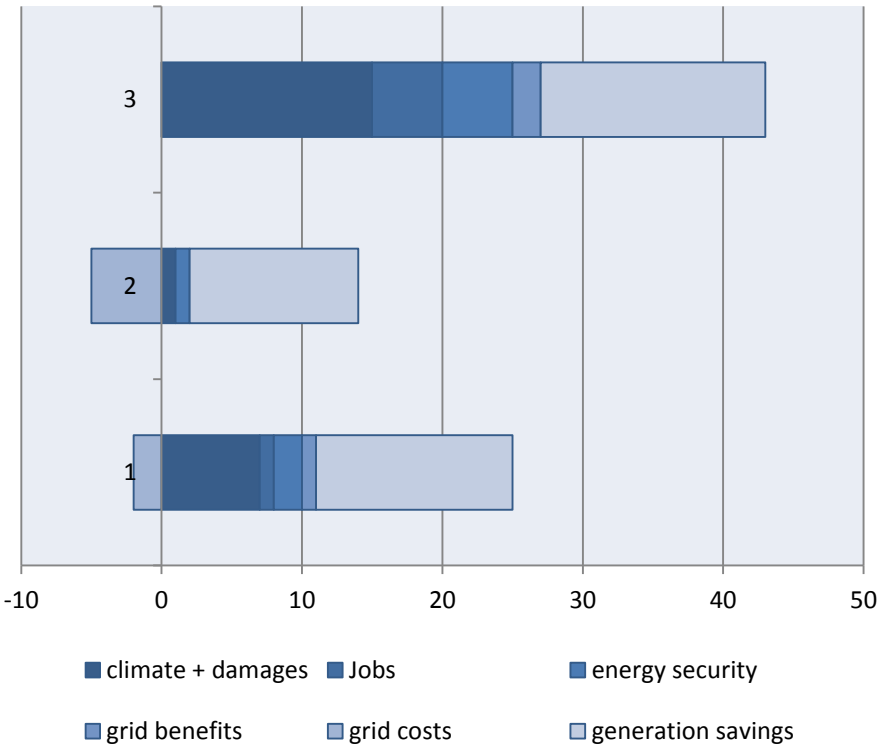
Problem:

- Estimates of RE benefits in literature are extremely inaccurate. Little empirical work [RMI2013]
- Wrong methods and secondary effects
- **Results = 4-40 US cents/kWh Error>100%**!
- Wait for "smart grid" und batteries

GIZ sector projects:

- **Operational Benefits: OpBen** at Optimal Dispatch
- Straightforward: Avoided fuel costs in actual generation parks
- Variation of up to 50% RE penetration without net loss of stability!!
- **Results: OpBen = 10-15 US cents/kWh ± 10%**
- Total benefits 2013 = 15-25 cents/kWh ± 30%
- F (country, RE penetration rate, price of gas)

Estimates of RE benefits are extremely inaccurate.



3. What can governments do? Examples.
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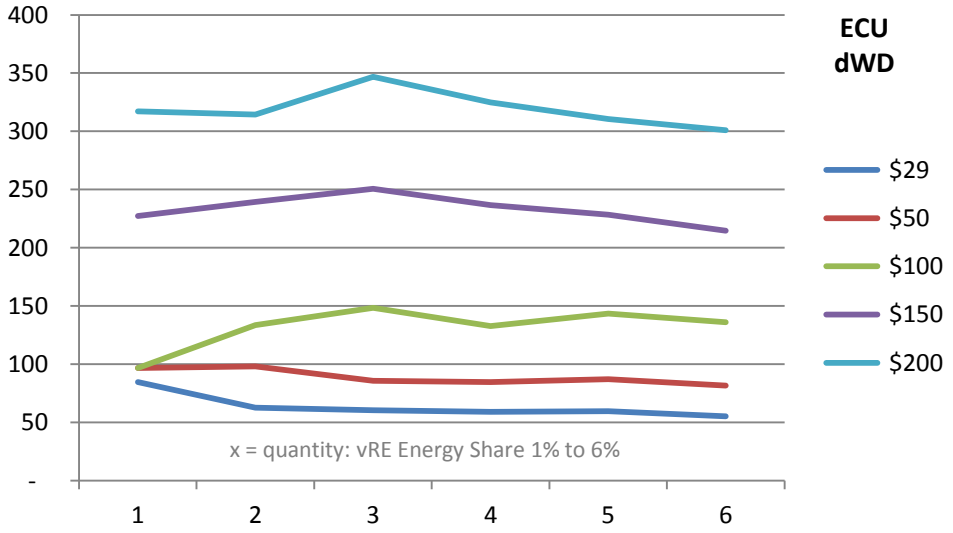
Results:

- Benefits higher than estimates in literature
- High penetration rates are possible without necessarily hindering benefits
- Benefits may rise with higher penetration rates
- Spinning reserve plays much smaller role than expected

	OpBen [$/MWh]
ARGENTINA	102
BOLIVIA	111
ECUADOR	132
EL SALVADOR	145



What We Want.

Which requirements do investors have for Renewable Energy in Emerging Markets?

Thank you for listening!

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