DISTRIBUTED SOLAR AND STORAGE – ICEF ROADMAP 1.0: OVERVIEW

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22 April 2016
PROJECT GOALS

- Assess possible scenarios for deployment of solar and storage technologies
- Identify strategies for overcoming barriers to deployment of solar and storage technologies
- Evaluate potential methodologies for ICEF Innovation Roadmaps

PROJECT SCOPE

- Solar and storage in combination
- Rooftop and community-scale (“small-scale”)
PROJECT METHODOLOGY

● Assess current state of the technology (both solar PV and storage)

● Compile best available information on publicly funded solar and storage R&D

● Describe likely uptake scenarios, based on developed and emerging market case studies

● Identify principal barriers and possible strategies for overcoming them
PROJECT TIMELINE

● Project launched in April 2015

● Initial presentation at WBCSD/LCTPi, May 2015

● Extensive consultation (IEA, IRENA, IIASA, WBCSD, French government, many others)

● Presented draft at ICEF 2015; detailed input from panel discussion (October 2015)

● Final product delivered at COP21 (December 2015)

● Possible Version 2.0 in 2016

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PROJECT TEAM

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SECTION: TECHNOLOGY BACKGROUND

- Assessment of current state of solar PV and battery energy storage technology, including cost trends and manufacturers

- Assessment of supply/demand balance for PV modules and public benchmarks of PV residential system capex

- Analysis and comparison of supply chains for PV modules and lithium-ion batteries

- Assessment of alternative storage technologies (beyond lithium-ion)
SECTION: SURVEY OF NATIONAL R&D PROGRAMS ON PV AND STORAGE

- Analysis of four largest national R&D programs (US, Japan, Germany, Korea)
- Include targets, program structure, technical focus areas, recent notable technical results
- Review of participating ministries and primary laboratories
- Provide snapshot of current state of publicly funded solar PV and storage R&D
ROADMAP COUNTRY BACKGROUND

- Roadmap framework broadly applicable to “mature” and “emerging” economies
- Specifically applied to Japan, Germany, US, China, India as example cases
- Initial background review of key population, economic, energy trends
SECTION: UNCERTAINTY ANALYSIS FRAMEWORK

- Assess factors that will impact emergence of solar & storage technology in both mature and emerging markets
- Evaluate (a) uncertainty of factor; (b) impact of factor
- Determine most relevant factors for further analysis in mature market and emerging market contexts
Figure 18: Development of mature markets scenario axes

- **Related uncertainties 1**
  - Storage cost
  - Electricity price
  - Competing solution cost
    - Solar costs
    - Wealth
    - Future lifestyle trends

- **Related uncertainties 2**
  - Regulation
  - Business model innovation
    - Electric vehicles
    - Utility finances
    - Grid reliability
    - Political instability

- **Mature markets Axis 1**
  - Rooftop and community solar with storage is economically **unattractive** vs.
    - Rooftop and community solar with storage is economically **attractive**

- **Mature markets Axis 2**
  - Electricity regulation is **defensive** of utility incumbents
    - vs.
    - Electricity regulation is **supportive** of rooftop and community solar with storage

Figure 19: Mature markets scenario overview

- **Unattractive economics**
- **Supportive regulation**
- **Attractive economics**
- **Defensive regulation**

Least important [ ] [ ] [ ] [ ] Most important
EMERGING MARKETS FRAMEWORK

Figure 20: Development of emerging markets scenario axes

- **Related uncertainties 1**
  - Storage cost
  - Competing solution cost
  - Business model innovation
  - Wealth
  - Future lifestyle trends
  - Solar cost

- **Emerging markets Axis 1**
  - Rooftop and community storage with solar is broadly **unaffordable**
  - Rooftop and community storage with solar is broadly **affordable**

- **Related uncertainties 2**
  - Grid reliability
  - Regulation
  - Utility finances
  - Political instability
  - Population growth
  - Price of electricity

- **Emerging markets Axis 2**
  - The central electricity grid is **unreliable** with frequent interruptions
  - The central electricity grid is **reliable** with infrequent interruptions

Figure 21: Emerging markets scenario overview

- **Unaffordable storage**
- **Affordable storage**
- **Unreliable grid**
- **Affordable grid**

Least important | | | | | Most important
SCENARIO EXAMPLES

FAILURE OF TRADITIONAL UTILITY MODEL

A severe shortfall in grid capacity – due to chronic underinvestment and growing demand – means frequent blackouts and a sharp rise in electricity prices, causing public outcry and forcing the urgent reformation of the utility sector.

In order to increase system capacity, new regulations are incentivized to encourage non-traditional generators to feed into the grid, including owners of rooftop and community solar and storage systems. The high price of grid-supplied electricity means that the economics of solar and storage are now particularly attractive.

STRONG GLOBAL ECONOMY DRIVES STORAGE INDUSTRY

A sustained period of economic growth globally sees a reduction in trade barriers and increased demand for electric vehicles. As a result a global industry for lithium-ion batteries emerges and battery prices fall rapidly.

Growing demand for electricity sees an increase in prices, further improving the economics of solar and storage but grid codes prevent non-utility actors from fully monetising distributed energy assets. However utilities, protected by regulation, are able to rate-base batteries, supporting the uptake of grid-scale storage technologies.
SCENARIO EXAMPLES

CONTROVERSY AND RE-REGULATION

A technology breakthrough leads to a dramatic fall in storage prices. The rapid and unforeseen uptake of solar and storage is controversial and disruptive. While many benefit from support schemes for the technology others complain that the government is giving public money to those privileged enough to own their own roof.

A lack of labour certified in the installation and integration of distributed solar and storage leads to a large number of “cowboy” headlines causing reputational damage to the industry. Responding to concerns, the government introduces restrictions on non-utility generation.

PUSH BACK AGAINST UNSAFE AND UNRELIABLE TECHNOLOGY

An incident involving storage – such as a fire or similar – will shock public opinion leading to the open questioning the wisdom of subsidising early-stage technologies that are yet to prove their safety.

Reacting to the incident regulators will place restrictions on storage technologies, particularly when located inside or near buildings. As a result opportunities for distributed solar and storage will be stifled due to restrictive regulation.
SECTION: APPLYING FRAMEWORK TO SELECT COUNTRIES

- Evaluate current scenario in each selected country
- Examine possible pathways to high-deployment scenario (attractive economics and supportive regulation or unreliable grid)
Examined six key barriers to further uptake of solar and storage

Ranked by impact on short-term and long-term basis

Storage costs emerge as most important
Business recommendations
- Create manufacturing scale
- Pursue synergies with EVs
- Encourage business model innovation

Policy & regulatory recommendations
- Reform electricity markets
- Fine-tune incentives to support solar + storage
- Invest in R&D
- Encourage solar-powered storage (bad grids)
- Reduce diesel subsidies
- Define quality and safety standards
- Reduce or eliminate trade barriers

Other recommendations
- Education and training
- Leverage local context
- Learn from early adopters

QUESTIONS

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