TIMEPAC

FINAL CONFERENCE

Barcelona, 4 October 2024

ICAEN – Catalan Institute for Energy

Local Levelised Cost of Energy Enhancing SRI & EPC with financial indicators - With a view of supporting policy making

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Integrating LLCOE in practice

Application

Certifiers

- No extra effort, training
- Needs an external model
  - As in current practice
    - Proposal measures → cost/benefit

Decision-making

Mission-oriented markets need a long-term view and systems thinking

Tenants, and Building Owners

- Respond to short term signals

Policy Makers

- Long–term outlook
- Implicit market-making
  - Shape support programmes
  - Regulation

Challenge: consumer-oriented financial guidance?

EPC and SRI have a consumer focus….

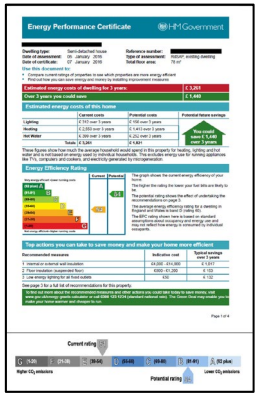
- EPC recommendation simple improvement propositions
- Building-related, but focus on owners, tenants

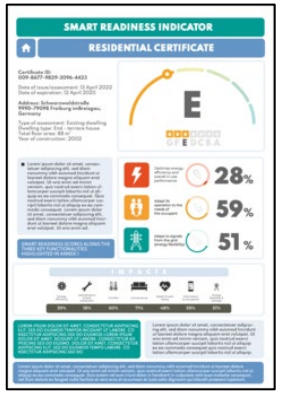
But EPC (and SRI?) also inform policy

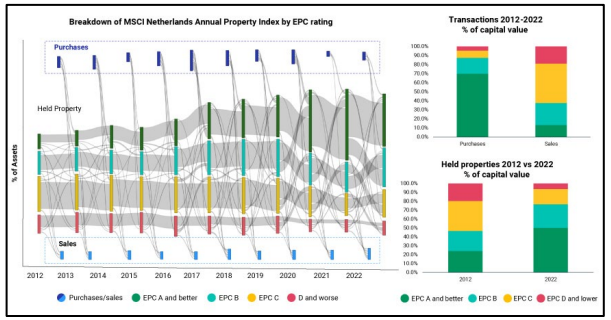
- National, regional policies, programmes and instruments
- Real estate owners and financiers
- Valuation practices

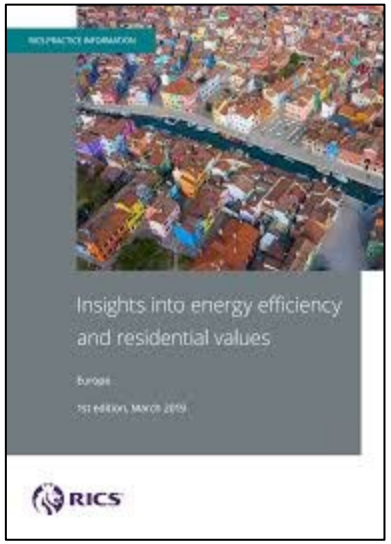
At what level do certificates have most impact?

What financial indicator is most fitting?



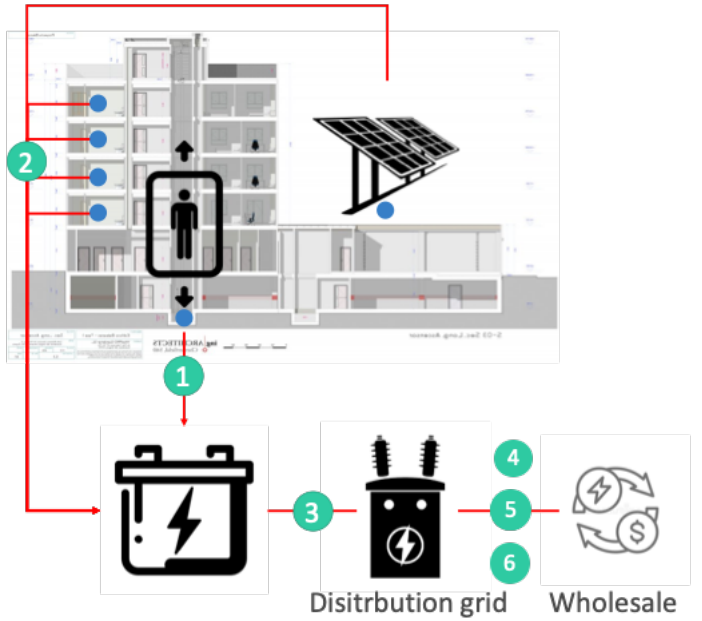






What is new: building – grid interaction and convergence

- Deep renovation programmes emerging
- Decentral smart systems become available
  - VRE generation
  - Storage systems
  - Flexibility services
- Smart systems are complex
  - Integrated (not stand-alone improvements)
  - Have value potential
  - Have dynamic outcomes
- What is a fitting financial indicator?
  - CAPEX/payback
  - ROI
  - Operating costs
  - ...



Self-consumption 1 2

DSO capacity services 3

TSO capacity and wholesale 4 5 6

+ Integrated asset management

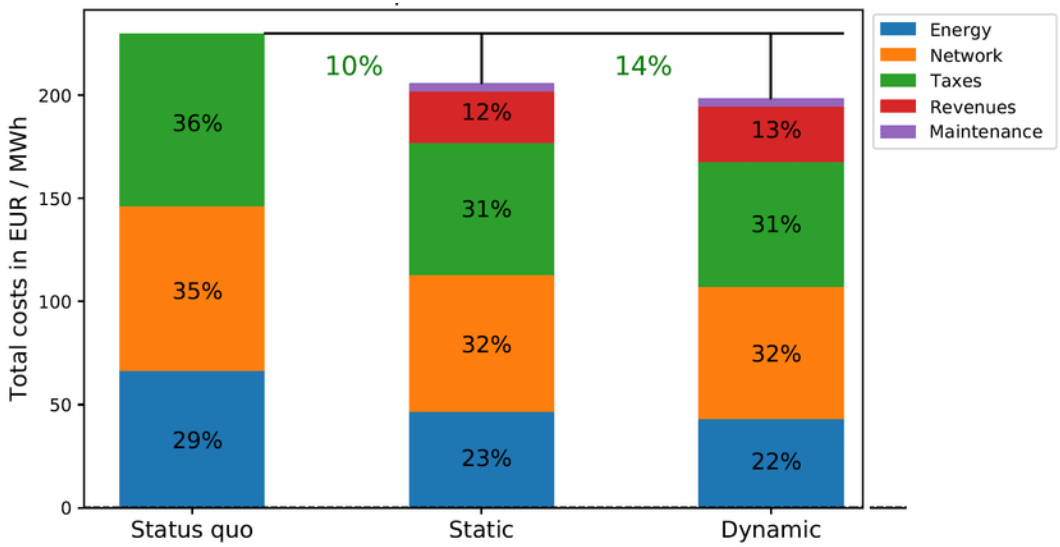
Proposition: Local Levelised Cost of Energy - €/kWh

Metric

- LCOE used to assess and compare alternative methods of energy production
  - Fits energy-producing buildings
  - Fits long term thinking
    - Buildings: Societal benefit v Owner/investor benefit v Tenant benefit

Localisation

- Energy cost/prices are mostly systems costs
  - Roughly unified at national levels
- Consumer choice tends to cheapest system
  - Among similar options (eg; green, effort)
  - In decentral markets this may lead to diverging solutions at building, district, regional level –
- Diverging System and €/kWh per location



De Clerq, 2018

Case study: applying LLCOE in the Netherlands

Case study: applying LLCOE in the Netherlands

Building type	Multi-family residential	Consumption	167.926 kWh/y
Location	Amersfoort, the Netherlands	Electricity price	0,1494 €/kWh

Scenario 1: grid-provided energy

		Per year	Per 15 year
Grid Connection (kVa)	110	€ 6.633	€ 99.489
Consumption (kWh)	167.926	€ 25.088	€ 376.322
15-year Total cost	2.518.890		€ 475.811
LLCOE (kWh)			**€ 0,189**

Scenario 2: PV + Storage + imbalance trading + grid consumption

		Per year	15 year
Grid Connection (kVa)	110	€ 6.633	€ 99.489
PV system	100kWP		€ 66.000
BESS ssytem	80kW / 160kWh		€ 100.000
Maintenance, insurance		€ 1.500	€ 22.500
Production PV (kWh)	85.000		
Net demand grid (kWh)	82.926	€ 12.389	€ 185.837
Imbalance trade revenue		-€ 17.563	-€ 263.445
Imbalance trade cost		€ 7.346	€ 110.190
15-year Total cost	2.518.890 kWh		€ 320.571
LLCOE (kWh)			**€ 0,127**

Scenario 2

A smart system including REG, RES, and providing flexibility services

- Investment €166k
- Savings €200k
- Revenue €150k

LLCOE

- Scenario 1: €0,189/kWh
- Scenario 2: €0,127/kWh

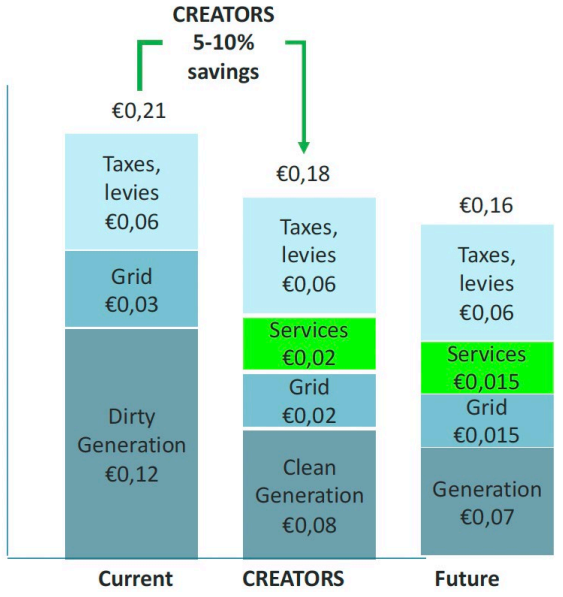
Proposition: Local Levelised Cost of Energy - €/kWh

LCOE

- For Systems (Ueckerdt, 2013)
  - Including Integration (TSO, DSO systems and Grid balancing)
- For VRE (IEA, EIA)
  - Including Integration (TSO, DSO systems and Grid balancing)
  - This may vary per actor or region

In decentral systems variety is higher

- Cost of land
- National, regional flex markets and revenues
- Labour costs (€/hr)
  - Preparation cost (Prep-ex)
  - Management costs (LEC/LES models)
  - Installation and maintenance



Phase	Services	Value added	Per-member Cost-benefit	Comm Potential
Prep	REC governance	Stakeholder representation	-€2k	Low
	Feasibility study, process	Technical leadership	-€0,4k	**High**
	Feasibility study, analysis	Accurate, fast design tools	-€0,1k	**High**
Build	REC installation	Technical installation	-€3k	**High**
Oper	REC governance	Stakeholder representation	-€1k	Low
	Local client engagement	Daily client support	- €4k	Medium
	Energy trading	Local balancing, trading	+ €2k	**High**
	Settlement	Settle micro transactions	+ €2k	**High**

PREPEX Underestimated

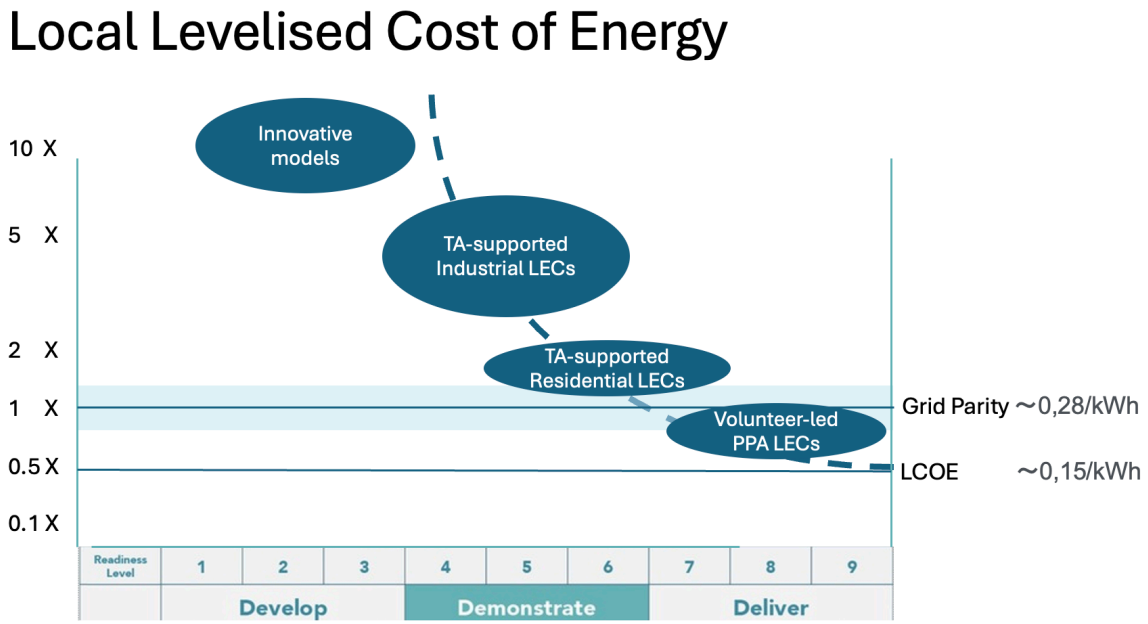
Insights for building owners and policy makers

- In decentral systems, LCOE varies locally

- Benchmarking across system alternatives
  - Central grid v decentral system v …
  - Grid parity as the consumer benchmark
  - Lowest LLCOE as policy goal
    - max societal benefit

- Those who can, invest for lowest LLCOE
  - This increasingly tends to LES
  - NZEB will rely less on the grid, contribute less
- Those who can't will carry high system cost
  - TSO, DSO costs per remaining users go up

- EU Energy price is €0,28/kWh (1x, grid parity)
- Lowest LES LLCOE is €0,15/kWh, or 0,5X



Limitations and improvements

Uncertainty

- EPC is an extremely impactful indicator, while there are significant differences with actual energy use

Methodology

- Normalisation
  - Time linked to economic/technical lifetime
  - Revenues

- Allowance for labour costs

Further research – a bit of R&D&I populism

Research to steer policy, policy to make markets

Macro level: Policy strategy

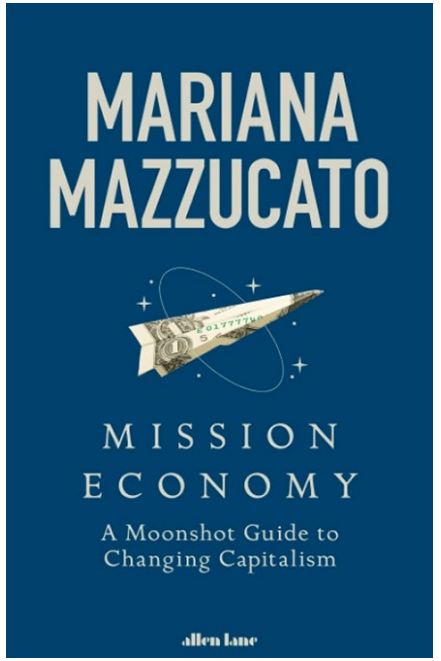
- Mission-Oriented Innovation needs targets. Such as min €/kWh
- Centralized (corporate) versus Decentralised (families, SME)
    - One of the largest wealth transfer options available
    - Varying LLCOE will have very significant social implications.

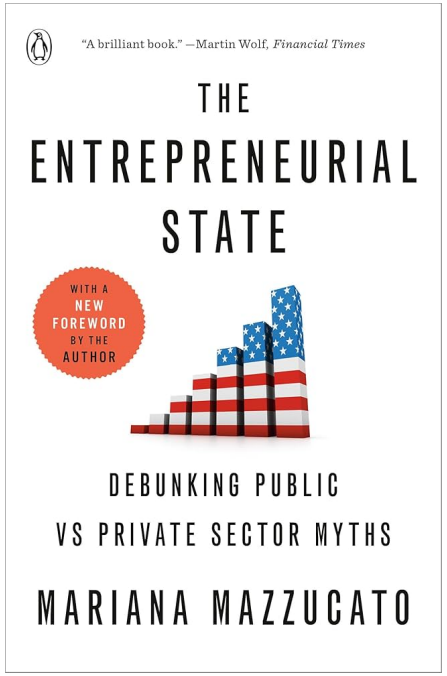
Meso level

- Reframe indicators in societal value
- Improve definition and calculation methods
    - Falko Ueckerdt, PIK Potsdam
- Economic analysis across regions, building types
    - Quantitative, Multi-level

Micro level

- Improve calculation method (flexibility)
- Demonstrate use, and *real impact*





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