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Quantifying additionality for renewable energy supply options

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1 Background & Motivation

- Companies consuming electricity can contribute to RE expansion via **demand pull**
- Degree to which demand pull contributes to RE expansion **varies between supply options**
- **Supply options** include:
  - Green tariffs
  - Unbundled purchase of electricity & energy attribute certificates (EACs)
  - Power purchase agreements (PPAs)
  - On-site installations
- ***Additionality*** describes **degree** to which demand for supply option contributes to RE expansion
- Metric to **quantify** additionality could guide companies choosing between supply options
- Until now, **no** agreed upon additionality **metric exists**

2 Goal

- Define an ***additionality metric (AM)*** to guide companies choosing between supply options that:
  - Allows companies to **rank** supply options with respect to their contribution to RE expansion
  - **Quantifies** degree to which a supply option contributes to RE expansion
  - Is calculable using **data and information available** to companies

3 Proposed Solution

How much does the company pay to get electricity via this supply option (not including taxes, grid fees etc.) $\left[\frac{€}{kWh}\right]$?

How long does the contract last for the company to procure electricity via this supply option $[a]$?

Additionality metric

$$AM = \sum_i TS_i \cdot \left(\frac{MP}{LCOE_i} - 1\right) \cdot \frac{CD}{ILT_i} \; [\%]$$

Market price — Contract duration — Technology share — Levelized cost of electricity — Installation lifetime

What is the share of technology i (e.g. PV) in the supply option's mix $[-]$?

What is the baseline cost for generating electricity using this technology (e.g. offshore wind) $\left[\frac{€}{kWh}\right]$?

What is the typical installation lifetime for this technology (e.g. offshore wind) $[a]$?

Underlying assumptions
1) The more money operators of installations receive… &
2) The further into the future operators of installations can expect to receive money…

…the higher their incentive to expand RE generation

4 Exemplary Application

Market data

Supply Option	MP [€/kWh]	CD [a]	Technology mix	AM [%]
Green tariff	0.203	2		32
Unbundled elec. & EACs	0.182	3		31
PPA	0.103	5		10
On-site installation	0.150	25		241

Assumptions

Technology	LCOE [€/kWh]	ILT [a]
PV	0.044	25
Wind onshore	0.030	25
Wind offshore	0.068	25
Hydro	0.044	30

Sources:
Eon, Naturstrom, PPA Preismonitor, CO2online, IRENA
1 USD = 0.91 €

On-site installation with highest degree of additionality, PPA with lowest (**counter-intuitive result!**).

5 Open Questions

- **Maximize or optimize contract duration** (security vs. flexibility)?
  If optimize, what is optimal CD?
- **Which value for LCOE and MP** to use (current, future, 3 year average)?
- Ho to account for **different qualities of service** between supply options (e.g. supply matches company load profile)?
- Use **physical or economic ILT**?
  If economic ILT, how to calculate it?
- Include **additional factors** (e.g. temporal/spatial correlation of supply and demand)?

<u>Central question:</u>
What is the main reason the **results do not match my intuition**?

(Intuitive order of supply options' AM, low to high: Unbundled EACs < green tariff < PPA < on-site)