Energy Storage Systems Issues Looking For Integrated Distributed Energy-Resource Planning

Viviane Tavares Nascimento, Patrícia Gimenes, Miguel E. Morales Udaeta e André L. V. Gimenes

Escola Politécnica, Group of Energy, University of São Paulo

Introduction

- The technological maturity and costs decrease of storage systems encourage the employment of storage-based services, fundamental to lead the integration of renewable sources and ensuring the balance of the grid [2-3]. Despite the strong confidence in the new role presented by storage systems, their employment depends on some concerns regarding business and legal barriers, and grid stability [4-5].
- To overcome the uncertainties and foster storage implementation, it is fundamental to map its input risks and identify further benefits as parameters to future projects. a management method that maps the uncertainties and opportunities regarding time requirements and human resources is essential to the success of a storage system implementation project.
- The proposed work presents a methodology to cope with energy storage systems implementation for a Brazilian scenario. The work distinguishes relevant issues and plans their insertion into a timeline, separating the required actions into short, medium, and long-term.
- The mapped issues consider strategic market orientation, society and populational changes, available technologies, political targets, and climatic agreements as essential terms to a storage deployment project evaluation.

Methodology

- The analysis of social changes, consumption habits, regulatory parameters, and laws set terms that state opportunities and gaps for technology implementation.
- **Opportunities** consider the particularities of the external scenario - energy market status and expectations regarding storage implementation - that may contribute to the storage implementation.
  - *Technology* establishes the effects of new technologies and initiatives adoption, investments in resilient and intelligent infrastructure, efficiency, reducing environmental impact, affordable and robust energy supply, and demand-side management structure.
  - *Taxes and Incentives* presents how energy storage systems lead to costs decreasing, expand the concurrency, and encourage independent generators entry.
  - *New Business Models and Process* describe how to create a commercial model that encompasses new strategic planning, market share, processes building, and performance models.
  - *Pilot Project* states how technical information regarding the reliability and quality of storage deployment contributes to the infrastructure implementation.
  - *Communication* defines how stakeholders may understand the new model advantages and competitive edges.
  - *Resources and Skills* presents the experience and knowledge regarding technology implementation.

Methodology

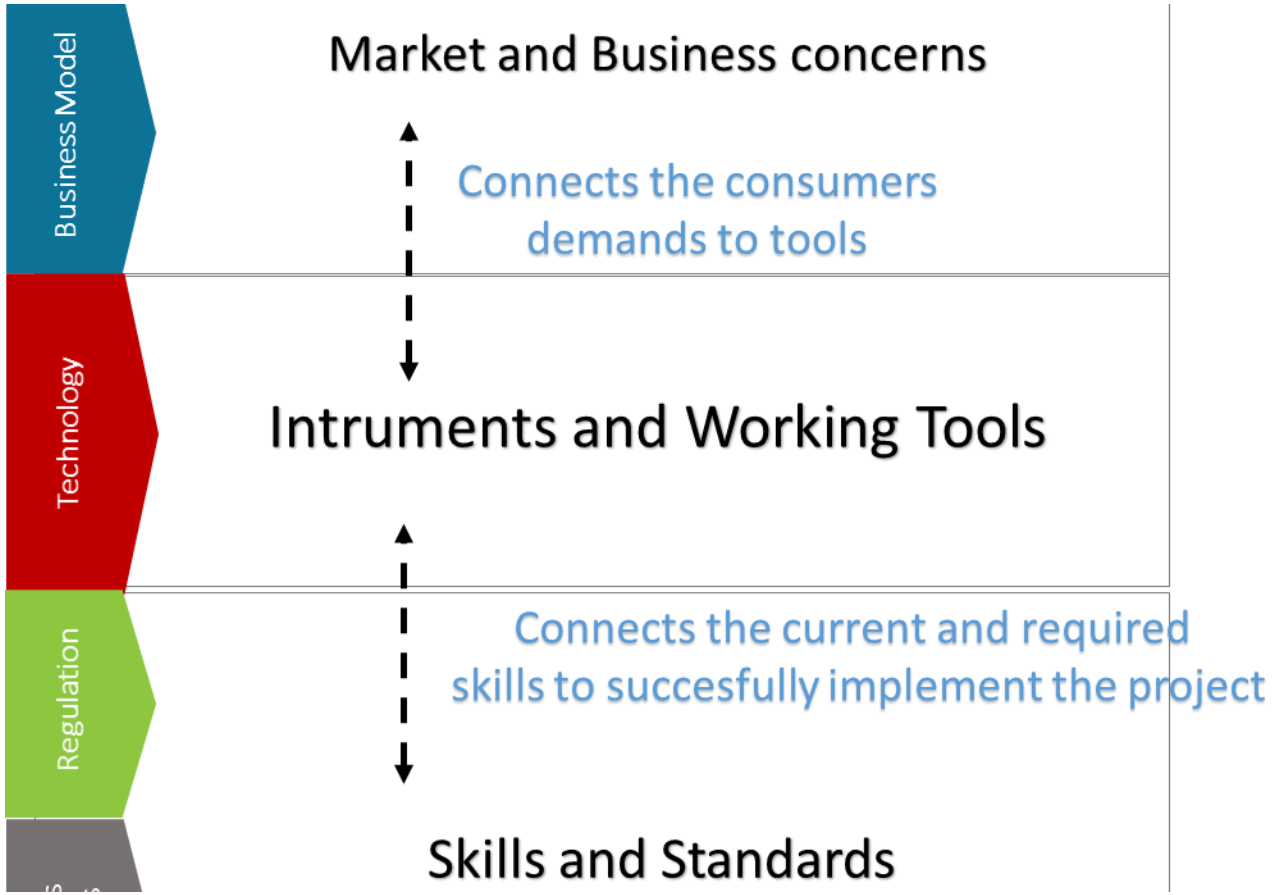
- The analysis of external factors also enables to establish the **Threats** that may delay or disable an energy storage system implementation.
    - *Technology and Incentives* issue: dependence on importation or policies to bolster technology input. The performance and massive scale production are concerns along with the absence of information regarding the load behavior and its threats to the distribution companies' business.
    - *Market* concerns about the effects of revenue and costs for distribution companies. The development of a new business model that encompasses this new consumption behavior depends on regulatory terms.
    - *Regulation* must define interests and stakeholders, but also standardize the operation, processes, and trading. The required time to approve or define these parameters is vital for the success of the storage implementation.
    - *Resources and Skills* point out that the absence of professionals that cope with the technology may delay its implementation.

Methodology

- The **Weakness** and **Strengths** identify the qualities and innovation capacity, pointing out how the sector may improve to overcome its limitations.
- **Strengths** set parameters of the distribution sector that encourage its development, particularly regarding regulatory terms and project proposals that bolster the distributed generation in Brazil.
    - Normative Resolution 482/2012, which stated conditions for micro or mini generators operate in the local energy sector,
    - Research and development projects, including projects related to storage implementation, are issues that may encourage technology implementation in the country.
    - Integrated works between Universities, companies, and the Brazilian regulatory body encourage an innovative scenario
    - Differentiation of tariffs for commercial and industrial consumers may encourage the implementation of generation and storage resources that decreases costs and allow new energy-based services to offer.
- **Weakness** encompasses factors that may disturb battery implementation in Brazil.
    - *Management* establishes how the absence of parameters regarding the management of these systems delays technology implementation and problems regarding the infrastructure purchasing.
    - *Tariffs* establish that it is important to differentiate consumers through fees, decreasing inequalities among consumers regarding access to the technology and consumption levels.

Methodology

- *Market* layer presents the actions and requirements for the successful implementation of storage technologies.
- *Business* layer states how to implement the required actions to successfully end the project, and current standards and required changes to enable the entry of technology in the sector.
- The *Market* layer proposes a cultural change to encourage storage deployment through communication and encouragement actions.
- The *Business Model* layer shows the required activities to develop a specific model for the storage system and its services.
- The *Technology* layer studies the technology potential and designs the infrastructure.
- The *Regulation* layer maps the barriers of the current regulatory documents, specifying the rules for implementing and managing a storage system.



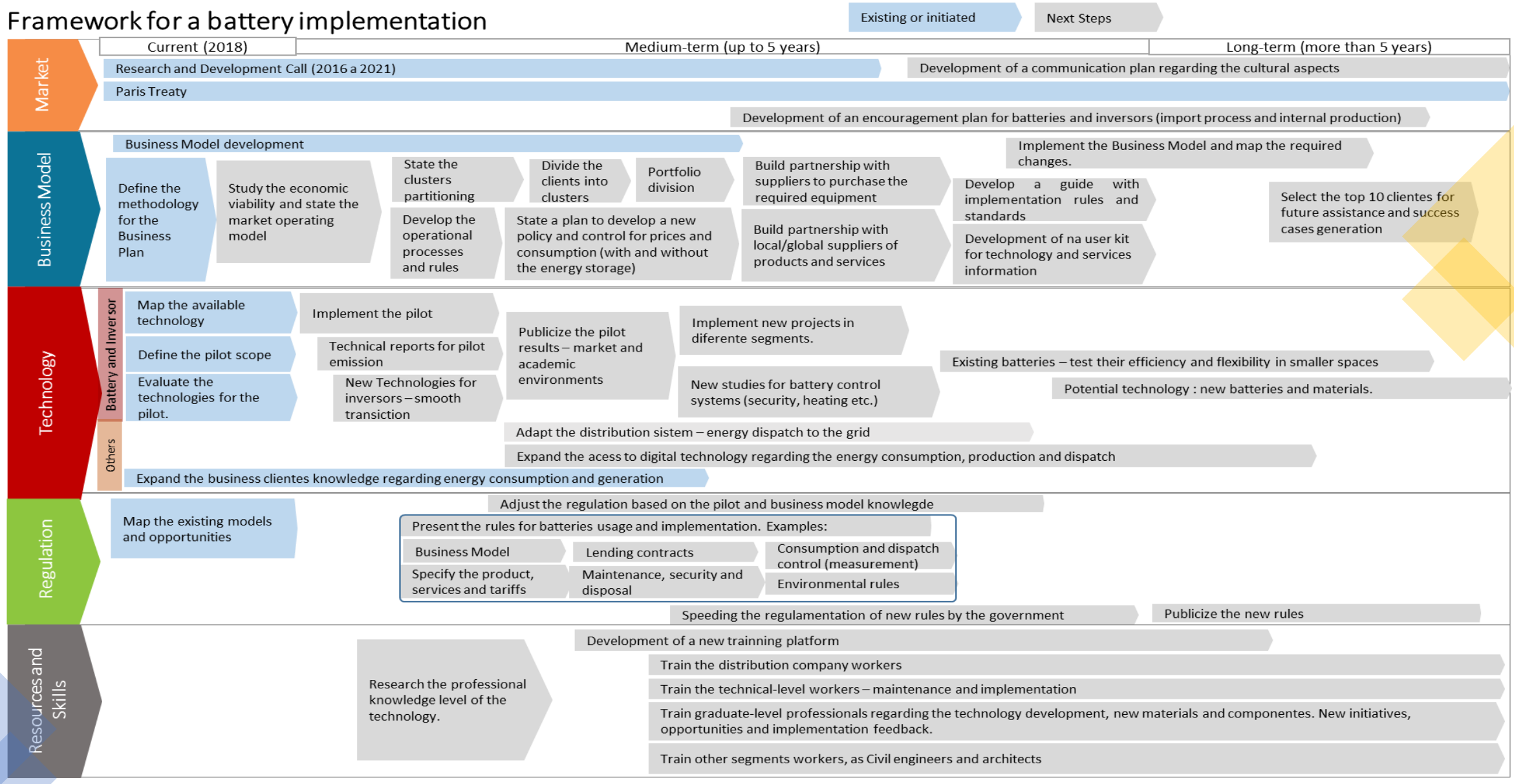
Layers organization for a Brazilian scenario

Benchmark Case

- The use case presents the implementation plan for a medium voltage client, located in Campinas, a city near the state capital São Paulo. The consumer owns a gas station and a restaurant in the location, both working 24 hours per day. The energy demand and consumption peak occur around lunchtime, out of the peak period.
- The project is focused on implementing a Lithium battery as an alternative energy source during the peak period - workdays, from 6 pm to 9 pm. The battery must supply the client during the peak period or power loss conditions.
- At the beginning of the project, the responsible crew took part in the interview processes focused in understanding the learning process and main points for each work. This stage mapped the perspective for the battery implementation, considering the existing barriers for the energy sector.

- The roadmap presents the issues regarding Opportunities and Threats defined by the responsible crew. The map is organized through time and layer requirements, and into current (short-term), medium-term, and long-term.

Framework for a battery implementation



Framework for a Brazilian scenario

References

[1] A. Eller e D. Gauntlett, “Energy storage trends and opportunities in emerging markets,” Navigant Consulting Inc., 2017.

[2] International Energy Agency, “International Energy Agency,” 06 06 2017. [Online]. Available: https://www.iea.org/news/etp-2017-maps-major-transformations-in-energy-technologies-over-nextdecades. [Acesso em 23 05 2020].

[3] EUROBAT, “Battery Energy Storage in the EU - Barrier, Opportunities, Services and Benefits,” 2016.

[4] I. Usera, P. Rodilla, S. Burger, I. Herrero e C. Batlle, “The Regulatory Debate About Energy Storage Systems: State of the Art and Open Issues,” IEEE Power and Energy Magazine, vol. 15, nº 5, pp. 42-50, 2017.

[5] A. B. Gallo, J. R. Simões-Oliveira, H. K. M. Costa, M. M. Santos e E. M. dos Santos, “Energy storage in the energy transition context: A technology review,” Renewable and Sustainable Energy Reviews, vol. 65, pp. 800-822, 11 2016.