World Economic Forum

Accelerating Grid Edge Transformation in Colombia

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The Context of the Grid Edge Transformation

What is the grid edge transformation?
The electricity system is a prime example of the impact of the Fourth Industrial Revolution, becoming more complex, with rapidly evolving technologies, innovative business models emerging and shifting regulatory landscapes. The so-called grid edge transformation is the combine effect of three trends, driven by the introduction of new (grid edge) technologies:

1. Electrification of new uses, such as light transportation driven by the advent of electric vehicles, and heating
2. Decentralization of the system's active resources, with increasing penetration of distributed energy resources like distributed storage, distributed generation and energy management systems
3. Digitalization driven by the advent of the internet of things and power-consuming connected devices, smart metering and other digital electricity network technologies (automation, remote control, smart sensors)

What benefits can this transformation bring to the industry and broader society?
The three trends act in a virtuous cycle, enabling, amplifying and reinforcing developments beyond their individual contributions. They can help to build a better, more resilient, secure, sustainable and efficient electricity system, also creating new services for customers and new jobs:

- With the system becoming fully digitalized, operations can be fully automated and capable of managing and exploiting the new flexible and mobile resources, such as distributed renewable generation or electric vehicles.
- Customers will be able to select the distributed energy technologies of their choice, connect them to the centralized grid and even transact electricity and related services with other distributed and centralized resources with real-time interactions.
- The role of the electricity network evolves beyond supplying electricity, becoming a platform that exploits and maximizes the value of distributed energy resources and the economic potential of retail services.

The World Economic Forum has identified that, over the next 10 years, the transformation of the electricity system can unlock more than $2.4 trillion of value for industry and for society by reducing carbon emissions, increasing the efficiency of infrastructure, creating jobs and increasing options to consumers.

Why are grid edge technologies expected to become highly relevant?
The potential of grid edge technologies is fueled by three elements:

- Cost is exponentially decreasing.
- Innovative business models are emerging, built around empowered customers.
- Significant improvement to the electricity system utilization rate – currently usually lower than 60% – by reducing peak demand, shifting and flattening the load profile.

Grid edge technologies will likely follow an adoption rate (S-curve) similar to other innovative products in the past; after initial linear progression, adoption will grow exponentially.

How to take advantage of this transformation?
The World Economic Forum has gathered and analysed practical examples and best practices of grid edge innovations from mature electricity markets worldwide, with the objective of providing an Actionable Framework that will support various other geographies in making an effective transition to the new electricity system, unlocking the value of grid edge technologies. This framework addresses four main areas relevant to the transformation: redesigning the regulatory paradigm; deploying the enabling infrastructure; redefining the customer experience; and embracing new business models.

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Why is the grid edge transformation relevant to Colombia?

Colombia is well-positioned among other non-OECD countries in terms of:

- Current organization of the electricity sector, with well-established independent entities in charge of planning and regulation, UPME and CREG (Comisión de Regulación de Energía y Gas), as well as strong electric corporations in the private sector in charge of infrastructure and service
- Relevance of grid edge technologies to solve current challenges in a cost- and time-effective manner, preparing the path for the future electricity system
- Overall development of the energy system (Colombia is ranked eighth out of 126 countries in the World Economic Forum Global Energy Architecture Performance Index 2016)

Context elements to consider

The initiative should consider the following:

- The Colombian electricity system has a very low load factor.
- Colombia is a large country and the status and opportunities of the electric sector vary by region.
- Colombia has already started on the road towards smart grid/digital technologies. For Colombia, the opportunity from grid edge technologies lies mostly in accelerating the progress along the lines already laid out in “Colombia Inteligente” and the “Smart Grids Colombia Visión 2030” developed by UPME (Unidad de Planeación Minero Energética).
- The public and private sectors are working to align on priorities for action.
- Action – in terms of new policy or new public-private partnerships – needs acceleration, especially to keep up the pace of the rapidly evolving technological landscape and around four main themes (smart demand and customer engagement, e-mobility, business models, micro-grid).
- The Actionable Framework developed by the World Economic Forum can support public and private stakeholders to converge on the main strategic lines for action.

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Grid Edge Transformation Initiative Colombia (GET-IC)

The Grid Edge Transformation initiative in Colombia was launched in December 2016, with a first workshop in Bogotá, which gathered the highest representatives of the public and private electricity sector to discuss the grid edge transformation and the opportunities for Colombia, and eventually define a roadmap for cooperation during 2017. This workshop was followed by meetings in March, and June.

The following structure and plan for the initiative were discussed and agreed by the Ministry of Energy and Mines, UPME, Colombia Inteligente, Celsia, Codensa, EEB, EPM, WEF.

Relevant themes for the GET-IC
Four main themes shall be the pillars of the initiative:

1. **Deployment of technology**: Accelerating active demand and distributed generation, particularly increasing speed of penetration of smart metering, with customer-centric approach.
2. **Electric Mobility**: Drive action to increase speed of electrification of transport.
3. **New Business Models**: Enable emergence of new innovative business models and partnerships among industry players, supported by regulatory changes.
4. **Micro-grid**: Development of sustainable micro-grids solutions for the electrification of remote areas.

The GET-IC Approach

- The whole initiative will be led by UPME (delegated by the Minister of Energy and Mines)
- For each theme, a Working Group (WG, see Appendix for the composition) is created, with a defined leader, responsible for agenda and coordination of the work and interactions within the group.
    - **Deployment of technology**: led by UPME in the person of Carlos Garcia
    - **Electric Mobility**: led by UPME in the person of Carlos Garcia.
    - **New Business Models**: led by Colombia Inteligente in the person of Juan David Molina.
    - **Micro-grid**: led by UPME.
- The WGs shall include representatives of the relevant stakeholders, with the mission to provide strategic vision and inputs. Each WG will have to identify the actions and initiatives needed to ***accelerate the progress of the "Smart Grids Colombia Visión 2030"***. Specifically the WGs will:
    - Assess the progress of the *Smart Grids Colombia Visión 2030* implementation.
    - Identify the top-three/five barriers and enablers to reach the **phase I** targets of the roadmap.
    - Define concrete and implementable solutions with 12-month horizon and by the end of phase 1 - 2020, in the forms of policy and business actions.
- Each WG will have regular meetings, at least on a monthly basis, and plan to achieve results by the end of October 2017. Starting July 2017, every week a web conference will be organized between UPME, Colombia Inteligente and the World Economic Forum to assess progress.
- The World Economic Forum will share the insights from the global Grid Edge Transformation project, relevant worldwide expertise and best practices. It will also develop the case for the World Economic Forum Annual Meeting 2018.
- The World Economic Forum shall provide a dedicated space on its digital collaboration, knowledge and community platform TopLink: WGs will have the possibility to share documents, discussions and get access to cutting-edge knowledge.
- A workshop with the highest-level representatives of the private and public electricity sector will gather on November 1st to review the results of the WGs and endorse specific actions to implement.

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GET-IC term and expected outcomes

The first phase of the initiative will be a one-year effort, starting in March 2017 and delivering results no later than March 2018. The specific expected achievements are:

- Agreement and commitment from the leadership of the sector on the strategic priorities.
- A set of specific policy recommendations on the identified priority themes (that later will have to be developed, detailed and implemented by the relevant regulatory bodies).
- Definition and launch of concrete initiatives (e.g. deployment commitments).
- Creation of a case study from the Colombia experience that will serve as the reference for implementation in other markets in the World Economic Forum Annual Meeting 2018 in Davos-Klosters.

GET-IC Milestones

A. *March – June: Sharing, Commitment and Organization*
   a. *Sharing*: "Ongoing projects on smart grids" (Colombia Inteligente); "Mapa de Ruta" (UPME); "The future of Electricity: New Technologies Transforming the Grid Edge" - Actionable Framework and relevant case studies/business cases (World Economic Forum).
   b. *Commitment*: The group will agree on the key achievements for 2017 (as delineated above).
   c. *Organization*: The group will discuss and agree on the governance model, WGs and overall timeline.

B. *July*: WGs operational.

C. *End of October* (1 day workshop with highest-level representatives): *Assessment, Decision and Action*
   a. *Assessment*: Discuss and review proposals elaborated by the WGs.
   b. *Decision*: Consolidate a short list of the most promising proposals.
   c. *Action*: Define the steps for action on the selected initiatives; formal endorsement and announcement of the parties to undertake the selected initiatives.

D. *January 2018* (Davos): Minister of Energy and Mines shares the initiative and announces the actions taken/initiatives launched and the progress made.

GET-IC governance model

- The whole initiative will be led by UPME (delegated by the Minister of Energy and Mines).
- The highest-level executives from key private sector organizations, with the involvement of heads of public bodies, and chaired by the Ministry of Energy and Mines, will be consulted to validate the achievement of the milestone C, in a specific in person meeting.
- On a weekly basis, the WG leaders and the WEF will align on the progress of the initiative

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Workshop 7 December 2016 – Participant List

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