DIW BERLIN

World Congress of Environmental and Resource Economists

Financing RE in the age of falling technology costs

Karsten Neuhoff, Nils May, Jörn C. Richstein

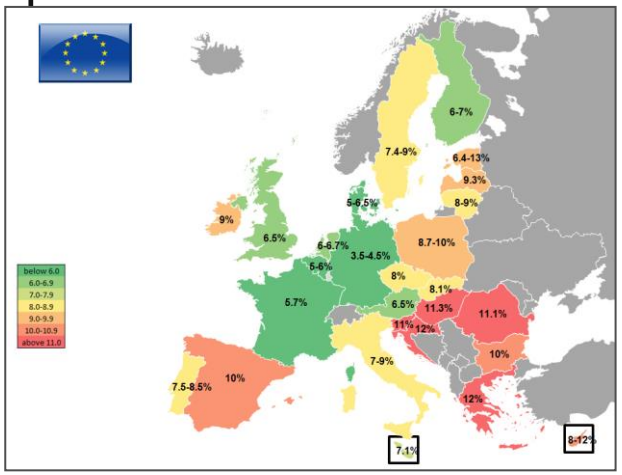
Climate Policy Department, German Institute for Economic Research

26.11.2020, Florence

1 Estimating risk mark-ups

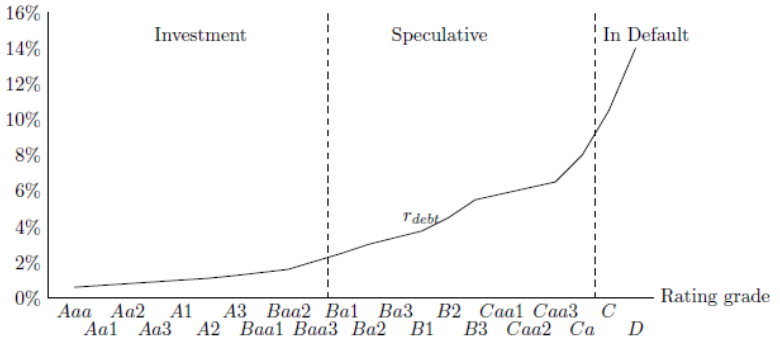
Financing cost premium of full power price exposure

- 0.8 – 1.7% NERA (2013)
- 1.2%



Risk transferred off-takers of LT contracts (Newbery, 2016)

- Default spread as function of credit rating (Damodaran 2017)
- 20% lower contract prices



Total costs increase 30%

(May and Neuhoff, 2017, Aurora Energy Research, 2018).

2 Comparison of 4 design options

1. Contracts for difference (Nera, 2013, Pollitt and Anaya, 2015)

$$a_d \mathrm{I} = \mathrm{Y} \mathrm{S}_C \quad \Rightarrow \quad \overline{C_C} = \mathrm{S}_C = \frac{a_d \mathrm{I}}{Y}$$

2. One-sided sliding premium systems (Klobasa et al., 2013; Kitzing, 2014)

$$a_d D = Y S_s \qquad a_e E = Y \int_{S_s}^{2P} \frac{(p - S_s)}{2P} dp$$

$$I = D + E \quad \Rightarrow \quad S_S = 2P \left(1 - \frac{a_e}{a_d} + \sqrt{\left(1 - \frac{a_e}{a_d}\right)^2 + \frac{a_e}{Y}\frac{I}{P}} - 1 \right)$$

$$\overline{C_s} = \int_0^{2P} \frac{1}{2P} max(S_S, p) dp$$

If $S_S > p$: Identical to CfD

$$= \frac{a_e}{Y} I + 2P \left(1 - \frac{a_e}{a_d}\right) \left(\left(1 - \frac{a_e}{a_d}\right) + \sqrt{\left(1 - \frac{a_e}{a_d}\right)^2 + \frac{a_e}{Y}\frac{I}{P}} - 1 \right)$$

If $a_e = a_d$: Identical to CfD

Comparison of 4 design options

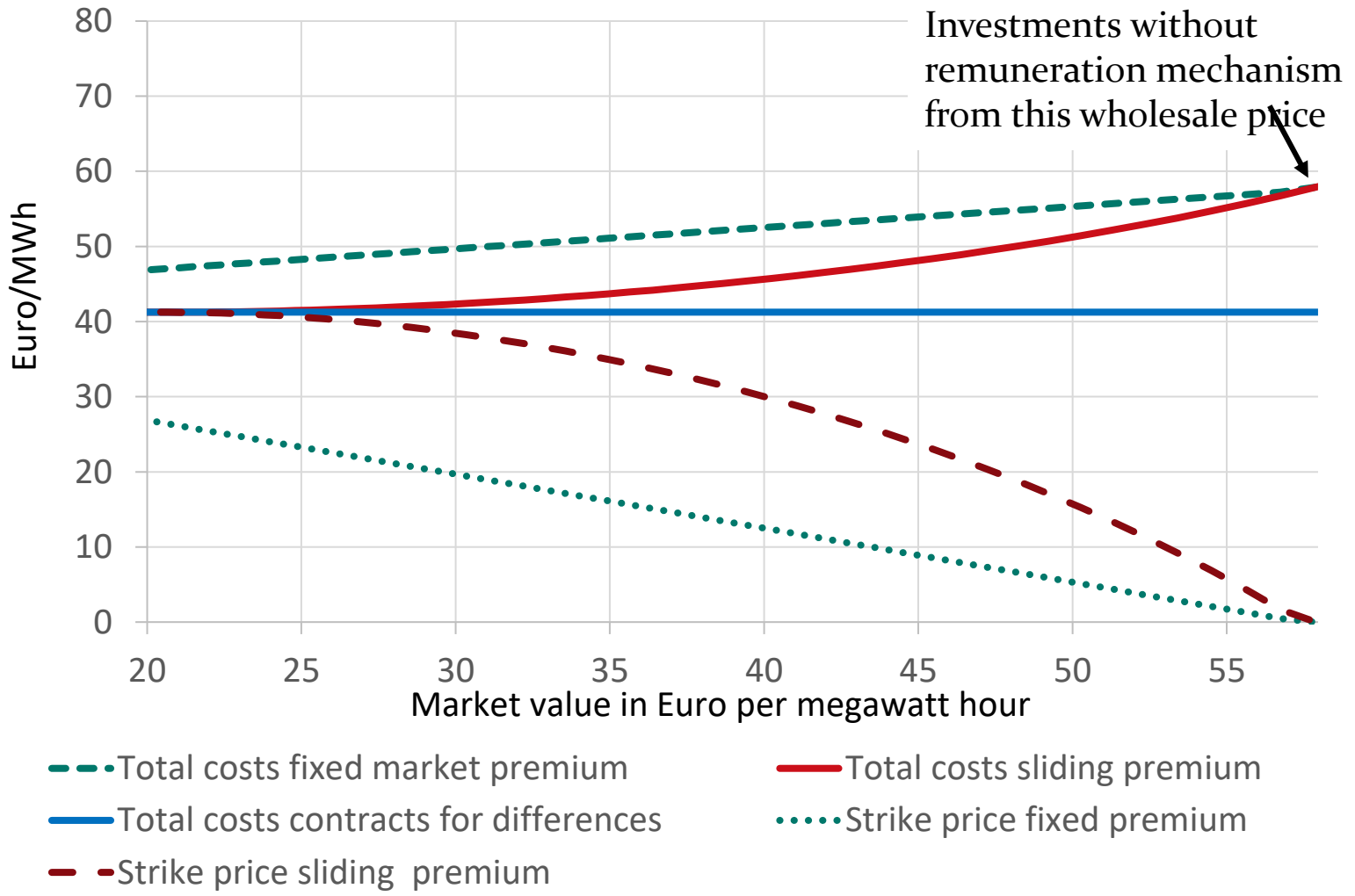
3. Fixed premia (Schmidt et al., 2013), Kitzing and Weber (2015)

$$I = D + E = \frac{YS_f}{a_d} + \frac{YP}{a_e} \qquad \overline{C_f} = \frac{a_d}{Y} I + \frac{a_e - a_d}{a_e} P$$

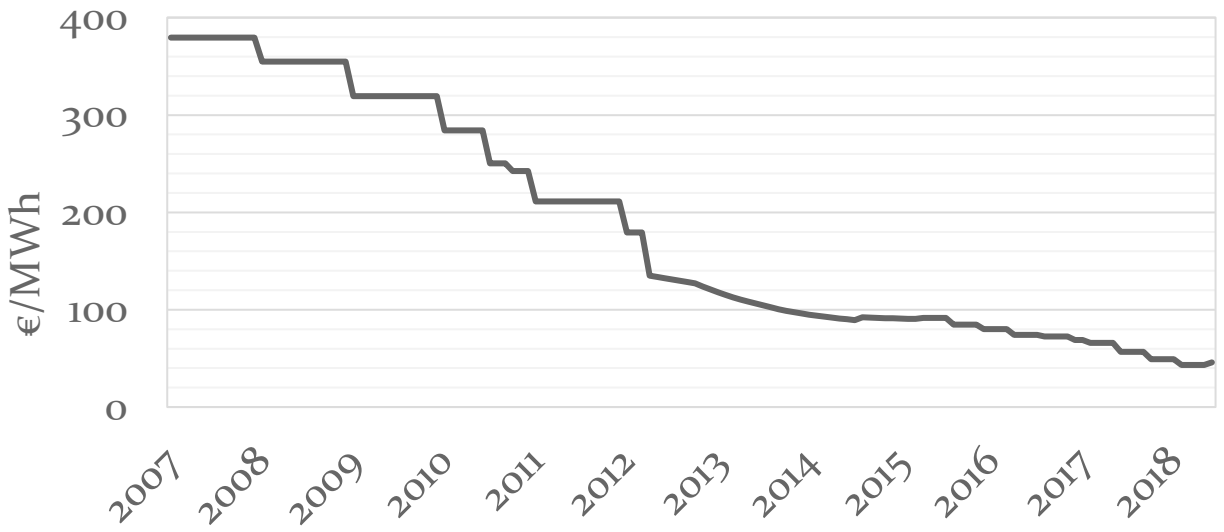
4. Only carbon pricing

$$I = E = \frac{YP}{a_e} \qquad \overline{C_N} = \frac{a_e I}{Y}$$

4 Evolution of strike prices and total costs to consumers with increasing expected wholesale price levels

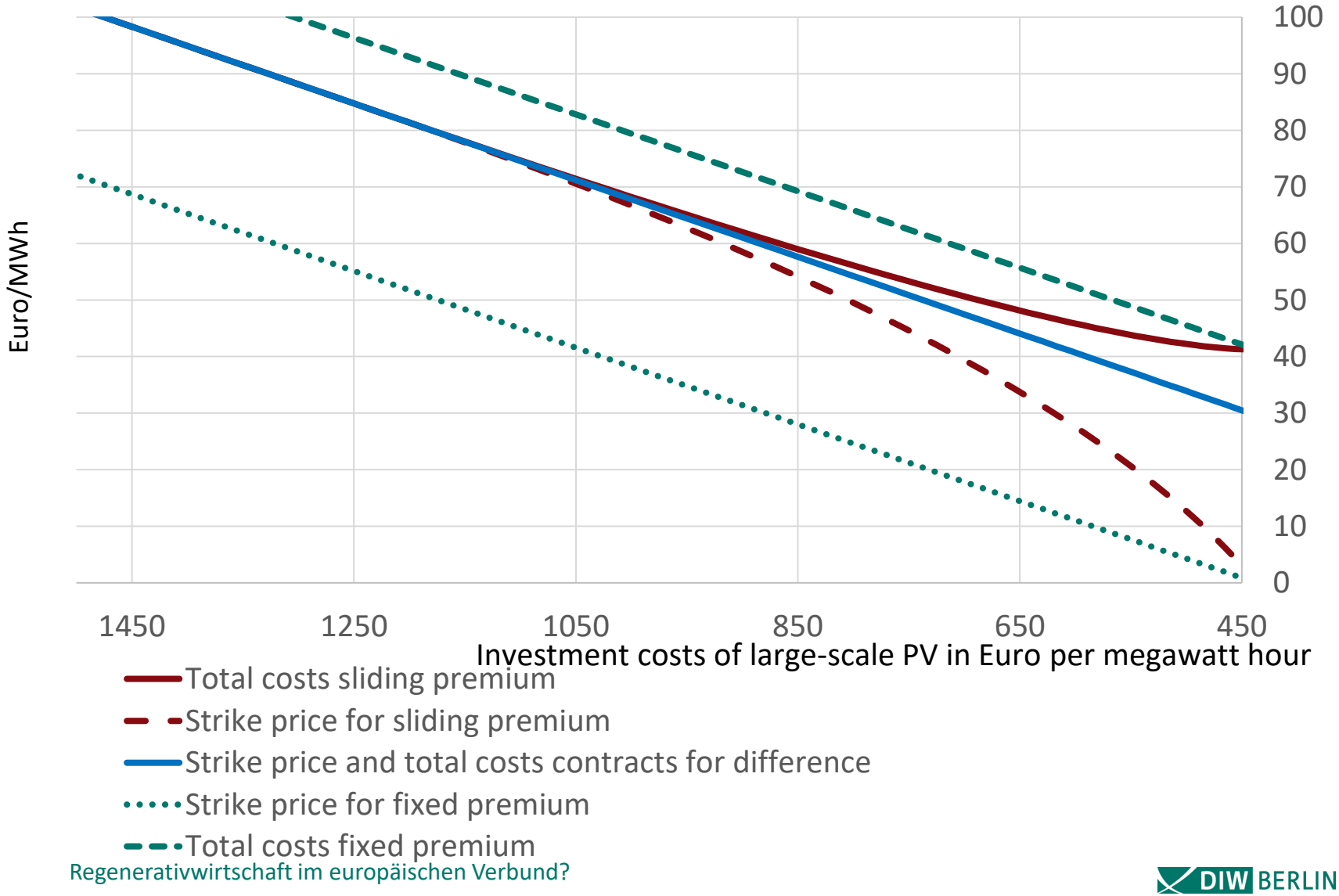


Remuneration levels of large-scale PV plants in Germany



Source: IWR, 2018 and Bundesnetzagentur

6 Evolution of strike prices and total costs to consumers of renewable energy with declining levelized costs of technology

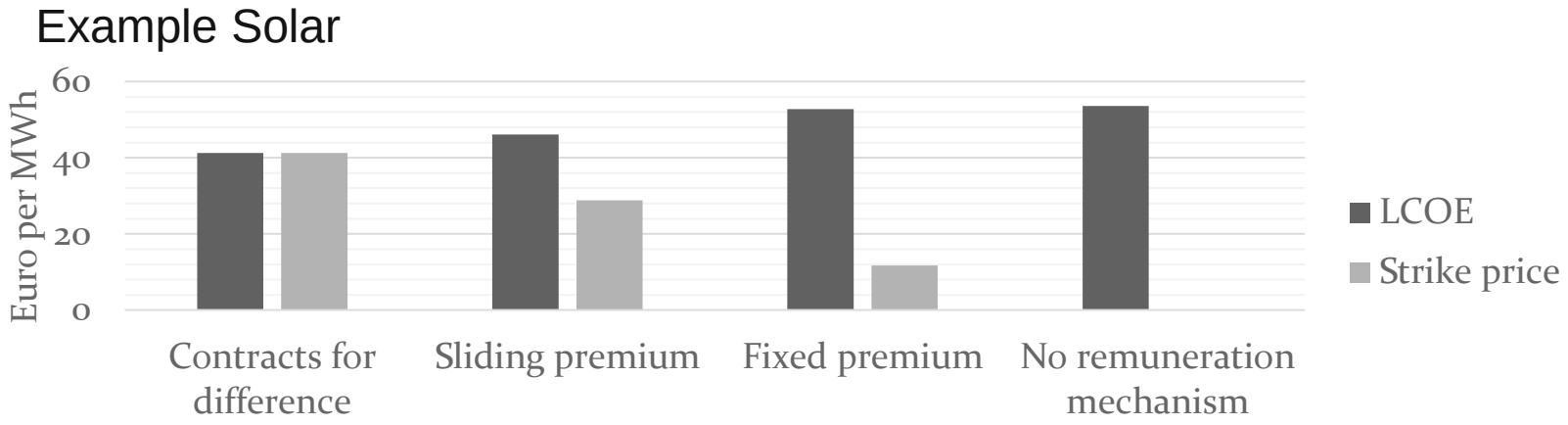


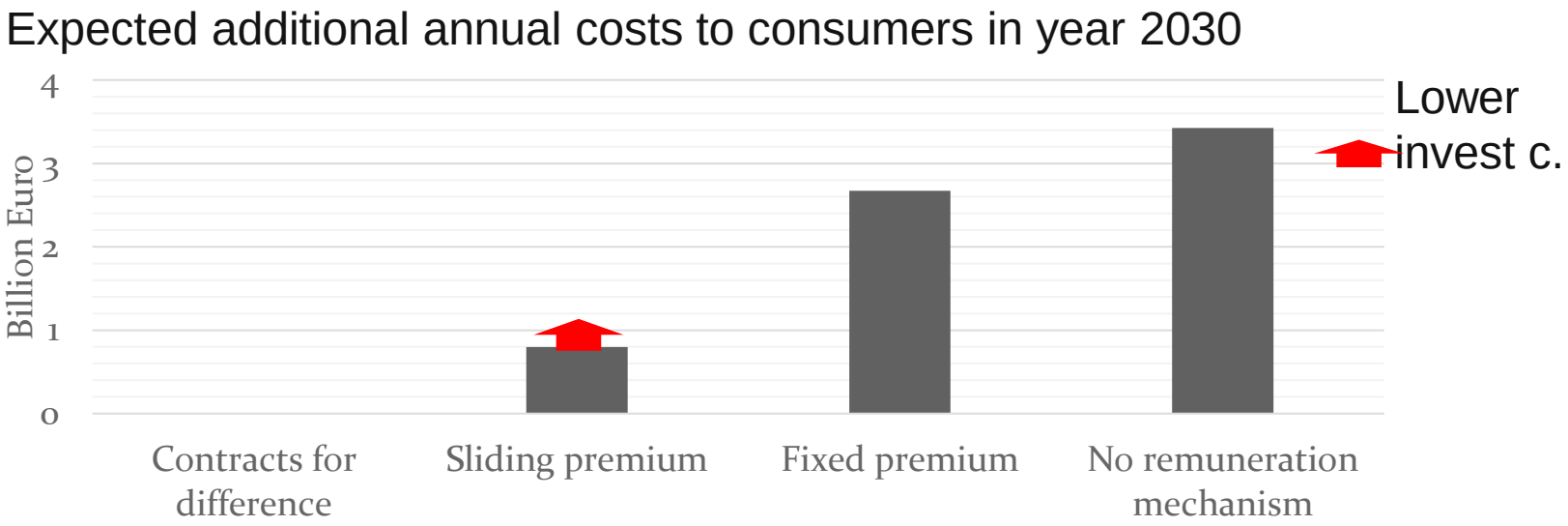
Quantification - Assumptions

- amortization period of 20 years for both equity and debt.
  - $r_e = 7\%$ -> a_e = 9.4% (min 20%)
  - $r_d = 2\%$ -> a_d = 6.78%
- Power price expectation: 43 Euro per MWh
- Market value PV 96%, Wind on-shore 83%, off-shore 91%
- RE share 2030 – 65% of 776 TWh -> 303 extra TWh

	Investment cost	Full load hours	O&M /kwh
PV	608 E/kW	1000	
Wind on-shore	1000 E/kw	2000	5
Wind off-shore	3800 Euro/kw	4100	5

Quantification – Results





Vielen Dank für Ihre Aufmerksamkeit.

DIW Berlin — Deutsches Institut für Wirtschaftsforschung e.V.
Mohrenstraße 58, 10117 Berlin
www.diw.de

Redaktion
Karsten Neuhoff