The Transformative Power of Storage:
Developing IRENA's Electricity Storage Roadmap
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Cost-Benefit of Electricity Storage

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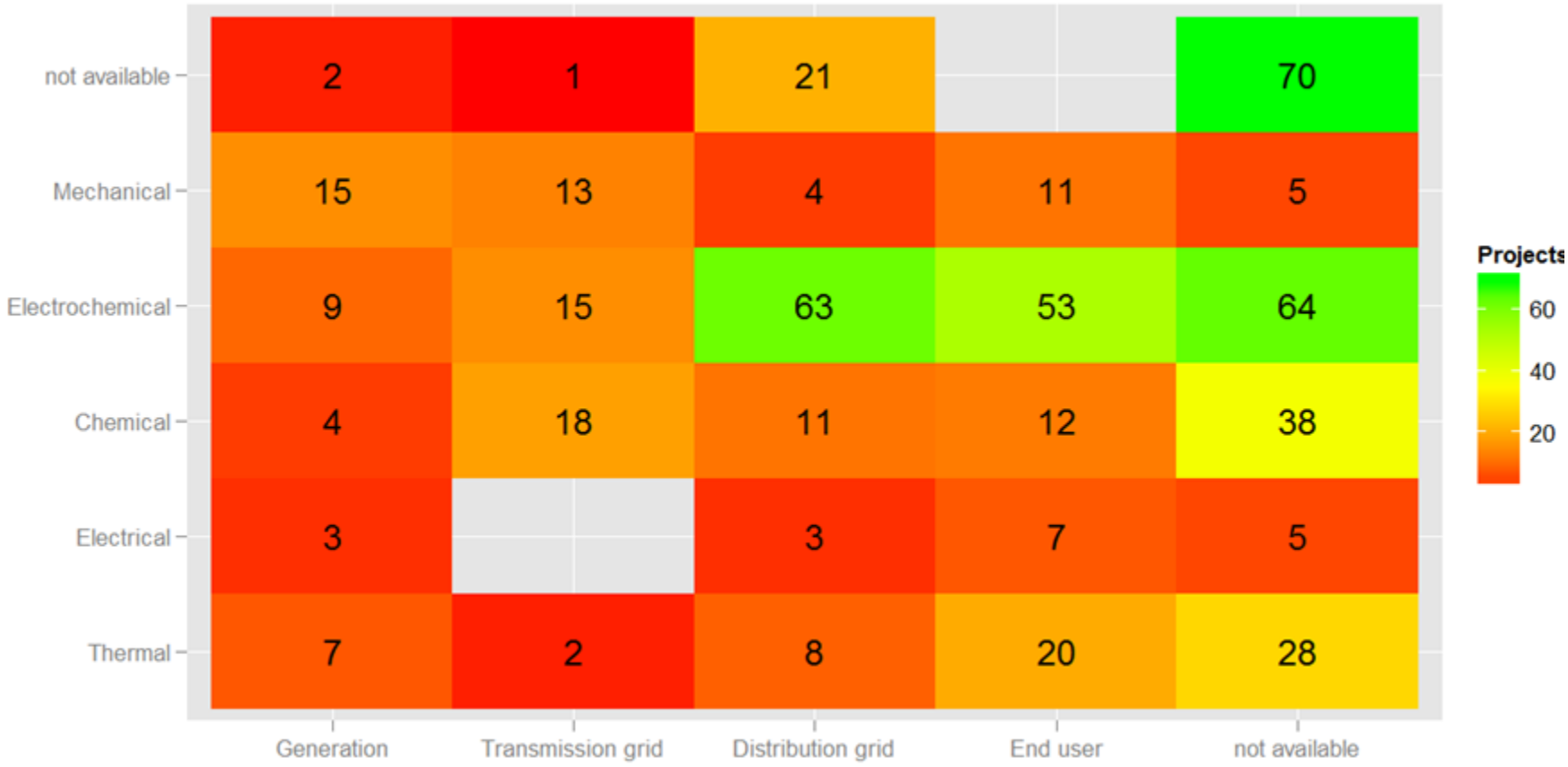
From: GRID+/EEGI Energy Storage Mapping Exercise



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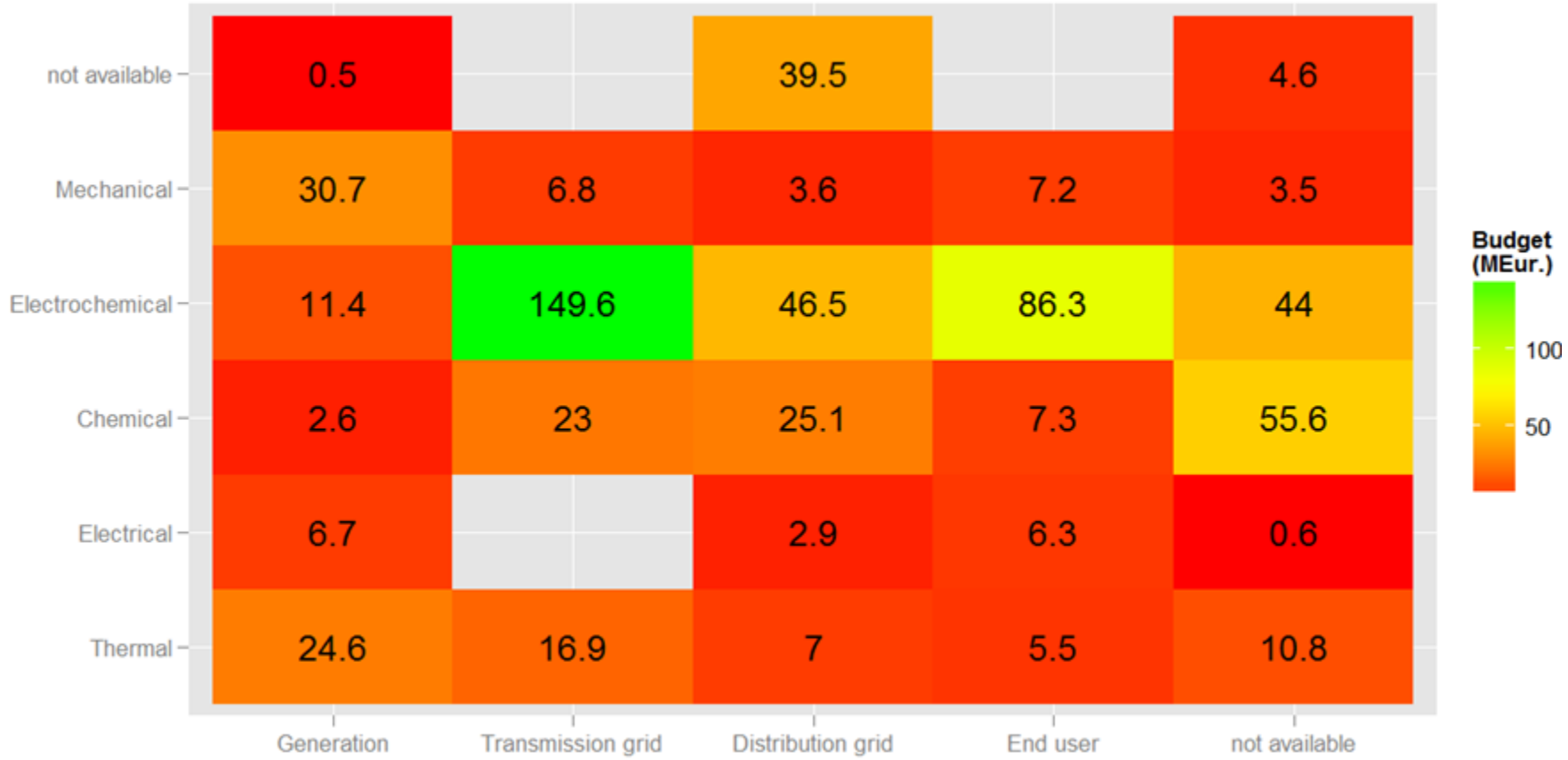


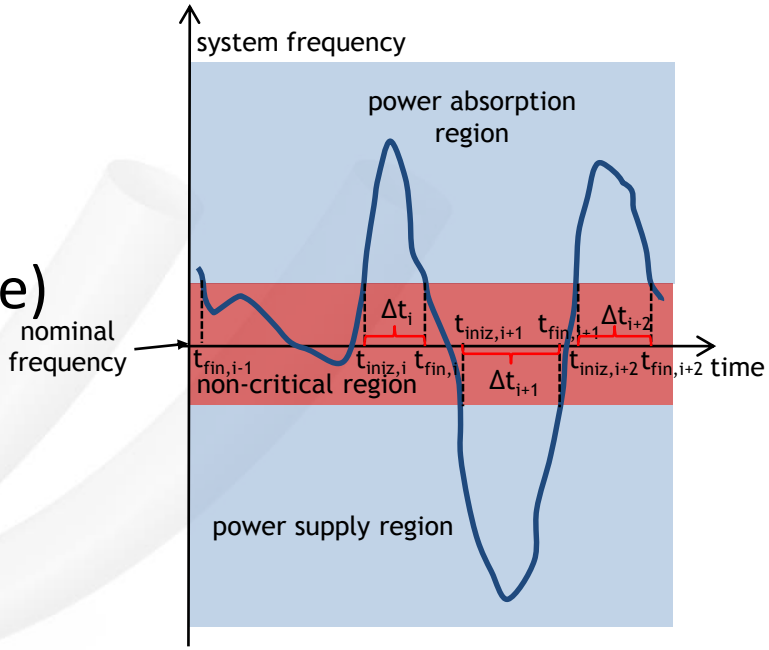
- Many electricity storage projects running in Europe (overall budget about 1 Billion €)
- Most are pilot and demo projects, even at large scale
- What is the cost-benefit balance, at the present technology status ?

RSE performed a number of analyses, mainly on battery storage (pumped hydro and CAES are cheaper, but siting may be cumbersome)

Primary Reserve for Transmission Grid

- Technology: Lithium Battery, 2 MW, 4 MWh
- Estimated Investment: 3 M€
- Source of income: New (2013) Italian Regulation for Primary Reserve
- Estimated annual net income:

  130.000 €
- PBT: 23 years (>> battery useful life)



Primary Reserve for PV plants

- Assumption: in the future, PV plants have to provide a primary reserve of 1.5% nominal power (Italian grid code for conventional plants) → two options:
  1) Inverters limit the output to 98.5% of maximum (loss of RES production)
  2) A relatively small battery is installed

Case study assumptions:

- 12 kW PV plant in Milano, Italy. Subsidy according to DM July 4, 2012 (196 €/MWh)
- Storage Technology: VRLA Battery, 0.8 kW, 1.67 kWh
- Estimated Investment: 900 €
- Source of income: increase of PV energy production
- Estimated annual net income: 120 €
- PBT: 7 years

Recovery of wind energy losses

- Sometimes, due to transmission grid bottlenecks, wind power has to be «cut»
- A relatively large storage system could help to recover a significant amount of renewable energy
- Technology: NaS Battery, 6 MW, 40 MWh
- Estimated Investment: 27 M€
- Avoided cost: Value of recovered energy
- Estimated annual avoided cost: 1M€
- PBT (not including interest and O&M costs): 27 years (>> battery useful life)

Wind energy imbalance

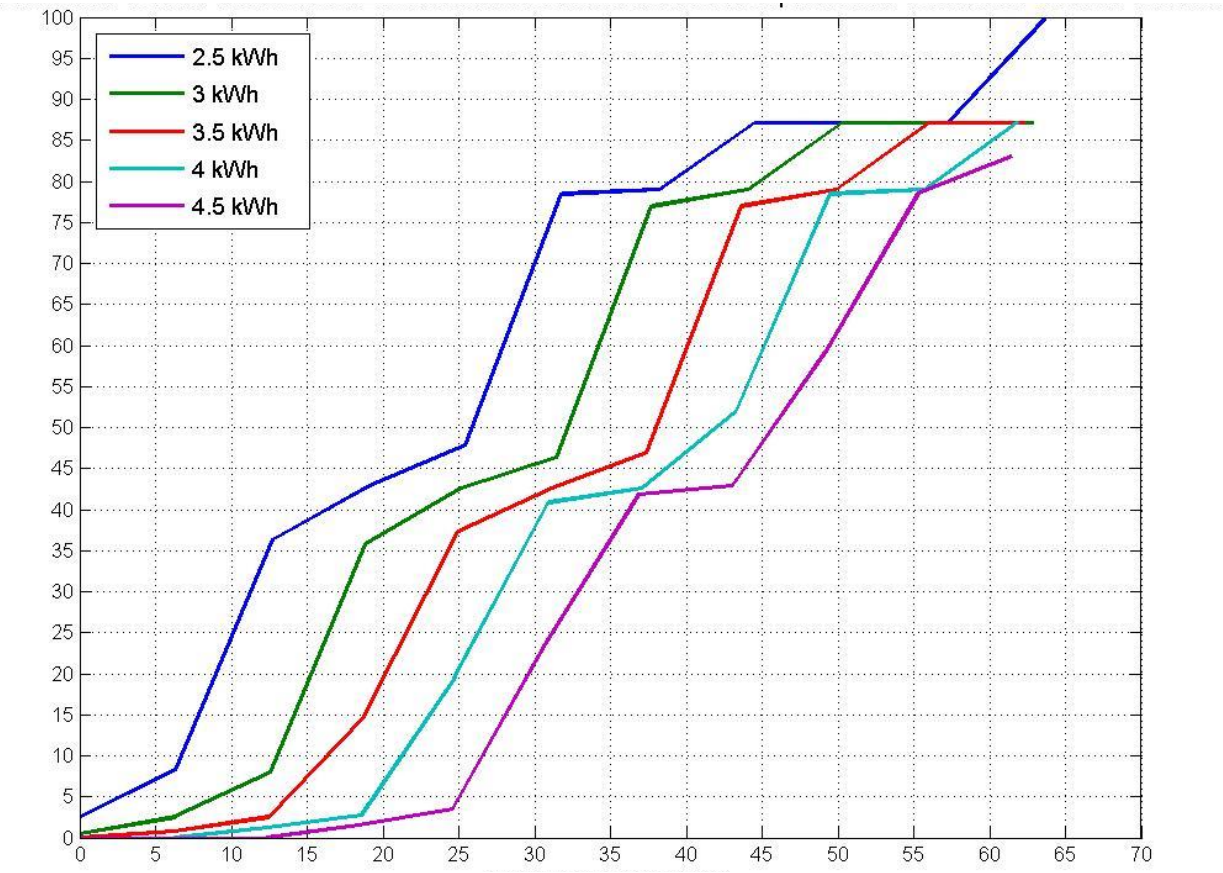
- Energy deviations from predicted profile produce costs that have to be paid by the producer
- Wind production forecast are usually made, but a perfect prediction is impossible. Energy storage may correct prediction errors
- Technology: NaS Battery, 1 MW, 7 MWh, for a 30 MW wind park
- Estimated Investment: 4.5 M€
- Avoided cost: Energy imbalance penalties
- Results: imbalance are reduced, some saving on imbalance penalties are possible, but battery energy losses overcome benefits ! Battery produce a net income loss

Energy storage for a residential PV plant

- Benefit: avoided cost of electricity purchase (price of energy sold to the grid is relatively low)
- Data base (load profiles) of some hundreds of residential users
- Assumptions: 3 kWp PV plant. All users need a contractual power increase for limited periods (1 h/day). No PV subsidies, no net metering
- Storage technology: Lithium battery, 3 kW, 2.5 ÷ 4.5 kWh
- Estimated investment (current prices): 2750 ÷ 4150 € (turnkey)
- Only a very limited fraction (< 5%) of users find a cost-benefit positive balance, at current prices
- Assuming a limited battery price reduction (-10 to -20 %), many users may find it profitable

Energy storage for a residential PV plant

Percentage of users having a positive cost-benefit balance



Storage system cost reduction

Conclusions

- Electrochemical storage is still relatively expensive for grid-connected applications
- Depending on the specific case, target prices are 20%, or factors 2 ÷ 3 lower than the present ones
- These targets can be achieved in the next 5 to 10 years, through intensive R&D, product innovation, demo projects, mass production
- In the mid-long term, battery storage systems will be a key technology for a decarbonized electrical system

Thank you for your attention !

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