DECREASING COSTS FOR RE-TECHNOLOGIES AND IMPLICATIONS FOR LONG TERM PLANNING OF INDONESIA

Johannes Eckstein, Jose A. Ordonez

March 2, 2020 – Wyndham Casablanca Hotel, Jakarta

Fraunhofer ISI

Agenda

March 2, 2020 – Wyndham Casablanca Hotel, Jakarta

15:00 - 15:20 Registration

15:20 – 15:30 Welcoming words and Introduction

15:30 - 16:00 Input presentation

Falling Costs for Renewables and their implications

16:00 - 16:30 Insights from a survey

Financing and barriers to the development of RE

16:30 - 16:45 Time for discussions - Coffee Break

16:45 – 18:15 Discussion

Reflecting key insights from discussions with Indonesian stakeholders of energy and climate policy

18:15 - 18:30 Wrap-up and Conclusion

18:30 - 20:00 Networking Dinner

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FRAUNHOFER SOCIETY AND FRAUNHOFER ISI

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The Fraunhofer-Gesellschaft undertakes applied research of direct utility to private and public enterprise and of wide benefit to society.

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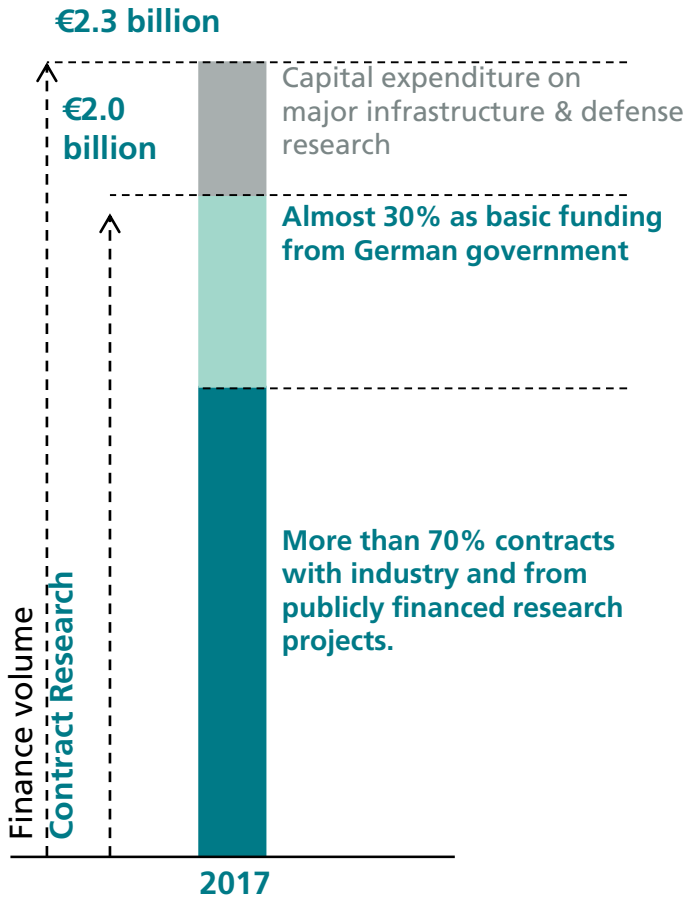
72 institutes and research units



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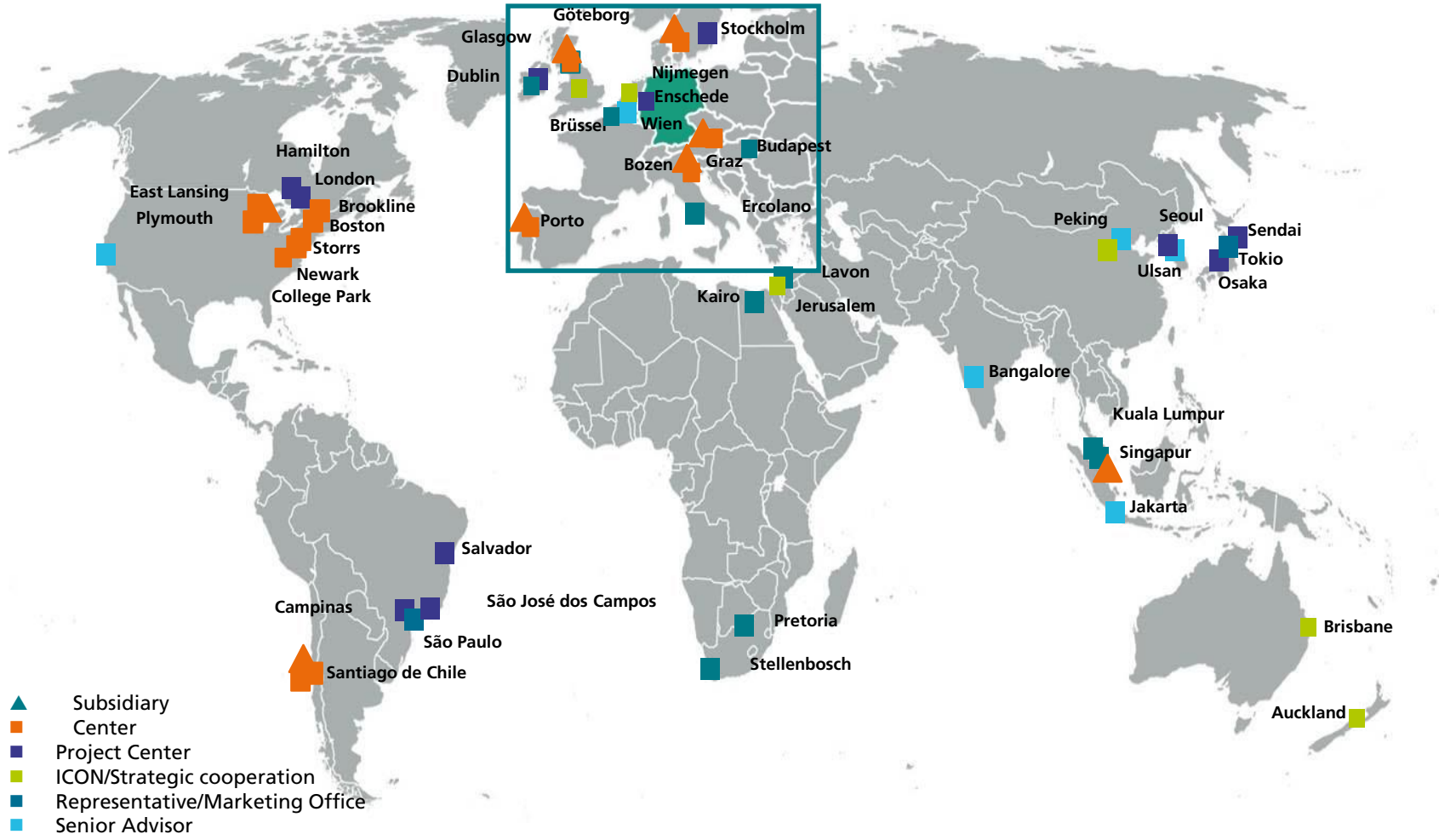
THE FRAUNHOFER SOCIETY WORLDWIDE



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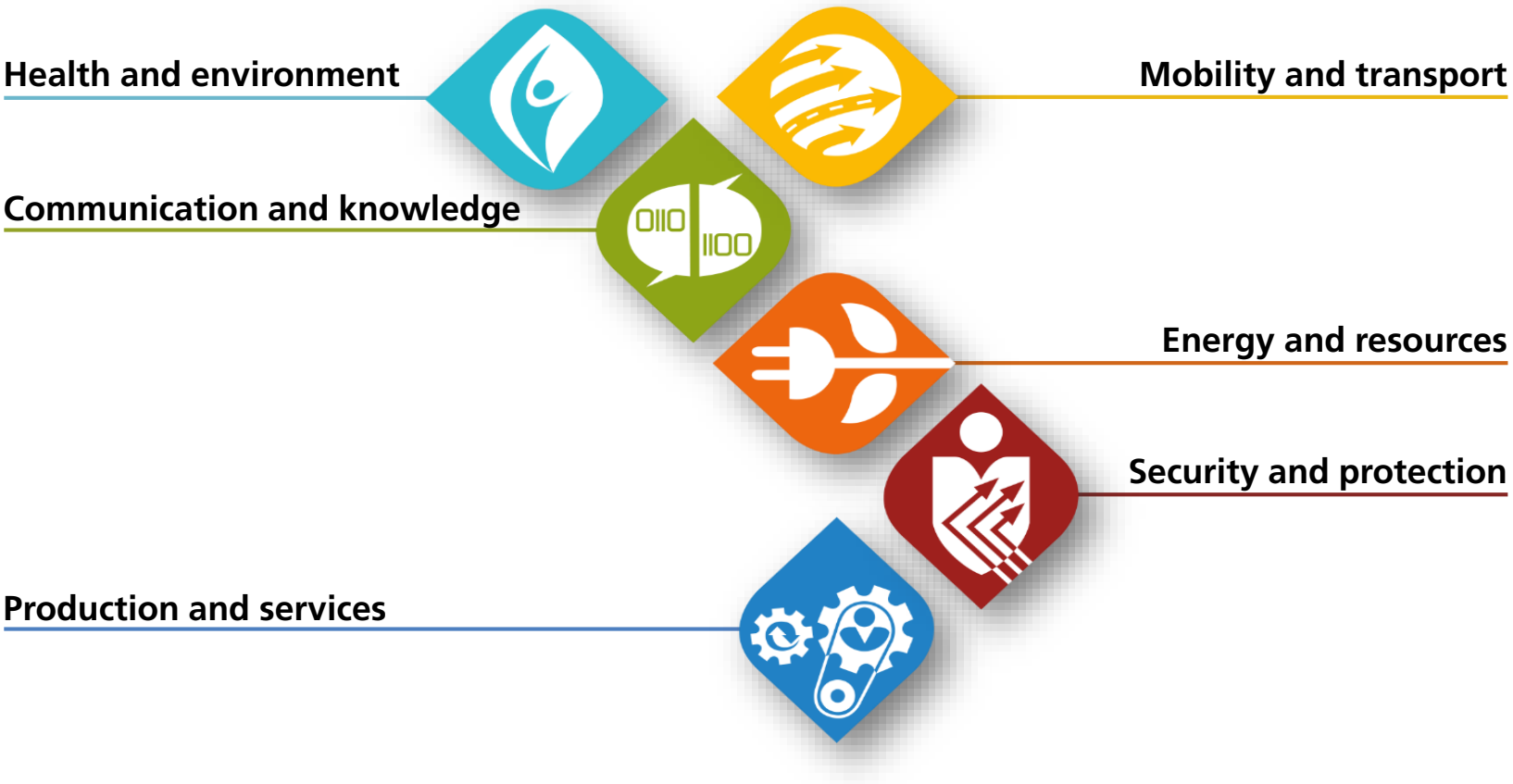
THE FRAUNHOFER SOCIETY – FIELDS OF RESEARCH



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The Competence Centers for Energy

We are 70 colleagues working together to...

- ... model energy demand and supply
- ... analyse new technological developments
- ... combine and integrate demand and supply of renewable energies
- ... evaluate policy instruments
- ... advise all political layers on questions related to
  - the energy transition
  - and climate policy
- ... advise companies on strategies for energy supply and use

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- Projects of Fraunhofer ISI in the international context
  - Support to the development to the 4th and 5th ASEAN Energy Outlook (ASEAN Centre for Energy)
  - Assessing local manufacturing potentials for conventional and renewable technologies in the Kingdom of Saudi Arabia
  - Developing and assessing long-term decarbonization scenarios for Germany and EU (2050)
  - Developing of energy efficiency baseline trajectory and scenario-based policy evaluation for the government of Mexico
  - Constant consultancy to the German government on the energy transition (Energiewende)

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INPUT PRESENTATION: FALLING COSTS FOR RENEWABLES AND THEIR IMPLICATIONS

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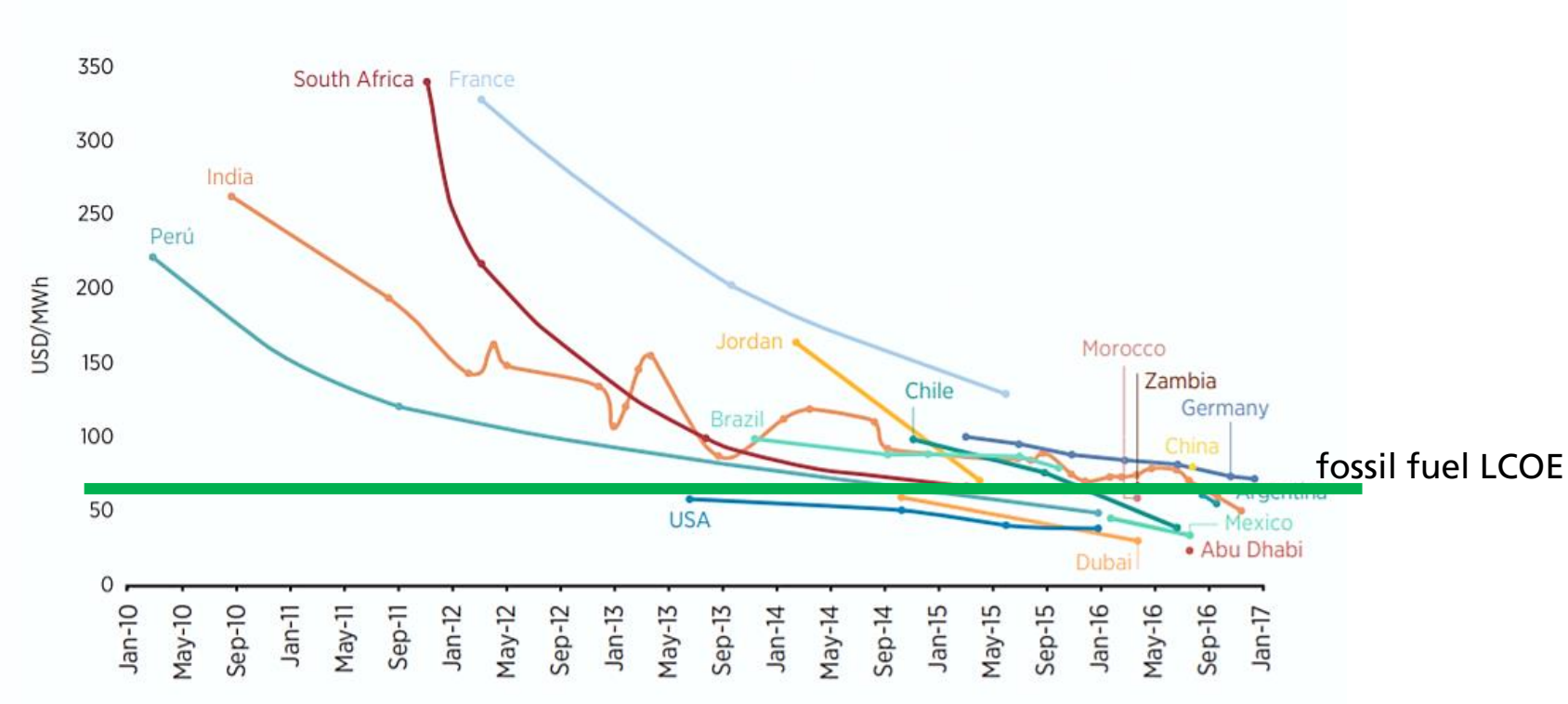
DECREASING COSTS FOR RE-TECHNOLOGIES AND ITS IMPLICATION FOR ENERGY PLANNING

- Solar PV and wind energy as well as battery technologies for EVs are substantially cheaper now than projected previously, e.g. in 2015, previous to the Paris Agreement.
- Technologies are expected to have faster cost reductions up to 2030 than assumed before.

- **Research question: How could these cost reductions be reflected in planning processes of Indonesia?**
  - in energy planning
  - in informing climate mitigation plans

DECREASING COSTS FOR RE-TECHNOLOGIES AND ITS IMPLICATION FOR ENERGY PLANNING

- Global auction prices for RE technologies have seen a massive reduction
- Evolution of **solar PV** auction prices between 2010 and 2017



https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Jun/IRENA_Renewable_Energy_Auctions_2017.pdf

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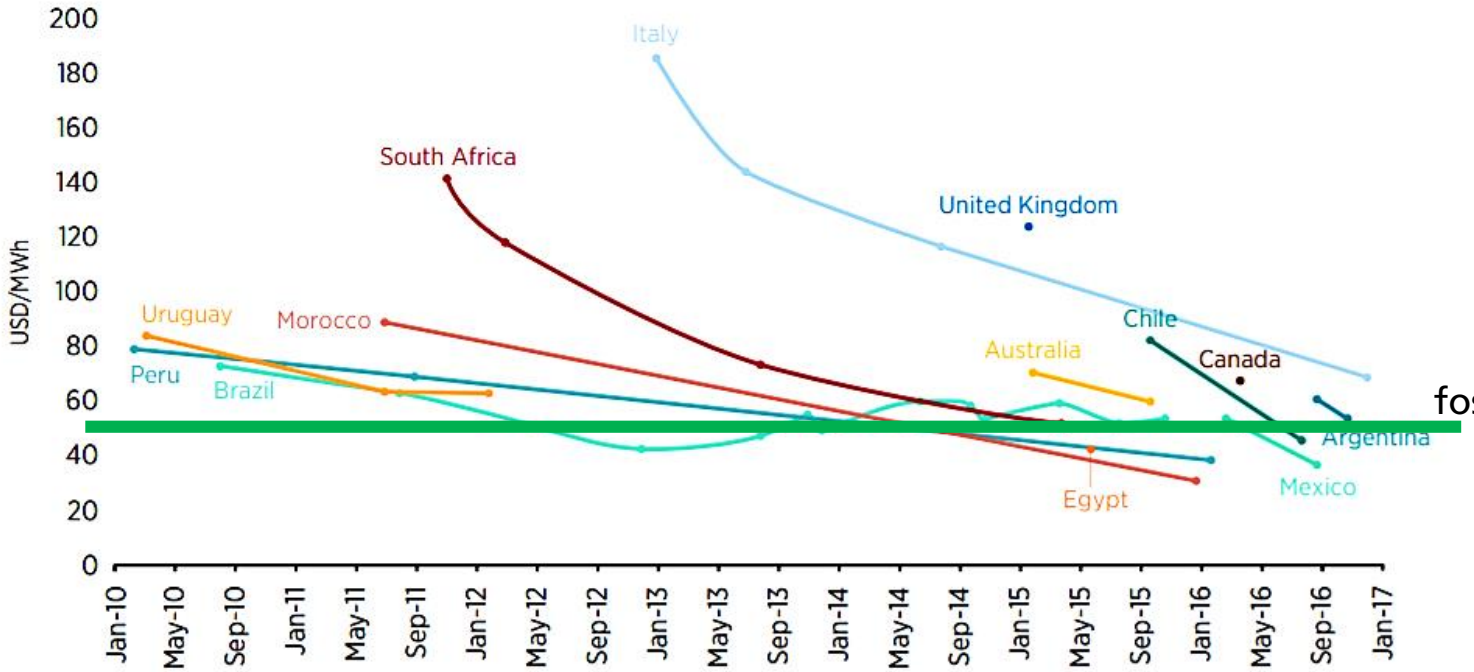
DECREASING COSTS FOR RE-TECHNOLOGIES AND ITS IMPLICATION FOR ENERGY PLANNING

- Global auction prices for RE technologies have seen a massive reduction
- Evolution of **wind** auction prices between 2010 and 2017



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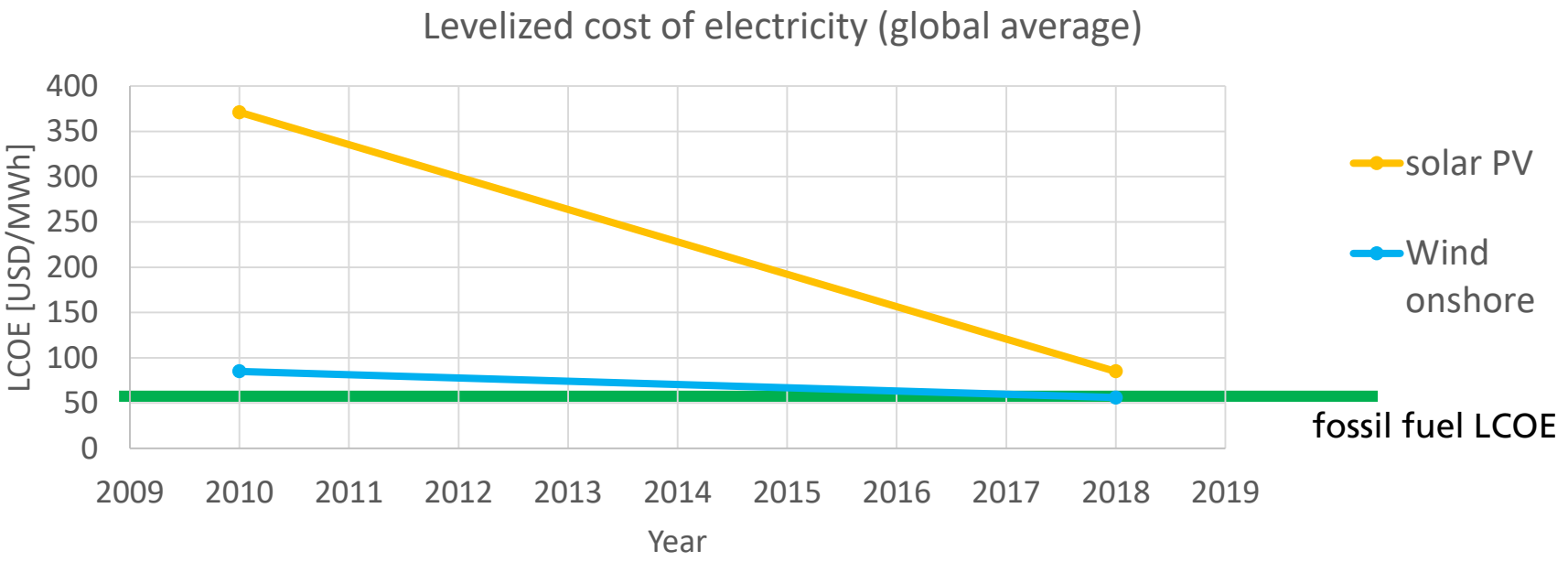
DECREASING COSTS FOR RE-TECHNOLOGIES AND ITS IMPLICATION FOR ENERGY PLANNING

- The LCOE (levelized costs of electricity) reflect all investment costs, the operational costs and their discount over
- LCOE is a measure to reflect the costs of a profitable project
- **The LCOE for solar PV and wind energy over the last 10 years, now reaching values of fossil fuel power**



IRENA, 2019: Renewable Energy Generation Costs in 2018

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DECREASING COSTS FOR RE-TECHNOLOGIES AND ITS IMPLICATION FOR ENERGY PLANNING

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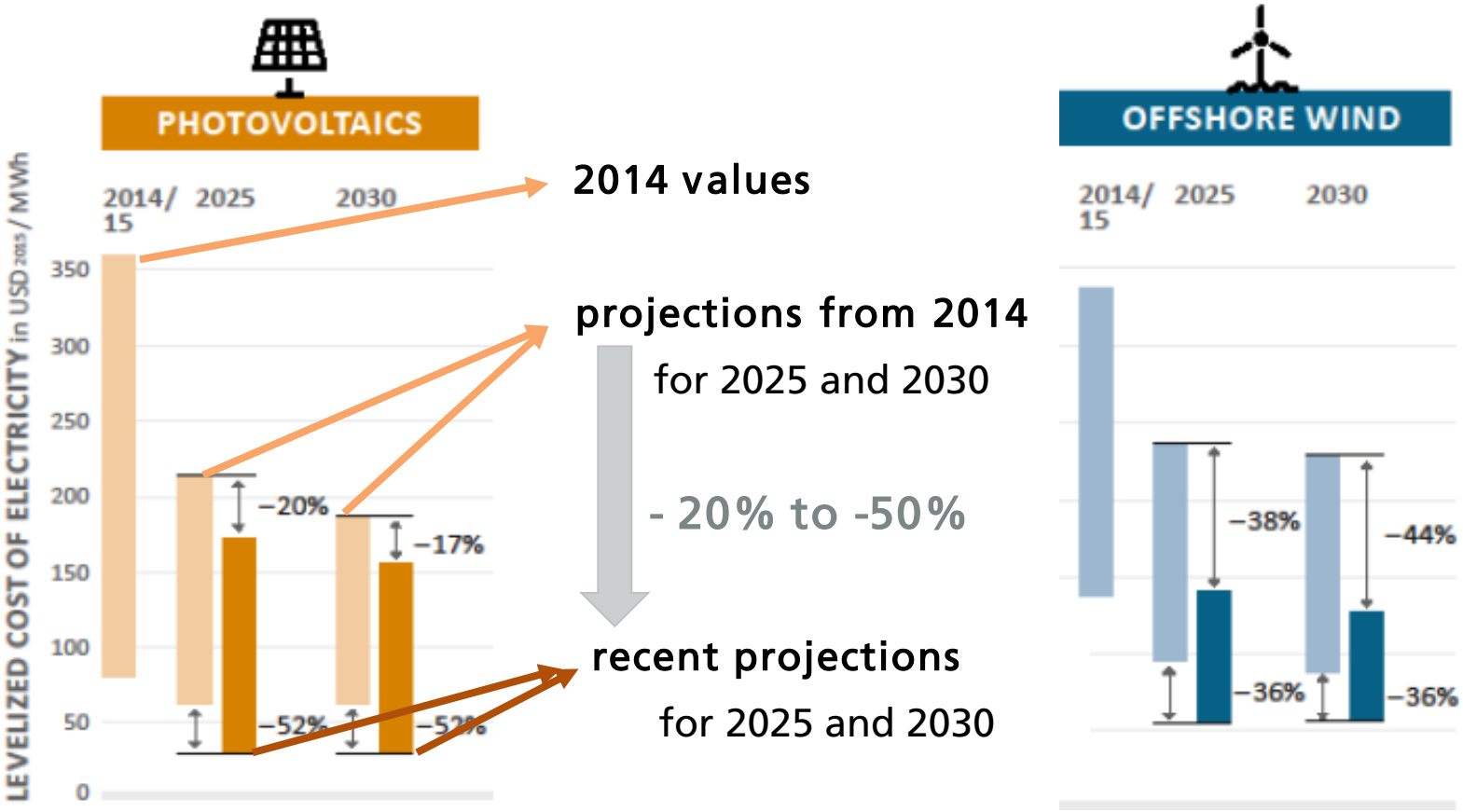

https://www.umweltbundesamt.de/publikationen/bringing-climate-policy-up-to-date-decreasing-cost

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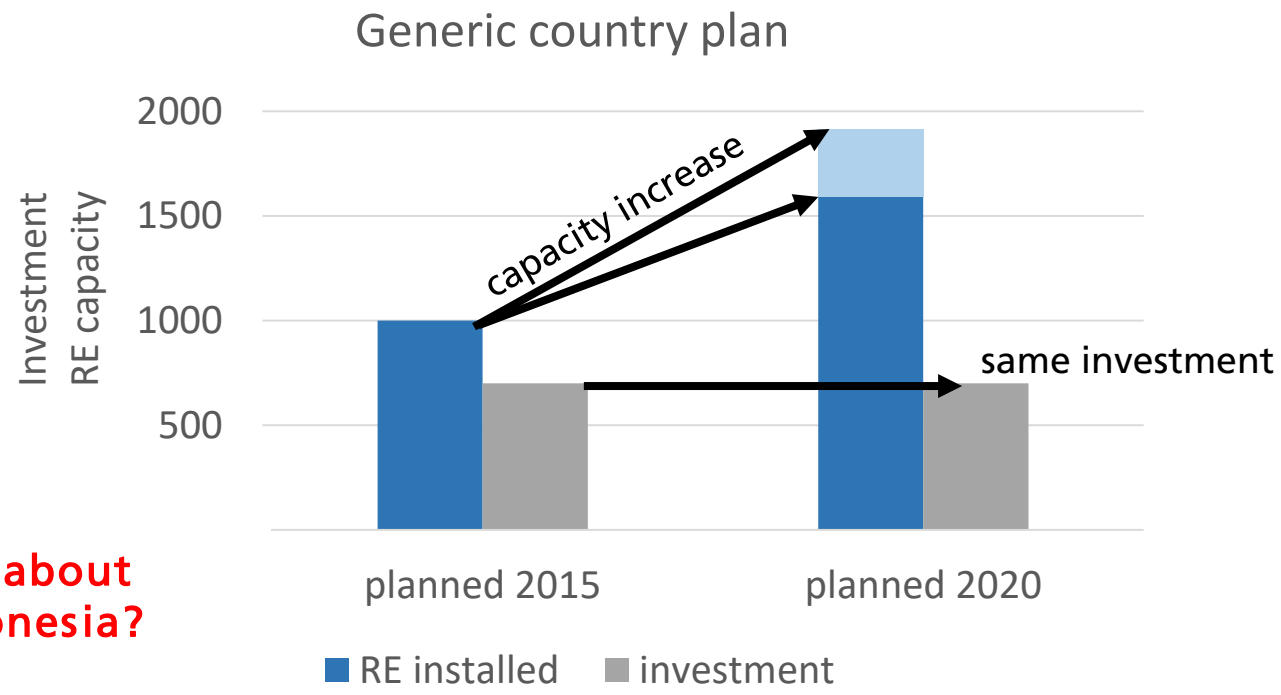
- Assuming the same investment as in 2015
- Considering that costs have fallen by 50%
- **The same investment now could lead to double the uptake of RE**



What about Indonesia?

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DECREASING COSTS FOR RE-TECHNOLOGIES AND ITS IMPLICATION FOR ENERGY PLANNING

- RE targets in Indonesia
  - 23% target RE in all sectors: set down in presidential regulation

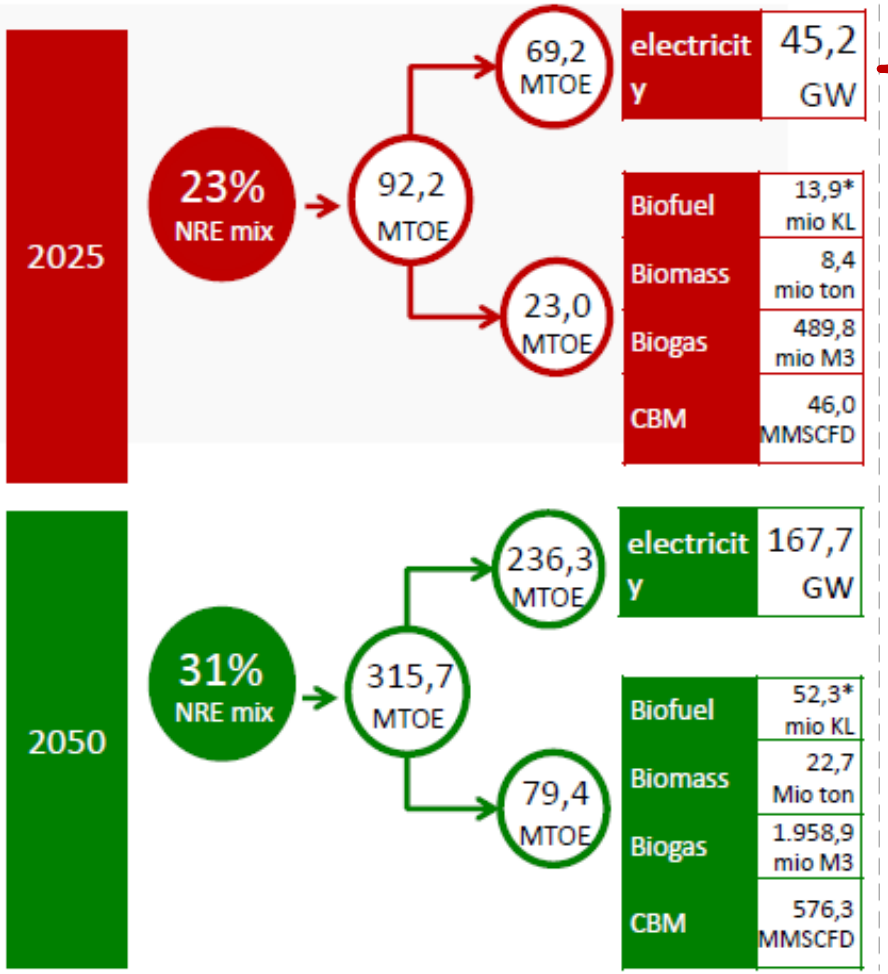
- RUEN is the national energy plan set down by DEN
  - for the energy system
    - includes electricity, transport, industry
  - 23% target in TPES

- RUPTL is the plan of PLN
  - for the electricity system
  - 23% target in generation

NEW & RENEWABLE ENERGY TARGETS

PLAN

ACTION



Type - [MW]	2025	2050
Geothermal	7,239	17,546
Hydro	20,960	45,379
Bionergy	5,532	26,123
Solar	6,379	45,000
Wind	1,807	28,607
Other RE	3,128	6,383

DEN, RUEN, 2014

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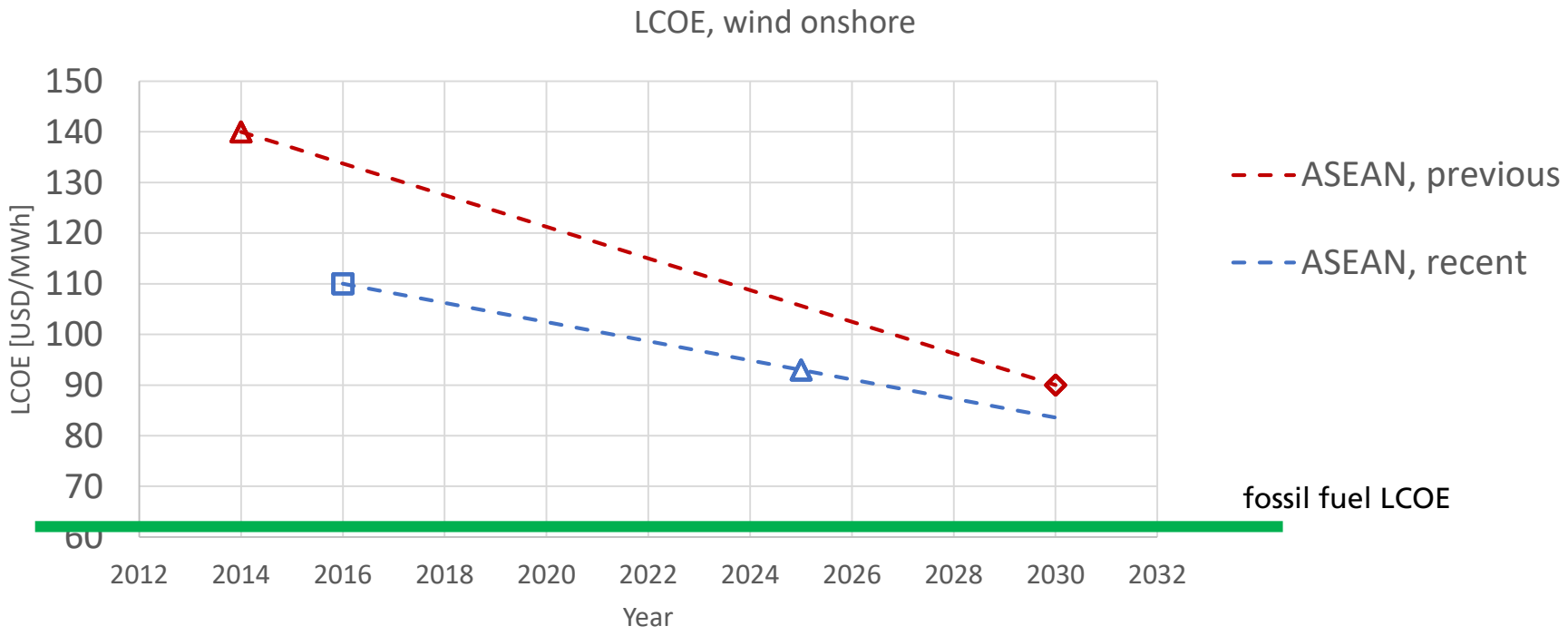
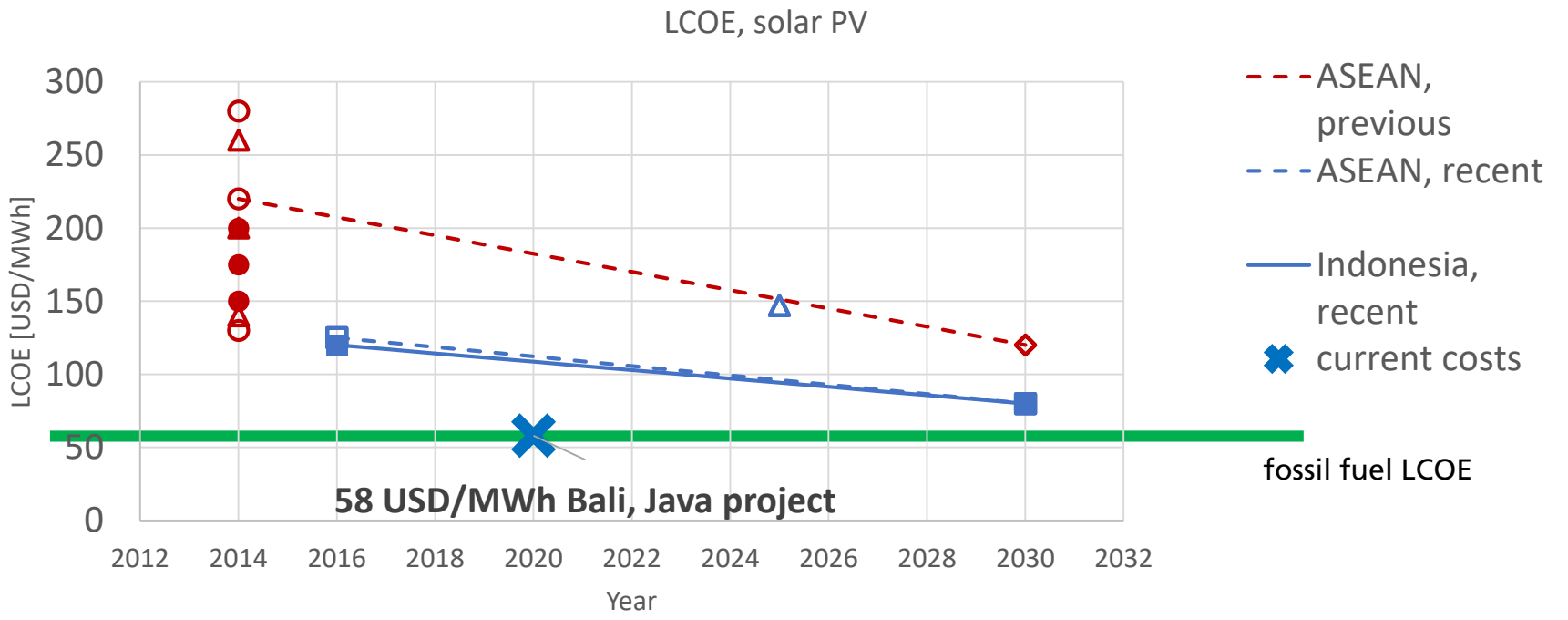
- In Indonesia, past LCOE projections are difficult to obtain, but **data from the ASEAN** region can be informative of the trend
- For **wind**, projected LCOEs have **dropped between 7% and 30%**



DECREASING COSTS FOR RE-TECHNOLOGIES AND ITS IMPLICATION FOR ENERGY PLANNING

- For **solar PV**, LCOEs have **dropped between 30% and 50%** in the ASEAN region; similar values for Indonesia where available
- most recent projects are undercutting the LCOE of projections for 2030 already, **now at 5.8 cents/kWh**



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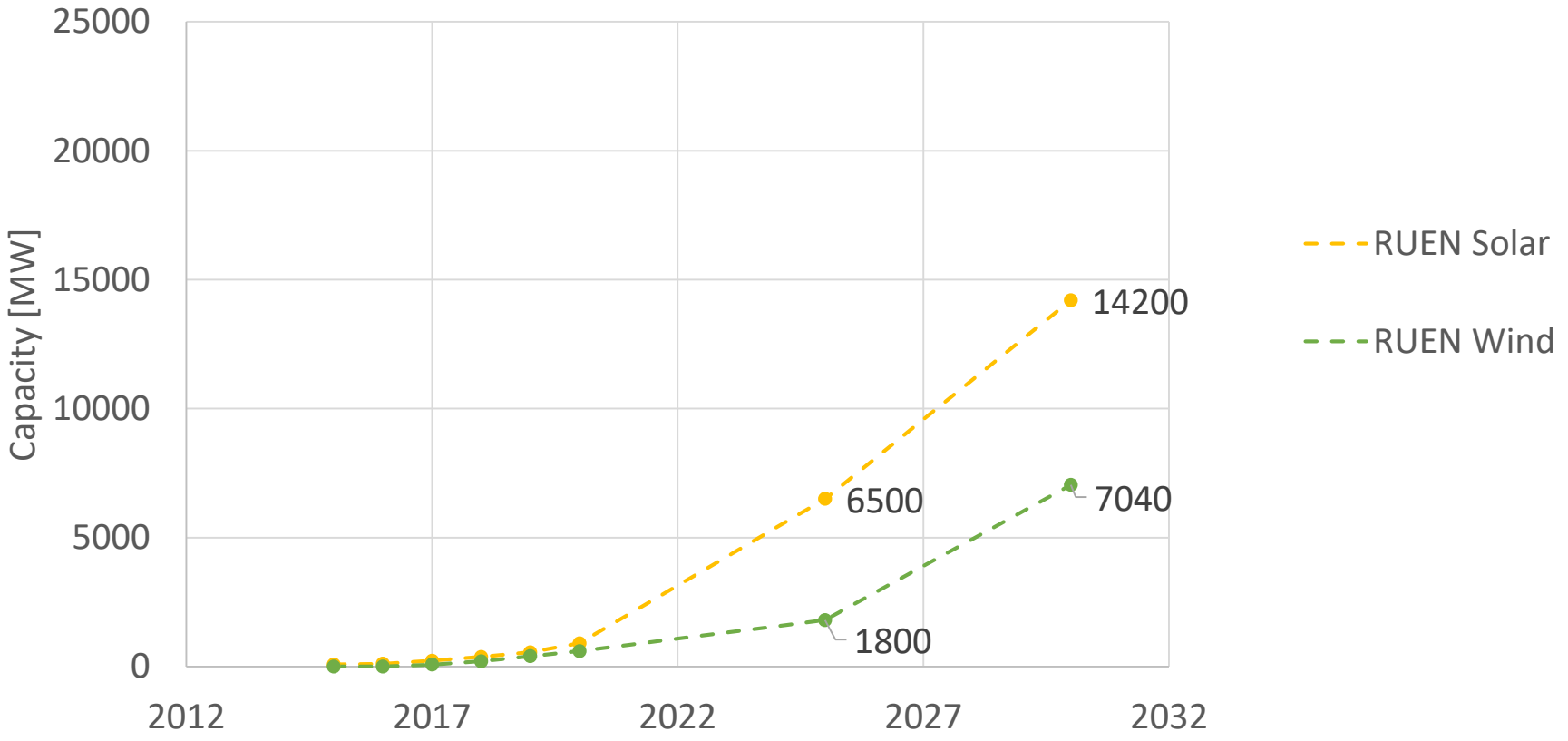
- **RUEN development** of **solar PV and wind** onshore for Indonesia



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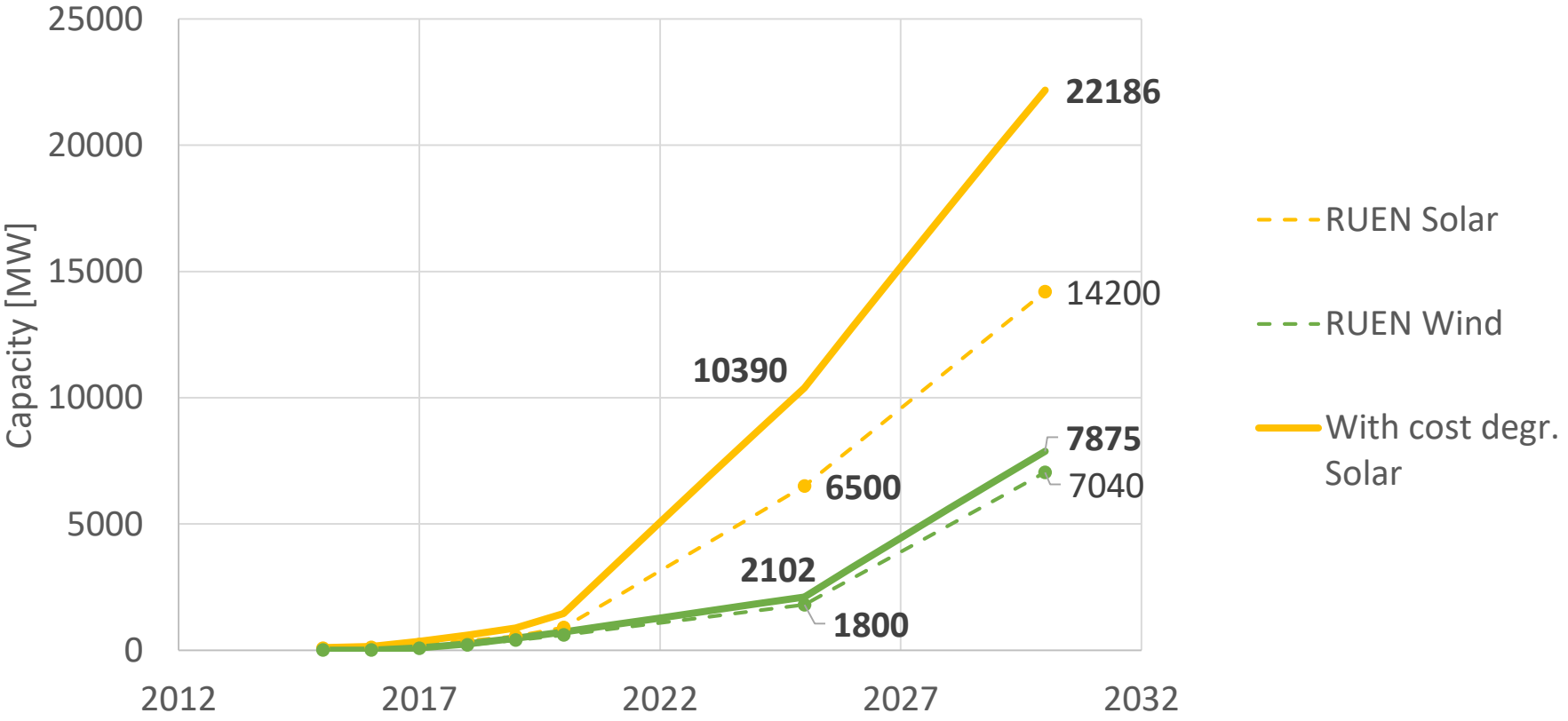
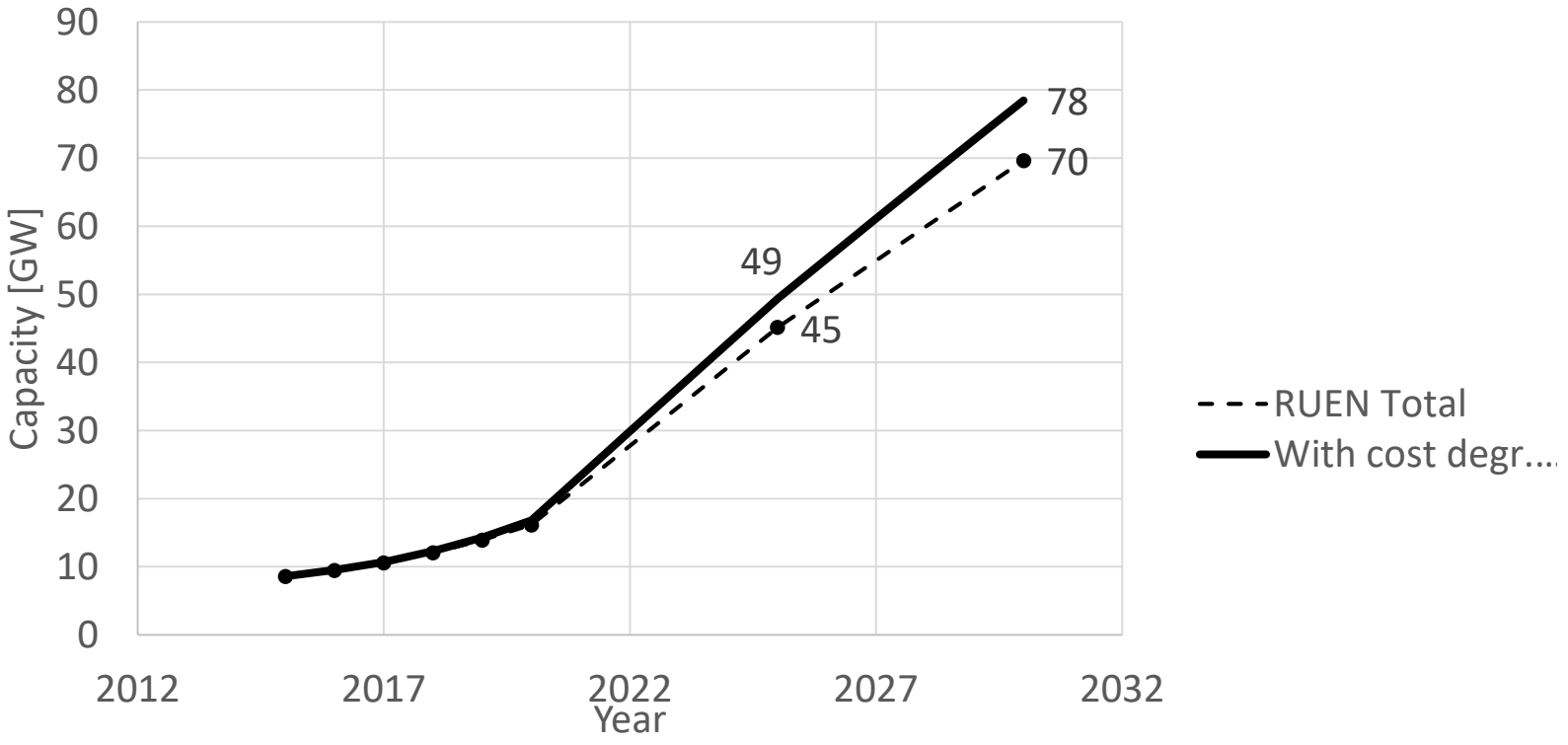
- Using updated cost projections, **the same investments** could inform a **higher ambition** in taking up solar PV and wind



DECREASING COSTS FOR RE-TECHNOLOGIES AND ITS IMPLICATION FOR ENERGY PLANNING

- The drop in costs of solar PV and wind energy could inform **an increase of the target from 45MW to 49MW**



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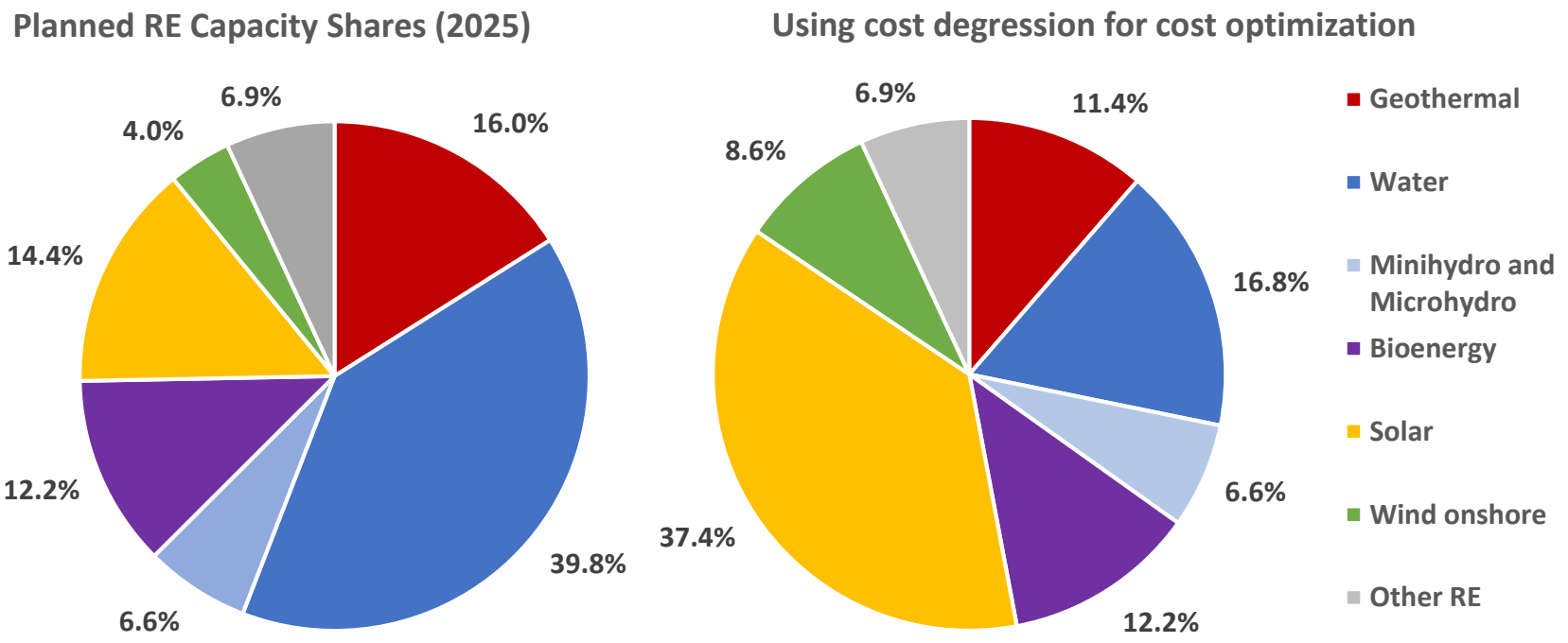
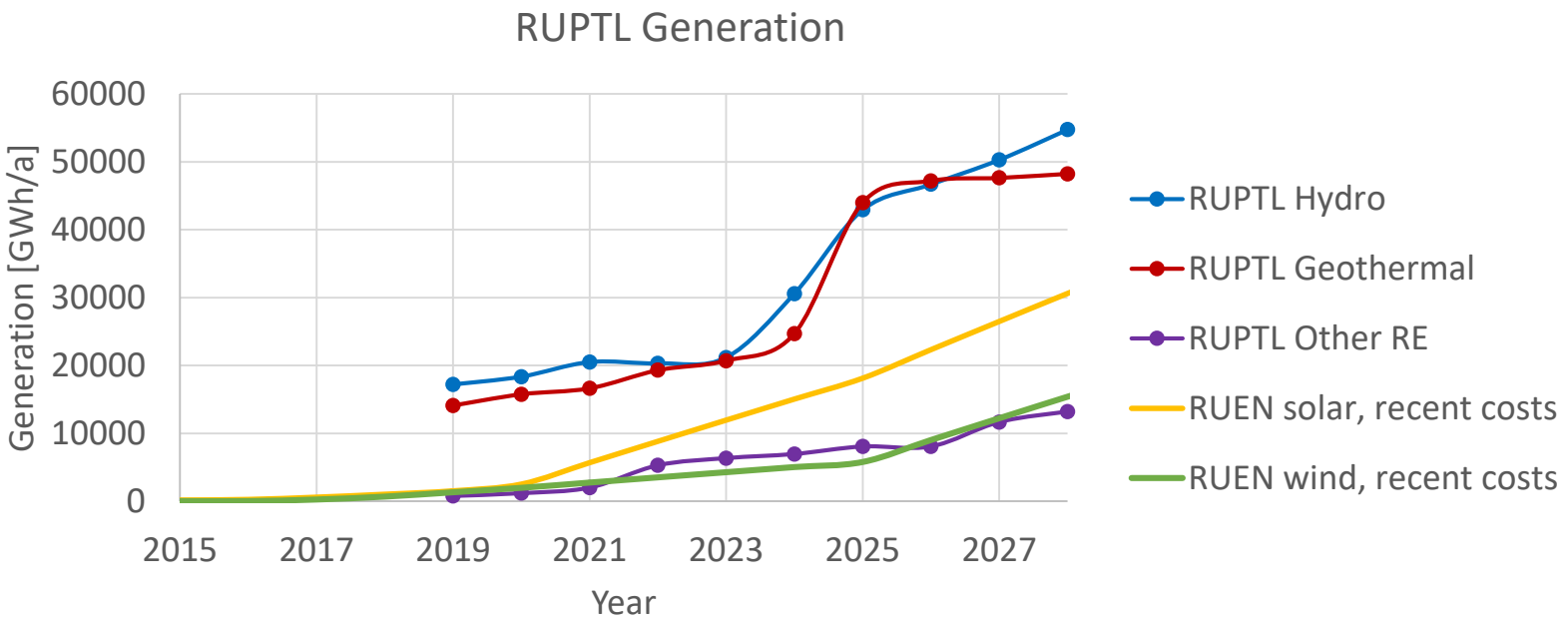
DECREASING COSTS FOR RE-TECHNOLOGIES AND ITS IMPLICATION FOR ENERGY PLANNING

- An increase in solar PV and wind could alter the energy mix to reach the target of 23%
- *Could this make the implementation more cost optimal?*



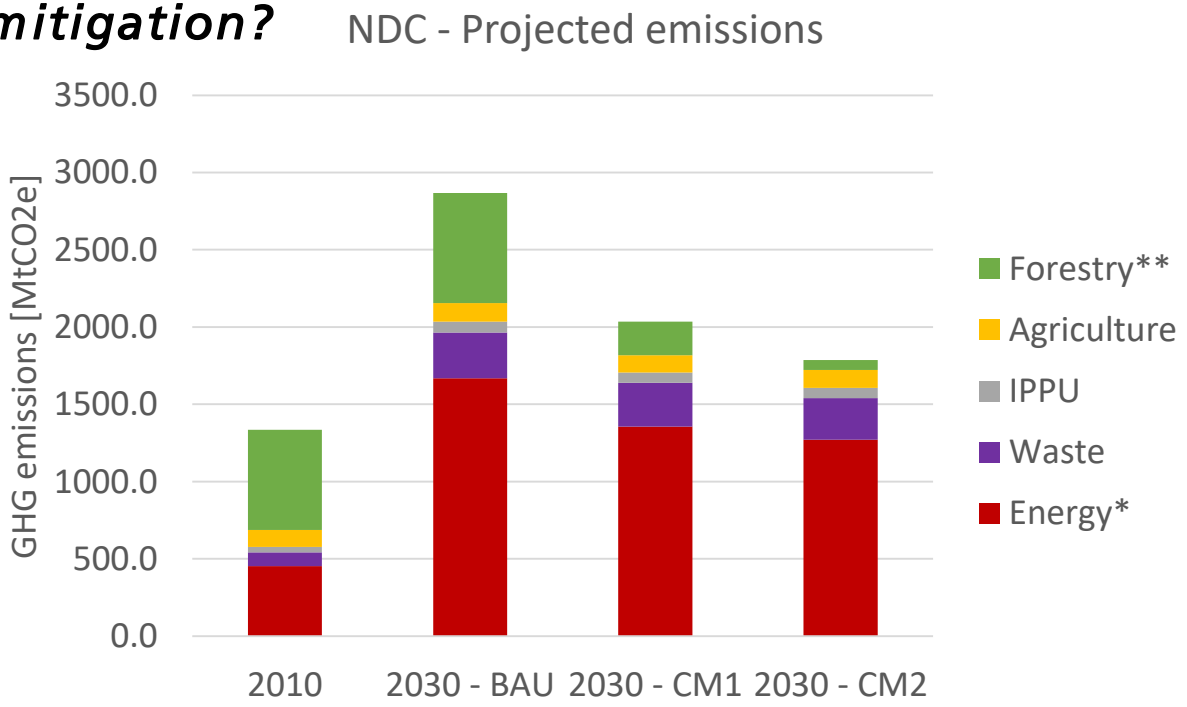
DECREASING COSTS FOR RE-TECHNOLOGIES AND ITS IMPLICATION FOR ENERGY PLANNING

- An increase of generation would follow from increasing capacity
- Could inform an update of the RUPTL
- ***Could this make the implementation more cost optimal for PLN and end consumers?***



DECREASING COSTS FOR RE-TECHNOLOGIES AND ITS IMPLICATION FOR ENERGY PLANNING

- The **NDC is currently being updated**, the main share of emission reductions currently is with forestry. 314 MtCO2 emission reduction is foreseen for energy.
- ***Considering cost reductions, could the energy sector take a higher share of mitigation?***



DECREASING COSTS FOR RE-TECHNOLOGIES AND ITS IMPLICATION FOR ENERGY PLANNING

- Costs for **solar PV and wind energy have seen massive cost reductions** over the last years
  - reflected in auction outcomes worldwide
  - reflected in falling LCOEs globally
- These cost reductions could inform an update of energy planning

- **For Indonesia:**
  - costs have also fallen dramatically, esp. considering recent projects
  - This could inform an update of RUEN, RUPTL
    - ***Could this make the planning more cost optimized?***
    - *Could this inform an increase in ambition?*
  - ***In turn, could this increase the share of mitigation taken by the energy sector?***

DECREASING COSTS FOR RE-TECHNOLOGIES AND IMPLICATIONS FOR LONG TERM PLANNING OF INDONESIA

INPUT PRESENTATION: BARRIERS TO RE DEVELOPMENT IN INDONESIA'S POWER SECTOR – A DOUBLE EDGED KNIFE

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BARRIERS TO THE DEVELOPMENT OF RE – A DOUBLE EDGED KNIFE

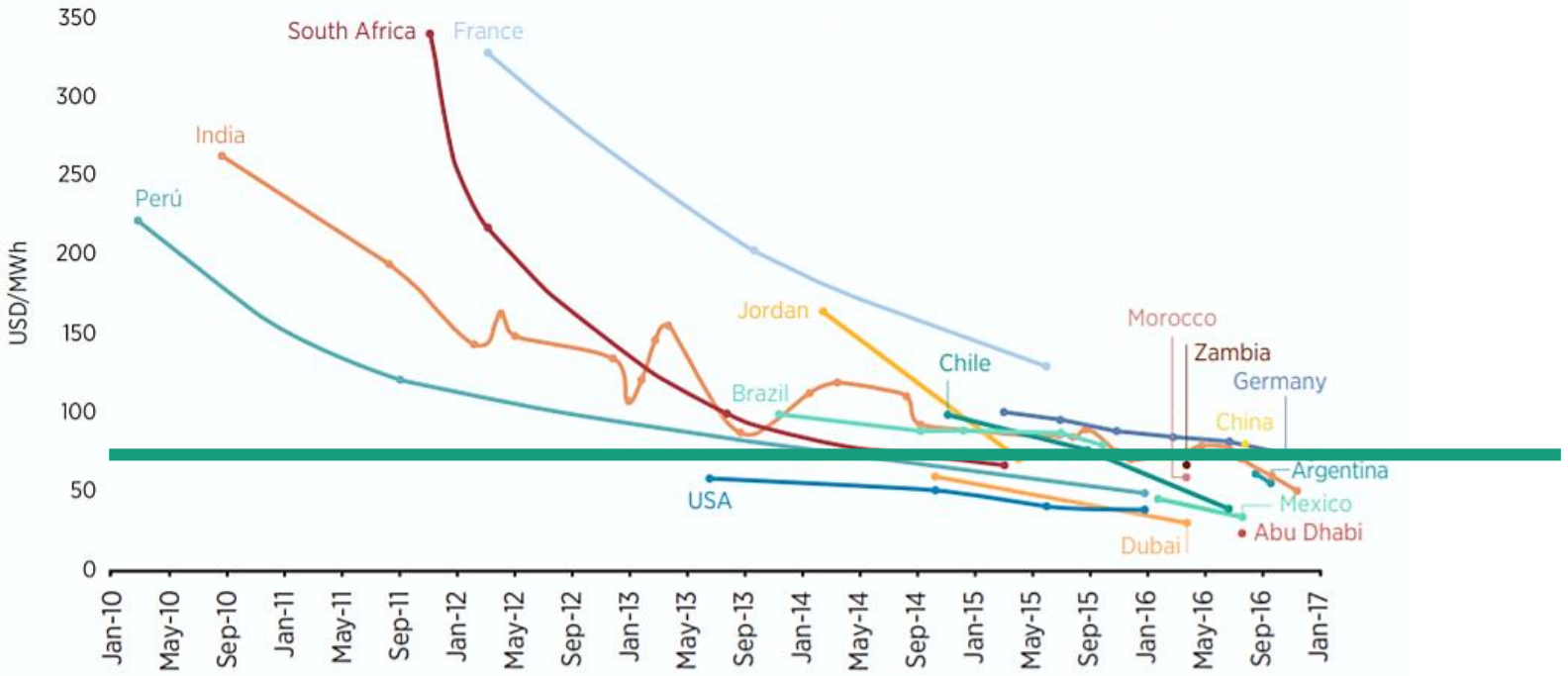
- Worldwide trend show a massive cost reduction for key RE technologies in the power sector.
- Indonesia, while having experienced reductions, is still at relative high cost when compared with global context.

Lead question:

Why are costs for key RE technologies still at relatively high level in Indonesia?

DECREASING COSTS FOR RE-TECHNOLOGIES AND ITS IMPLICATION FOR ENERGY PLANNING

- Global auction prices for RE technologies have seen a massive reduction
- Evolution of **solar PV** auction prices between 2010 and 2017



Source: IRENA (2017)

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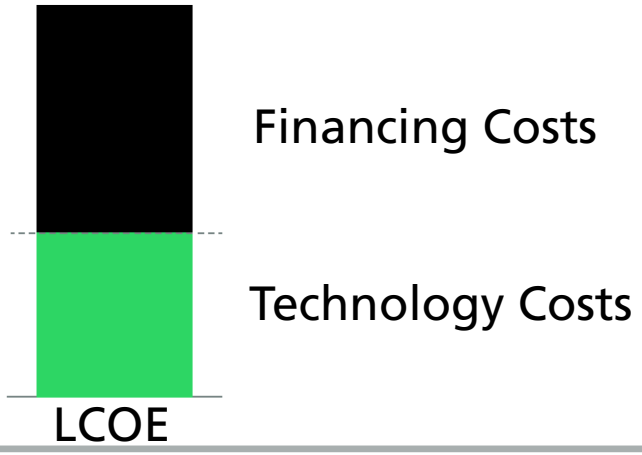
COMPONENTS OF LCOE

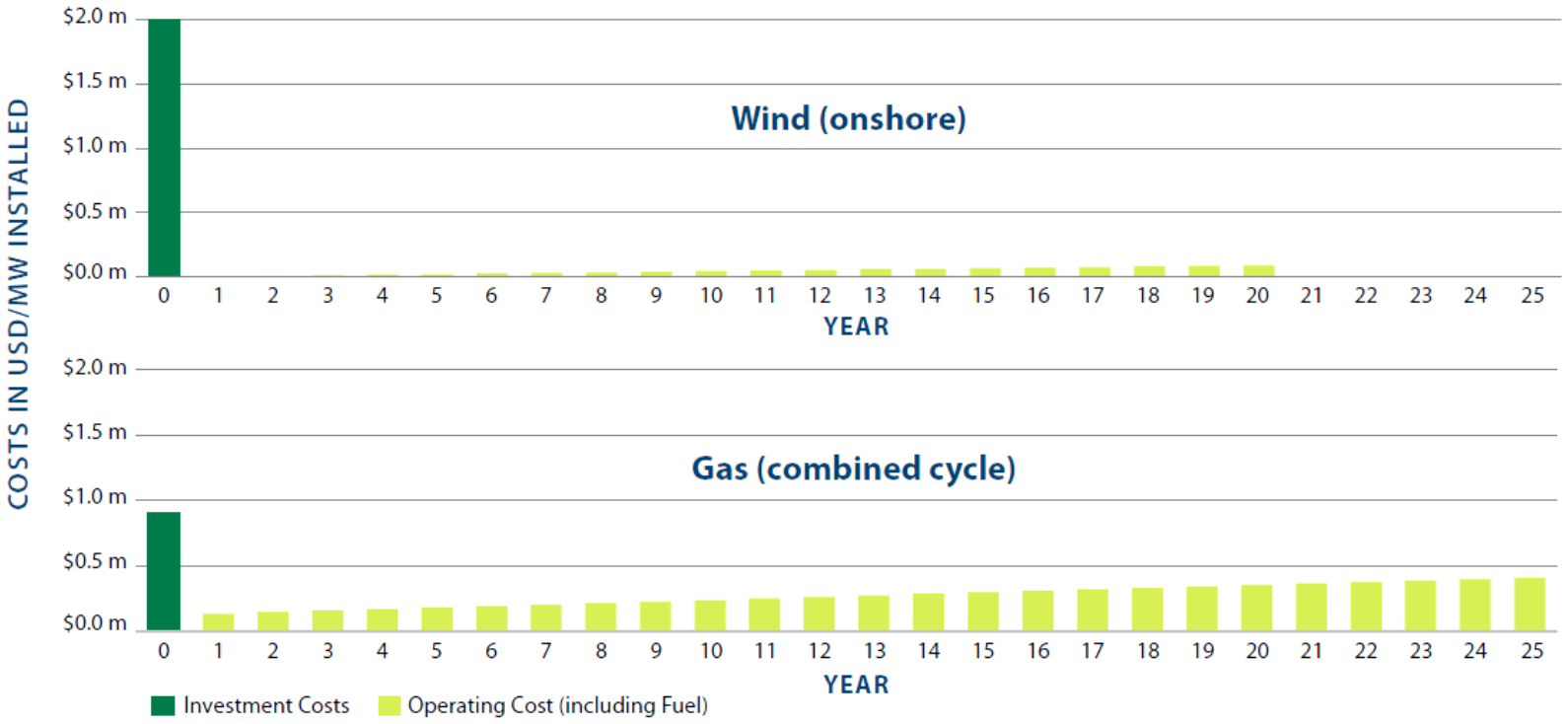
- **LCOE** can be understood as life-cycle costs of an energy project, e.g. costs by the project's electricity generation over its lifetime (USD cents per kWh).
- LCOE can be divided in **technology** and **financing costs**.
  - **Technology costs** are made up of investment costs and O&M
  - **Financing costs** are made up of the cost of equity and debt.



COST STRUCTURE OVER LIFTIME OF WIND AND GAS PROJECT

- The **cost structure** of a **wind onshore** over its lifetime

Figure 11: **The different capital intensity of electricity production from wind energy and combined cycle gas**



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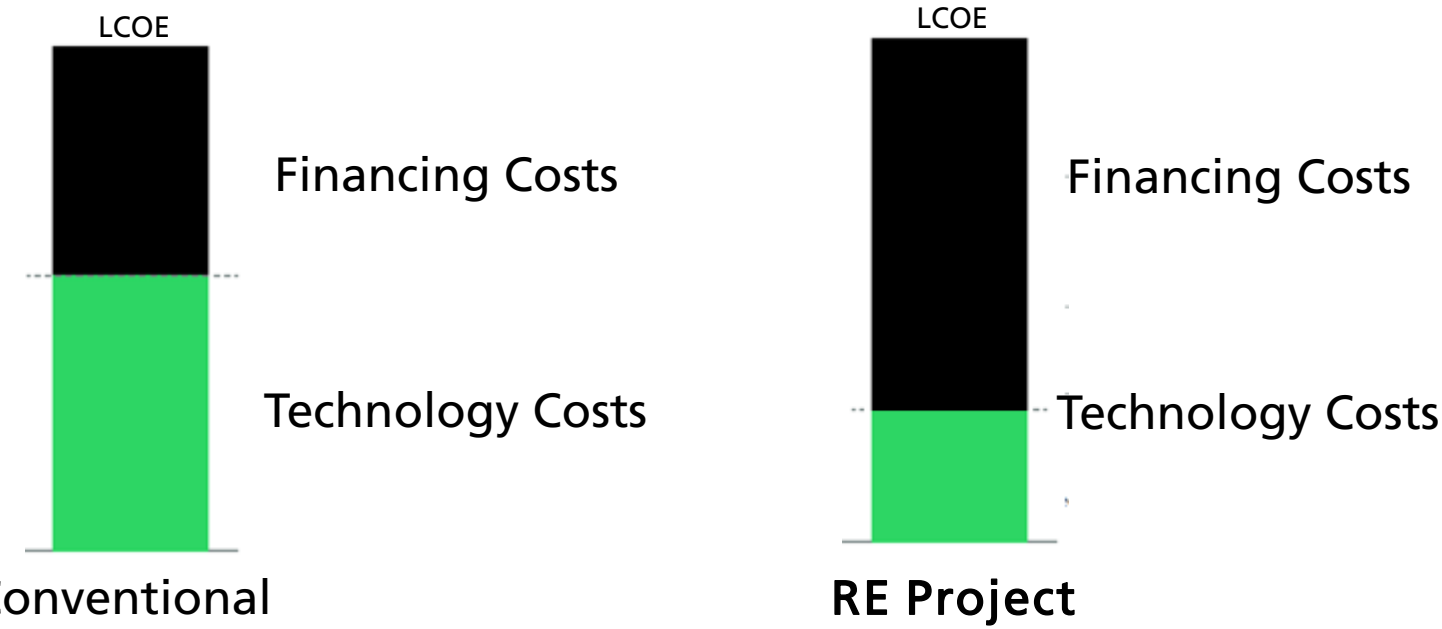
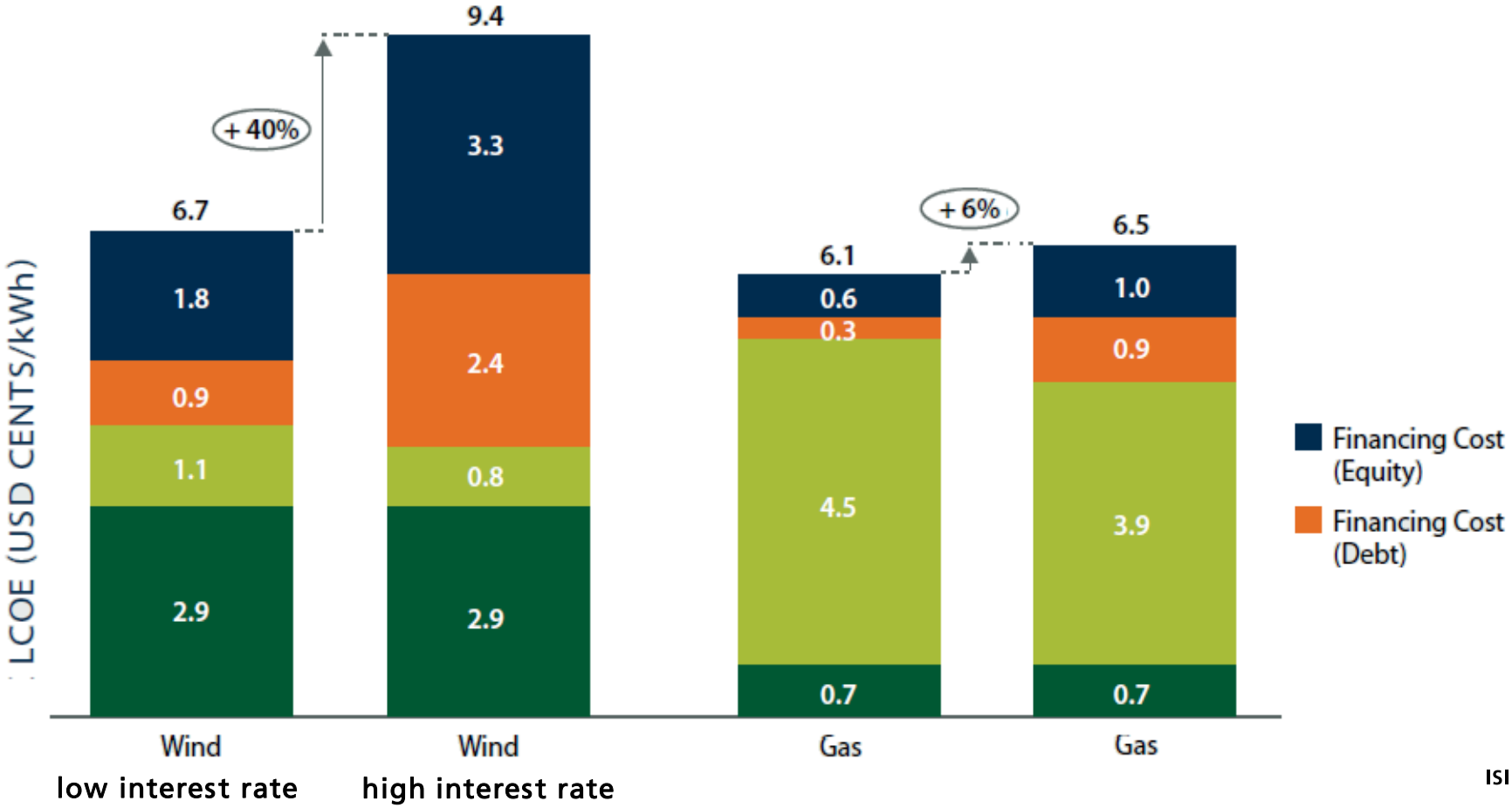
COMPONENTS OF LEVELIZED COST OF ELECTRICITY

- **LCOE as a metric allows comparing the generation** costs of conventional plants with RE, despite their different cost structures
- **The capital intensity of RE–high upfront investment costs** and low operational costs – results in renewable energy investments being especially sensitive to financing costs.



Why, despite big potential, so little installations to RE?

- If **interest rate for financing are high**, RE projects quickly become expensive, as compared to conventional projects.
- Increse in the interest rates of cost and equity:



Source: UNDP (2013) Derisking Renewable Energy Investment

COST STRUCTURE OVER LIFTIME OF WIND AND GAS PROJECT

- The **cost structure** of a **wind onshore** over its lifetime **compared to a natural gas** power plant

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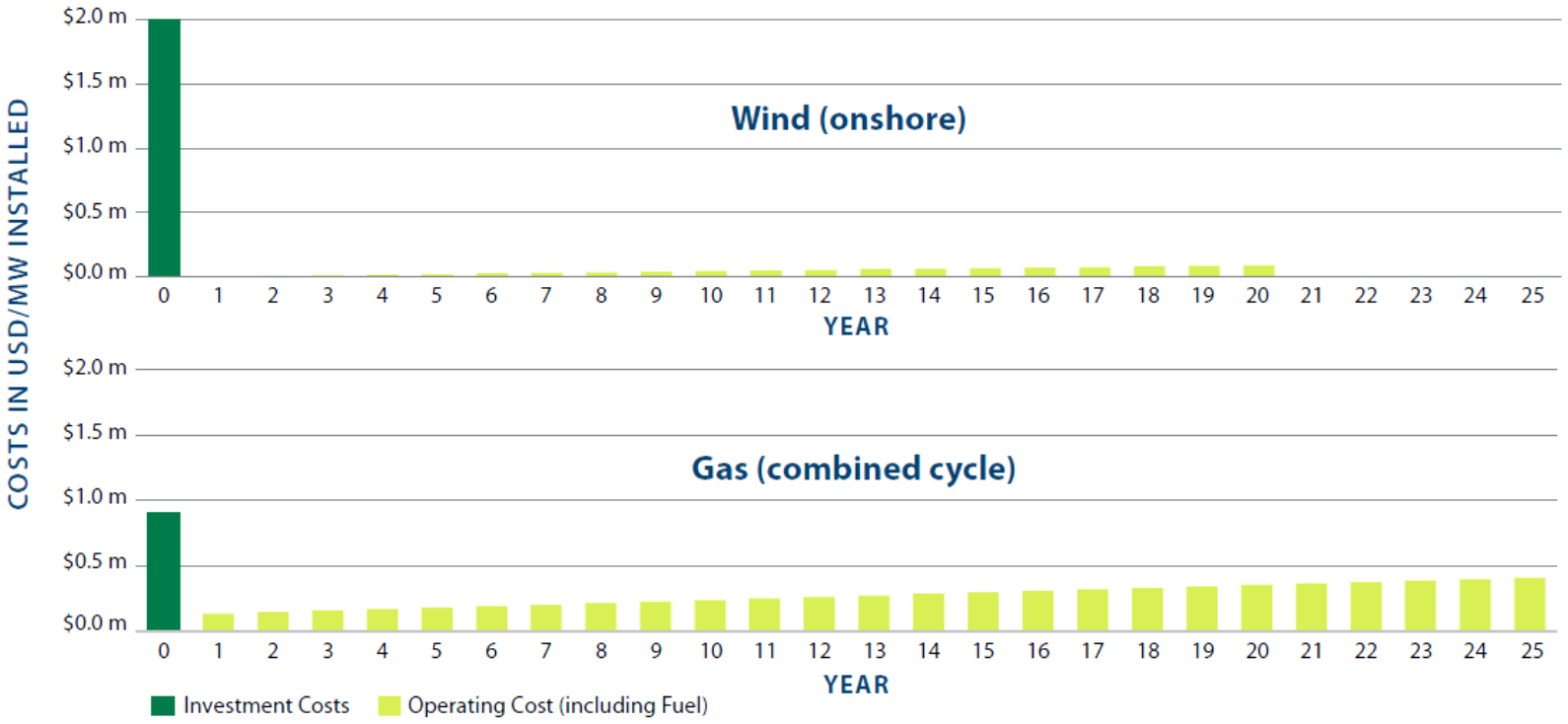

Source: UNDP (2013) Derisking Renewable Energy Investment

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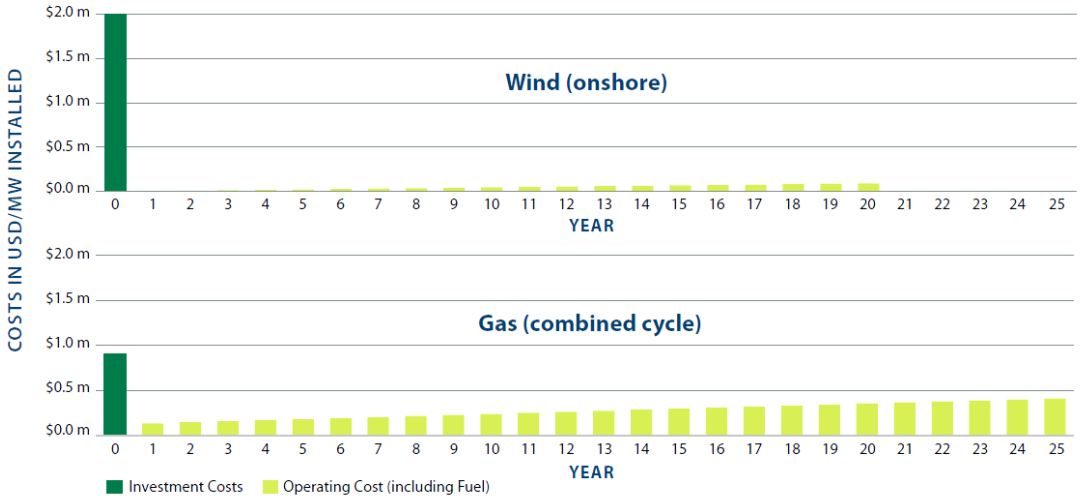
COST STRUCTURE OVER LIFTIME OF WIND AND GAS PROJECT

- **Investment costs** account for approx. 80% of the total lifetime technology costs for wind but only 15% for gas.
- **O&M costs are relatively low for wind energy**, high for gas (fuel cost)
- RE investments exchange long-term fuel costs for **upfront investment costs.**

Figure 11: **The different capital intensity of electricity production from wind energy and combined cycle gas**



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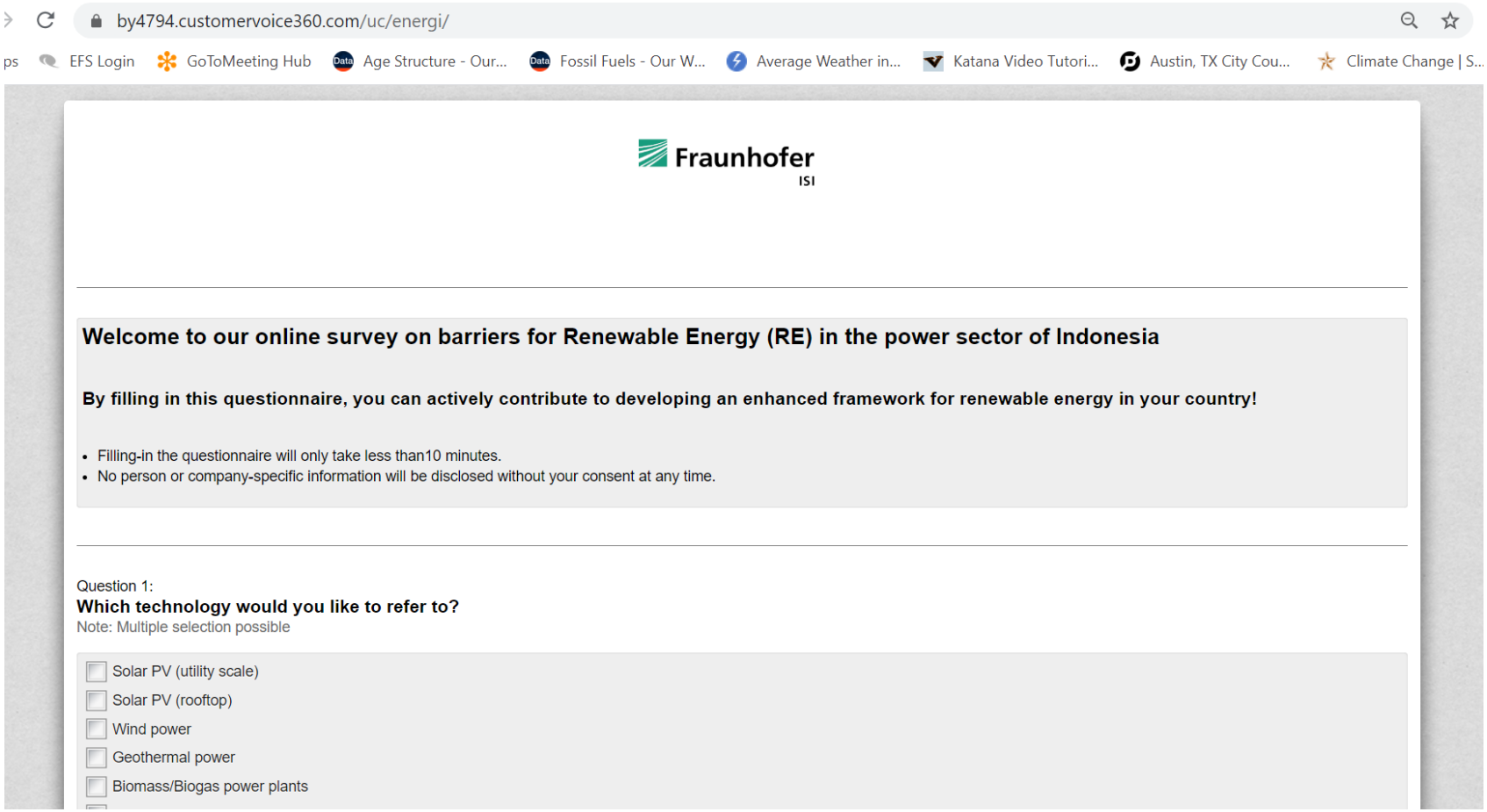
A DOUBLED EDGE KNIFE
BARRIERS TO THE DEVELOPMENT OF RE PROJECTS



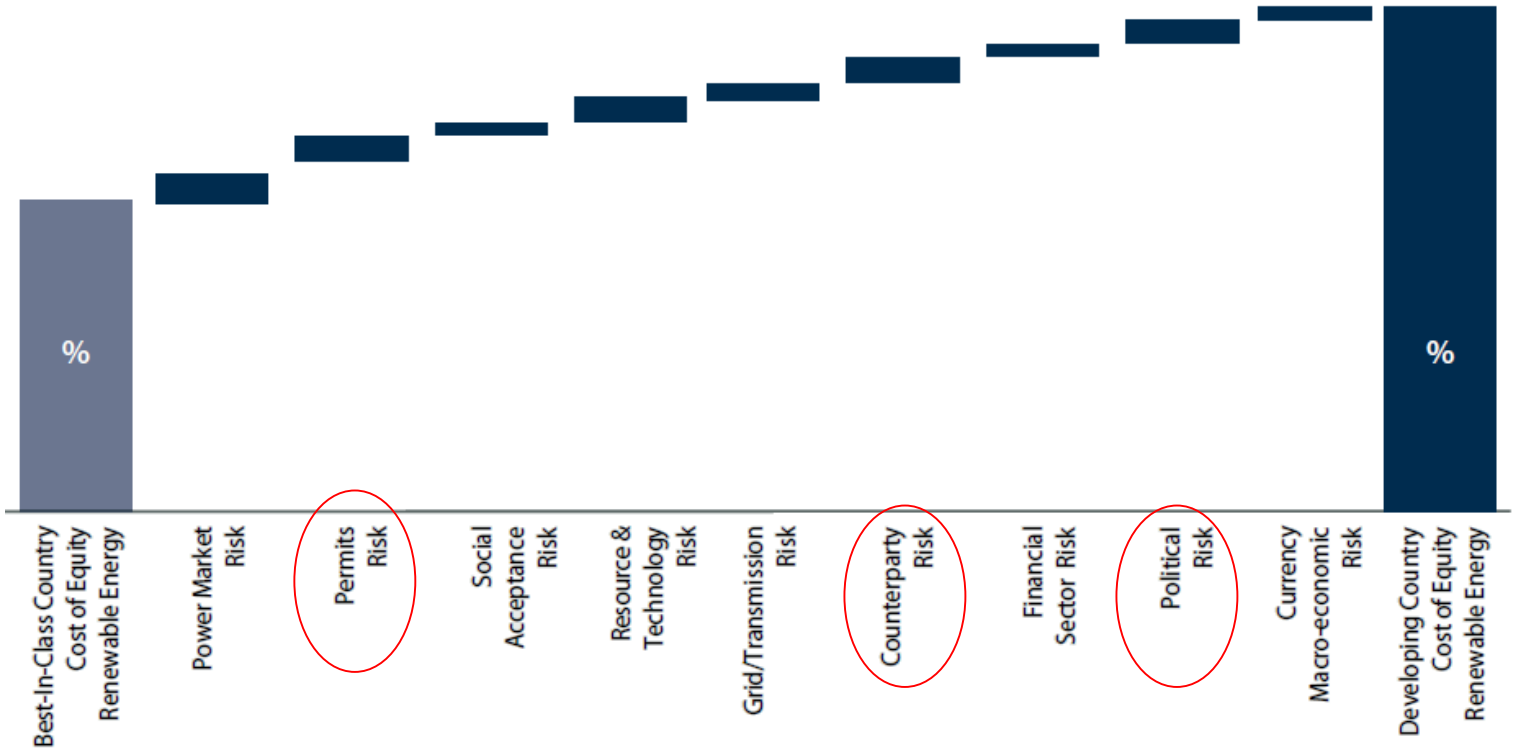
A DOUBLED EDGE KNIFE – BARRIERS TO THE DEVELOPMENT OF RE PROJECTS

- Barriers to the development of RE projects

1) Economic and political framework	2) Electricity market structure and regulation	3) Grid infrastructure and grid regulation	4) Administrative procedures for RET projects
• Existence and reliability of RET strategy and support scheme • Relative remuneration level • Access to finance • Revenue risk	• Fair and independent regulation of the electricity sectors • Existence of functioning and non-discriminatory short-term markets • Availability of reliable long-term contracts (PPAs)	• Cost of RET grid access • Lead time for RET grid access • Predictability and transparency of grid connection procedure • Treatment of RET dispatch (curtailment) • Transparent and foreseeable grid development	• Cost of administrative procedure • Duration of administrative procedure • Complexity of administrative procedure

A DOUBLED EDGE KNIFE
BARRIERS TO THE DEVELOPMENT OF RE PROJECTS

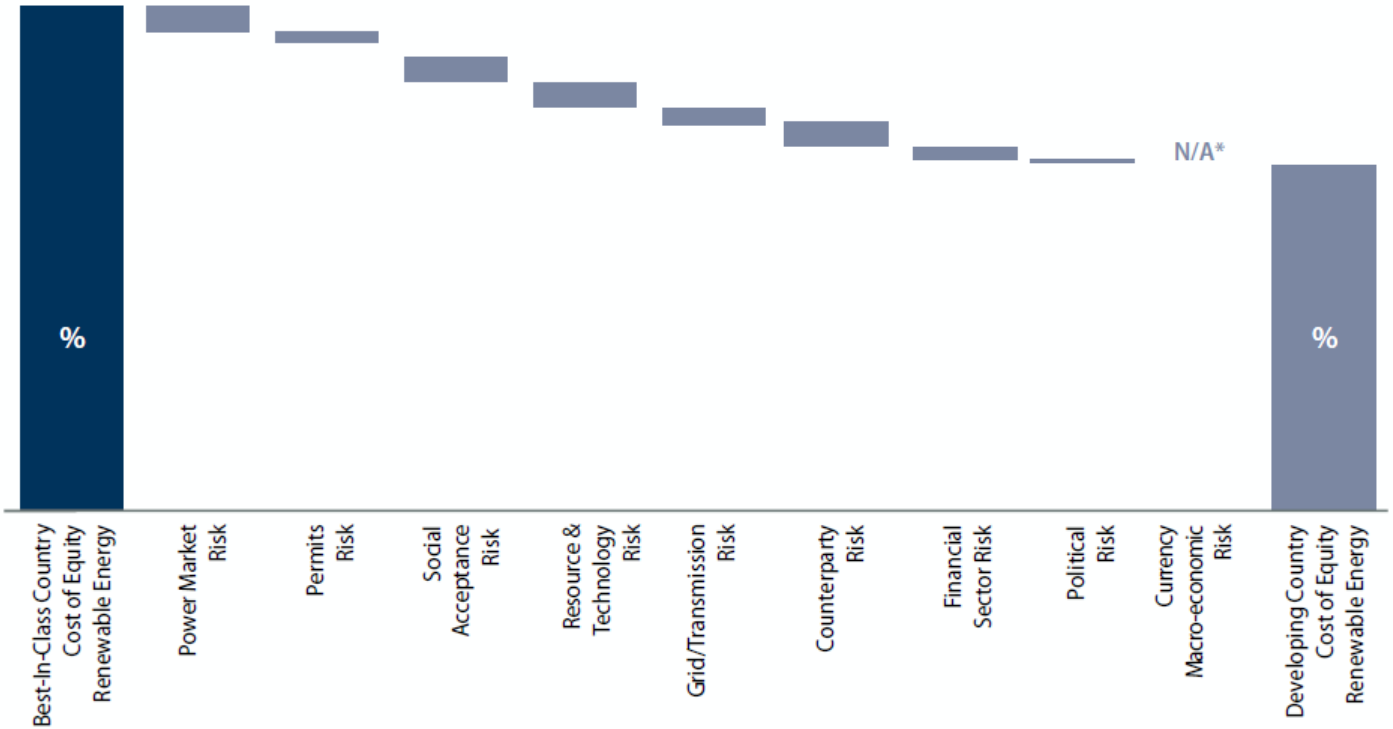
- Barriers to the development of a power project in general and to RE projects in particular are two fold
  - **Firstly, they are barriers** to the development
  - **Secondly, they increase the risk** of success and thereby increase the financing cost:



Source: UNDP (2013) Derisking Renewable Energy Investment

A DOUBLED EDGE KNIFE
BARRIERS TO THE DEVELOPMENT OF RE PROJECTS

- Barriers to the development of a power project in general and to RE projects in particular are two fold
  - Policies such as permit simplification, reduced counterparty risk, attractive and stable RE support schemes can **derisk investment and lower LCOE of RE project**



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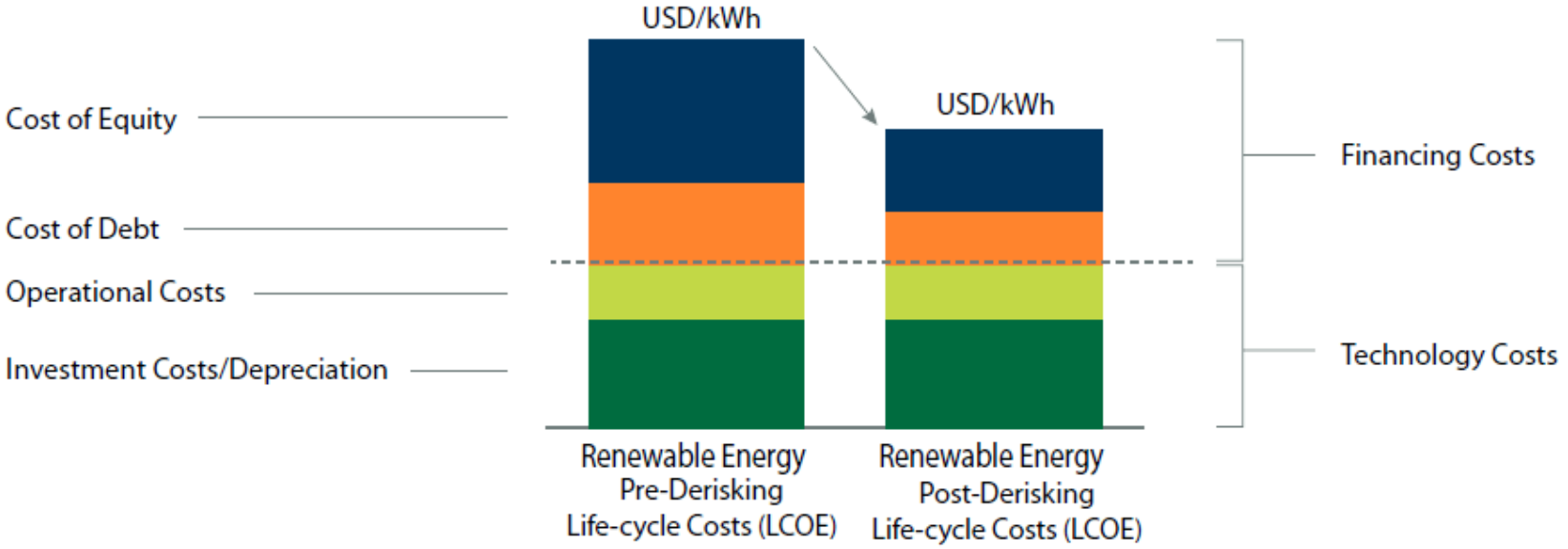

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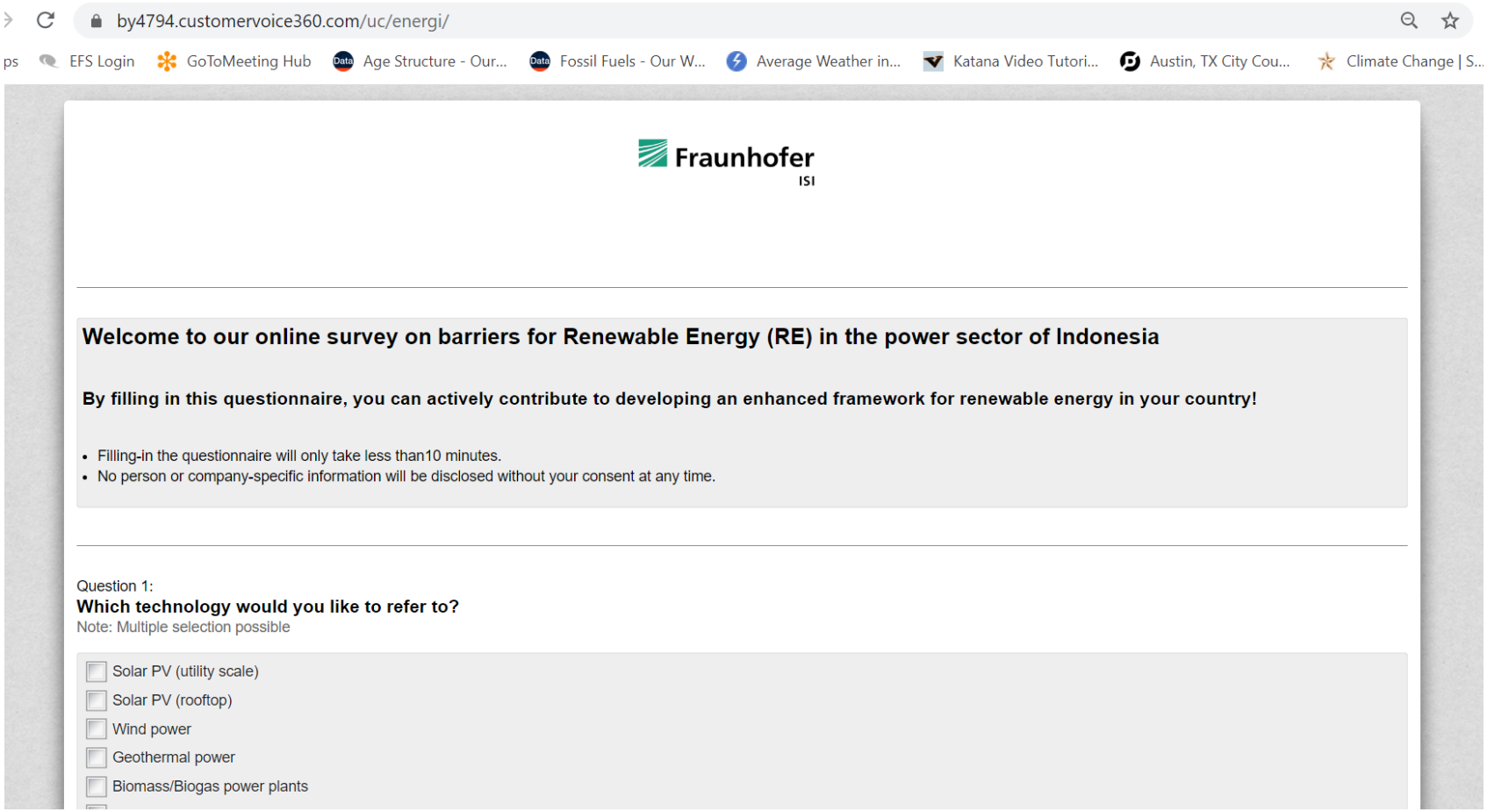
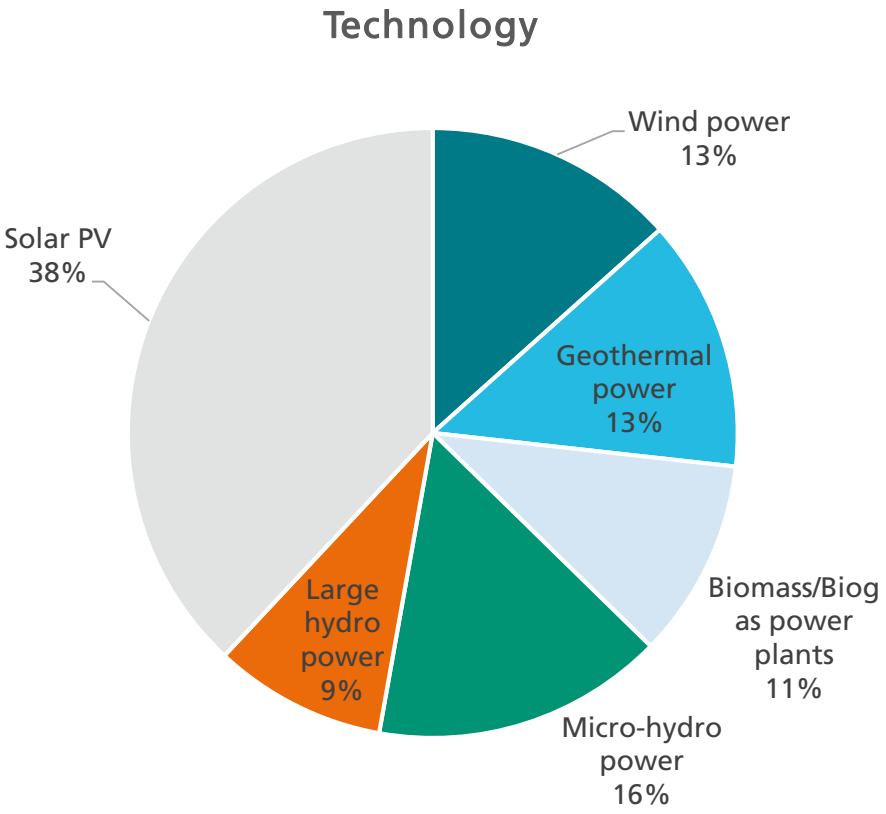
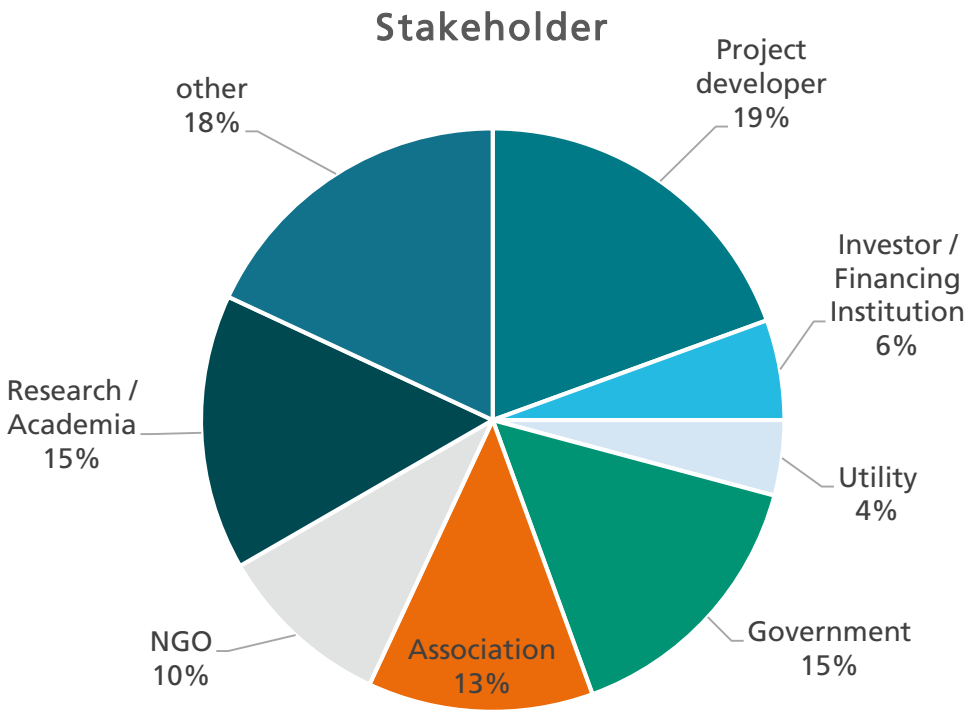
BARRIERS TO THE DEVELOPMENT OF RE PROJECTS



BARRIERS TO THE DEVELOPMENT OF RE PROJECTS SURVEY INSIGHTS





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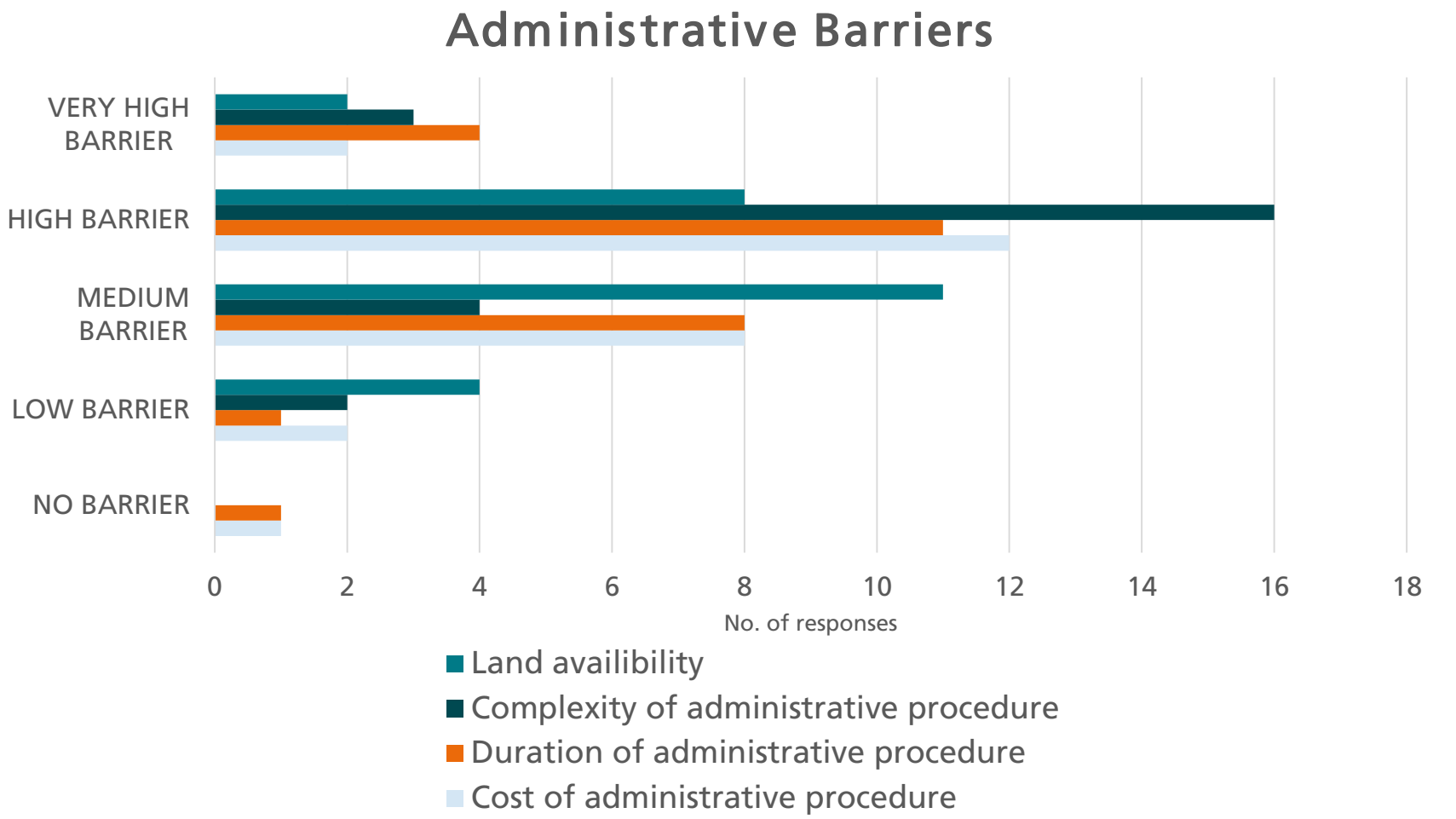
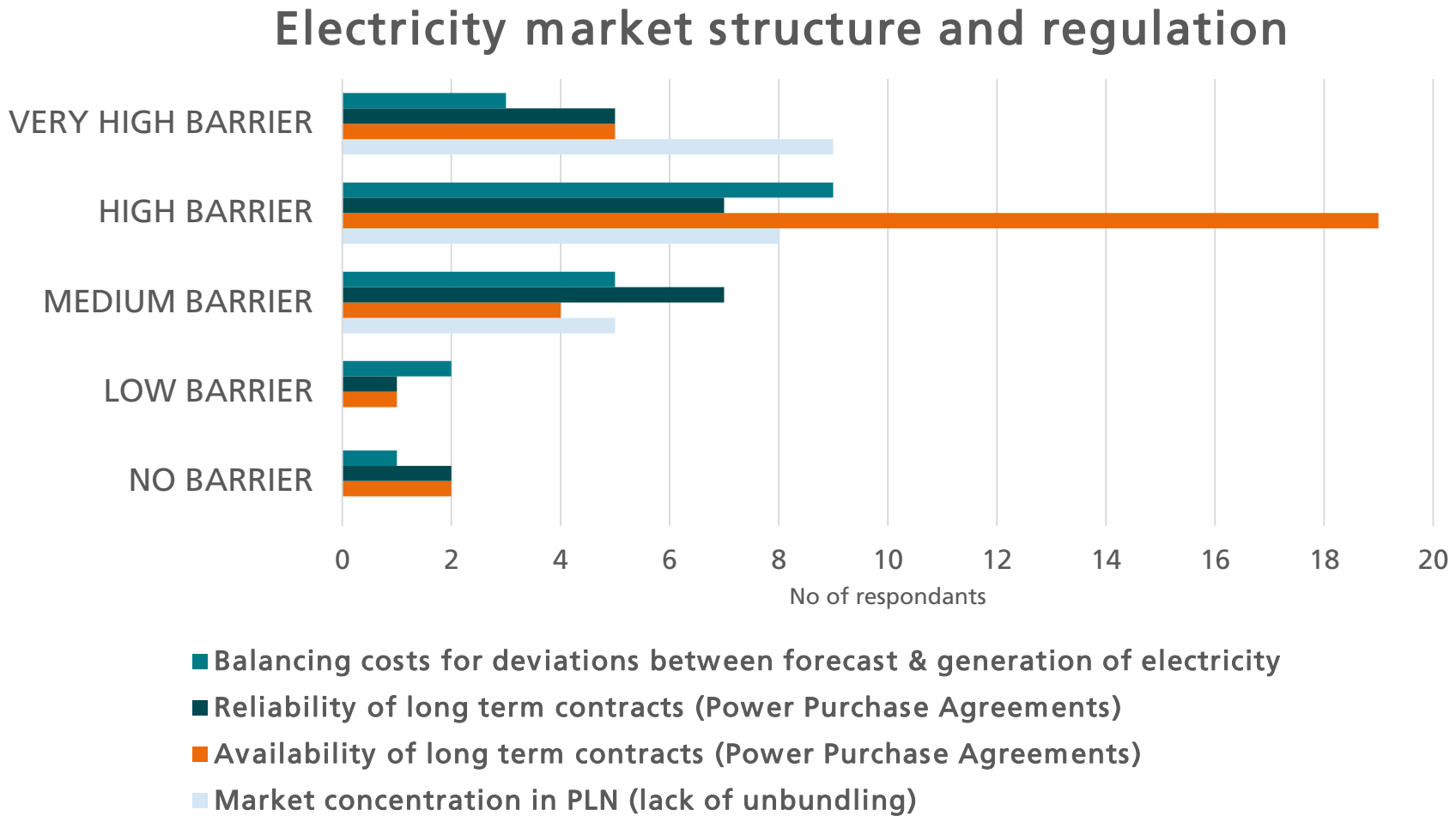
Source: Woodman et al (2017)

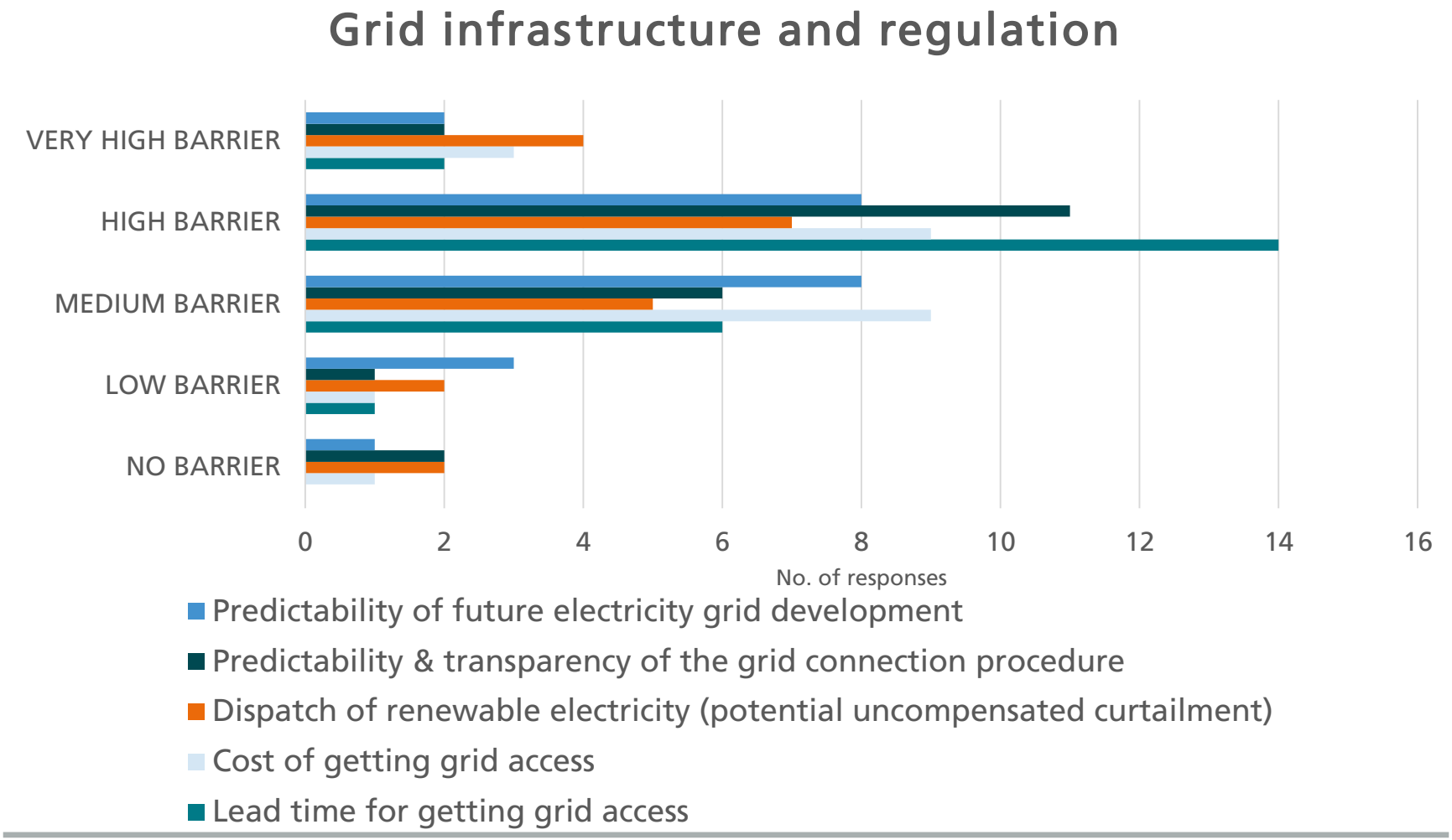
INSIGHTS FROM THE SURVEY ADMINISTRATIVE BARRIERS



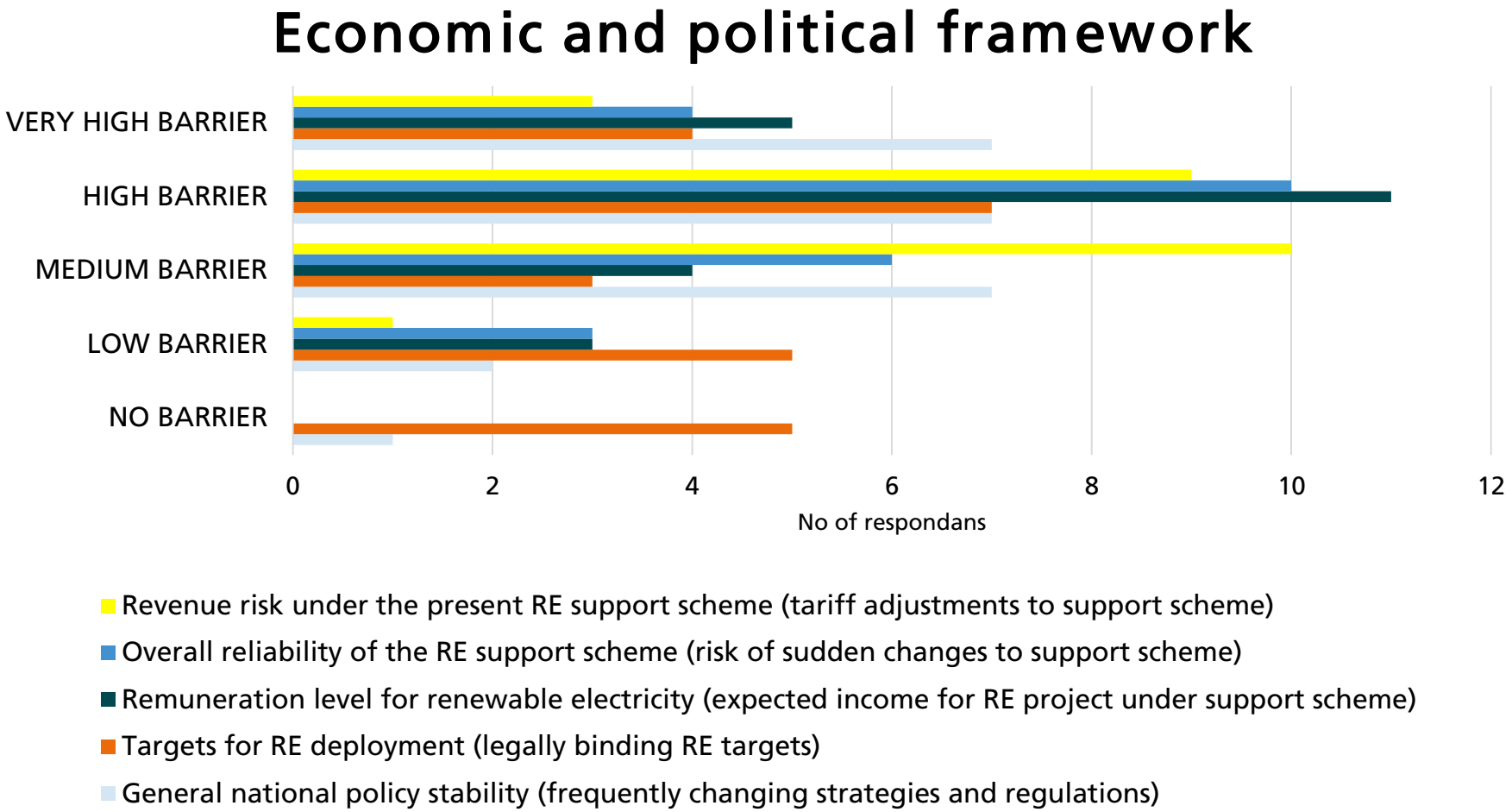
INSIGHTS FROM THE SURVEY ELECTRICITY MARKET STRUCTURE AND REGULATION



INSIGHTS FROM THE SURVEY
GRID INFRASTRUCTURE AND REGULATION



INSIGHTS FROM THE SURVEY
ECONOMIC AND POLITICAL FRAMEWORK



Conclusions

- *LCOE can be divided in technology costs and financing costs.*
- *Technology costs have showed massive cost reductions globally.*
- *Financing costs depend on interest rate and country specific risks and barriers.*
- *Barriers can be reduced by right policies, finance can be de-risked*
- *Thereby, LCOEs can drop even more in years to come*

Questions or comments?

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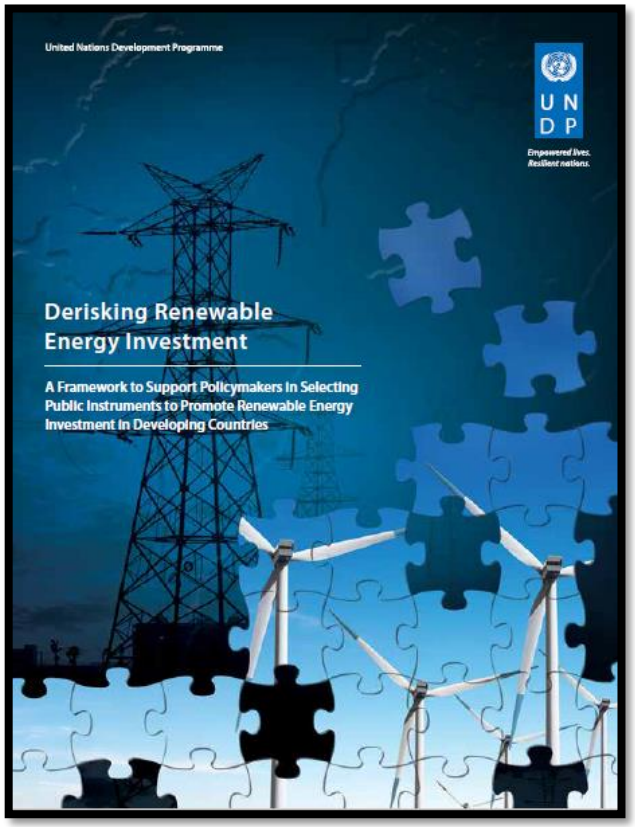
Thanks for your attention

- Take part in the survey here: https://by4794.customervoice360.com/uc/energi/
- Sources and recommended literature:



ENERGY & ENVIRONMENT

Article

A composite indicator for short-term diffusion forecasts of renewable energy technologies – the case of Germany

Inga Boie, Mario Ragwitz and Anne Held

Abstract

This paper investigates the impact of energy policy and the regulatory environment on the deployment of technologies based on renewable energy sources in Germany and presents a model to forecast future renewable energy technology diffusion. Our concept is based on the development of a composite indicator for renewable energy diffusion with a focus on wind energy (onshore) and photovoltaic. The approach has three major components: in-depth, semi-structured interviews with renewable energy developers and energy sector stakeholders to identify the major drivers and barriers (determinants) for renewable energy diffusion in the case study country; an EU-wide, questionnaire-based survey to understand the relevance (weights) of the individual determinants; and an analysis of past renewable energy diffusion patterns resulting in the deduction of a model for short-term renewable energy technology diffusion forecasts. Results demonstrate the substantial impact of economic and non-economic framework conditions on the diffusion of photovoltaic and wind energy in Germany. Furthermore, the use of composite indicators for renewable energy technology diffusion analyses proves to be a promising approach.

Keywords

Renewable energy, diffusion analysis, diffusion model, composite indicator, renewable energy policy

Introduction

In 2009, the European Member States (MS) adopted the Renewable Energy Directive,[1] which stipulates that 20% of the total final energy consumption have to come from

COFFEE BREAK

WORKSHOP, MARCH 2, 2020 – WYNDHAM HOTEL JAKARTA

DISCUSSION: REFLECTING KEY INSIGHTS ON PLANNING AND PROCESSES

WORKSHOP, MARCH 2, 2020 – WYNDHAM HOTEL JAKARTA

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CHEAP ELECTRICITY VS. SUSTAINING COAL INDUSTRY

Key insight: Solar PV and wind will, in 5 years from now, be definitely cheaper than coal.

- Solar PV already less than 6 US cent /kWh, technology costs will certainly fall even more.
- Java-Bali grid is big enough to take 10-15% share of variable RE, so far close to 0%.
- Coal mining is a backbone industry, providing employment, profits, public-income at local and national level.

2025: Will PLN go for the cheapest technology?

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HARMFUL ECONOMIC IMPACTS

Key insight: Reliance on coal and higher electricity prices can harm industrial competitiveness

- Energy and electricity intensive industries might relocate to emerging economies with cheaper prices.
- Exporting products to other countries that impose boarder carbon taxes or regulatory measures using grid emission factors as indicator can strongly harm exports.
- India (175GW RE target), Vietnam (5GW RE in 2019) and other countries moving more quickly could leave Indonesia behind.

Will economic impacts of using coal harm Indonesia?

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COST OPTIMAL TECHNOLOGY MIX

- **Key insight: Official planning documents and targets in RUEN, RUPTL, NDCs, could be cost-optimized**
  - Cost optimization models considering costs per unit of electricity, lifetime of plant, impact on power system as a whole, would lead to a different composition of power sector.
  - Different plans with different pathways (RUEN, RUKN, RUPTL) could be streamlined based on minimal costs for PLN and consumers.

Are there backsides to using cost optimization?
If not, why isn't it considered more strongly?

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GLOBAL WARMING

Key insight: Low cost RE in the power sector can support CO_2 emission reduction targets

- Coal, even supercritical or ultra-supercritical, has the highest emission factor among all fuels.
- Indonesia is top 4 country with envisioned coal-fired plans development.
- Indonesia aims to reduce its GHG emissions as internationally communicated.

Should the energy sector contribute more strongly with low-cost RE to mitigation efforts?

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WRAP-UP AND NEXT STEPS

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DECREASING COSTS FOR RE-TECHNOLOGIES AND ITS IMPLICATION FOR ENERGY PLANNING

- We are happy to receive your feedback!
- We will publish results and a report. Please provide your email to receive updates.

- Please follow the project on our website

https://www.isi.fraunhofer.de/en/competence-center/energiepolitik-energiemaerkte/projekte/ndc-update.html#tabpanel-1

- *Many thanks for your time and the insights shared!*

DECREASING COSTS FOR RE-TECHNOLOGIES AND IMPLICATIONS FOR LONG TERM PLANNING OF INDONESIA

Johannes Eckstein, Jose A. Ordonez

March 2, 2020 – Wyndham Casablanca Hotel, Jakarta

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Please visit our project website for further information

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