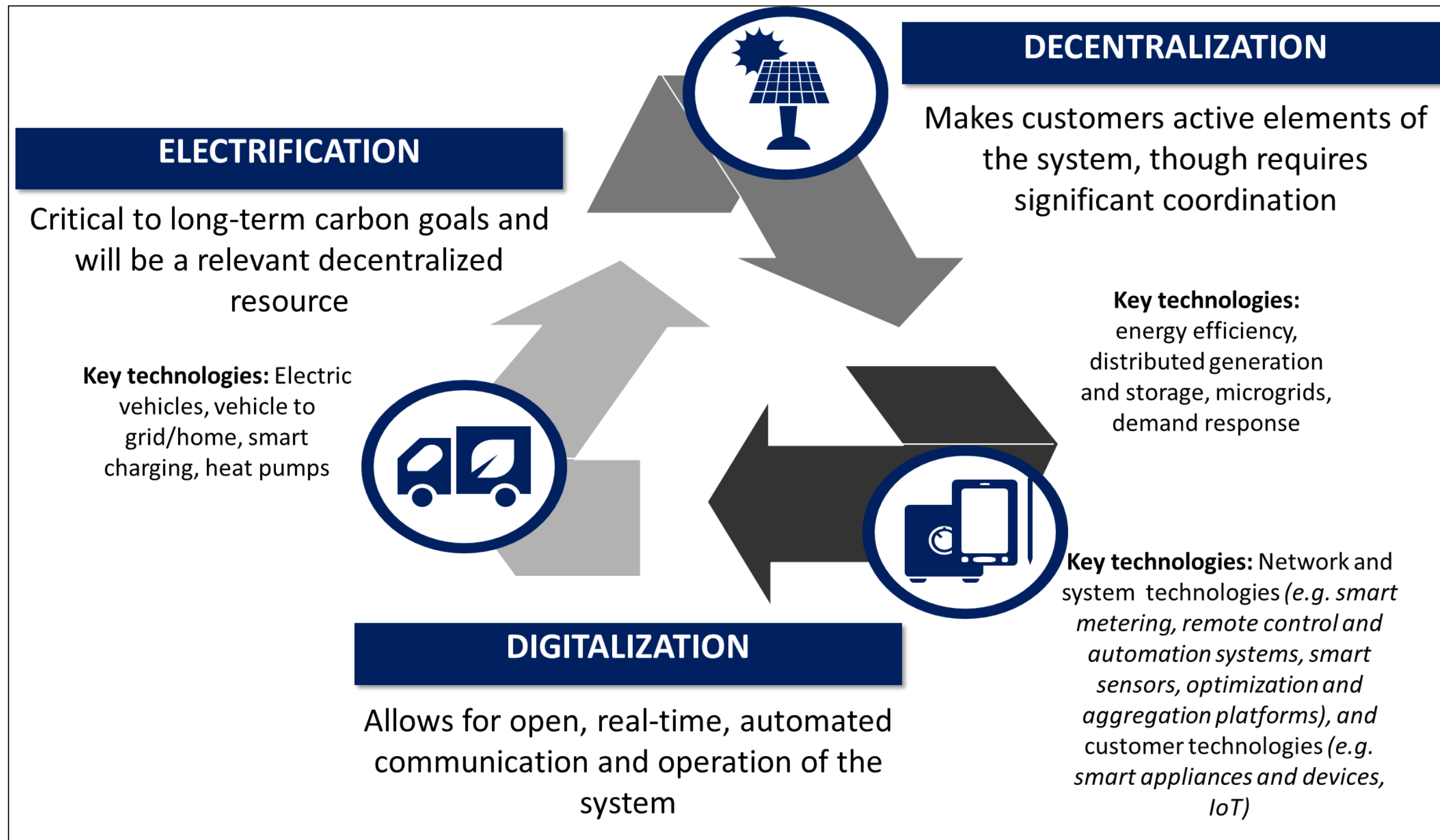


# The grid edge transformation – New business models



# Three trends have the potential to disrupt the electricity system – reinforcing each other in a virtuous cycle

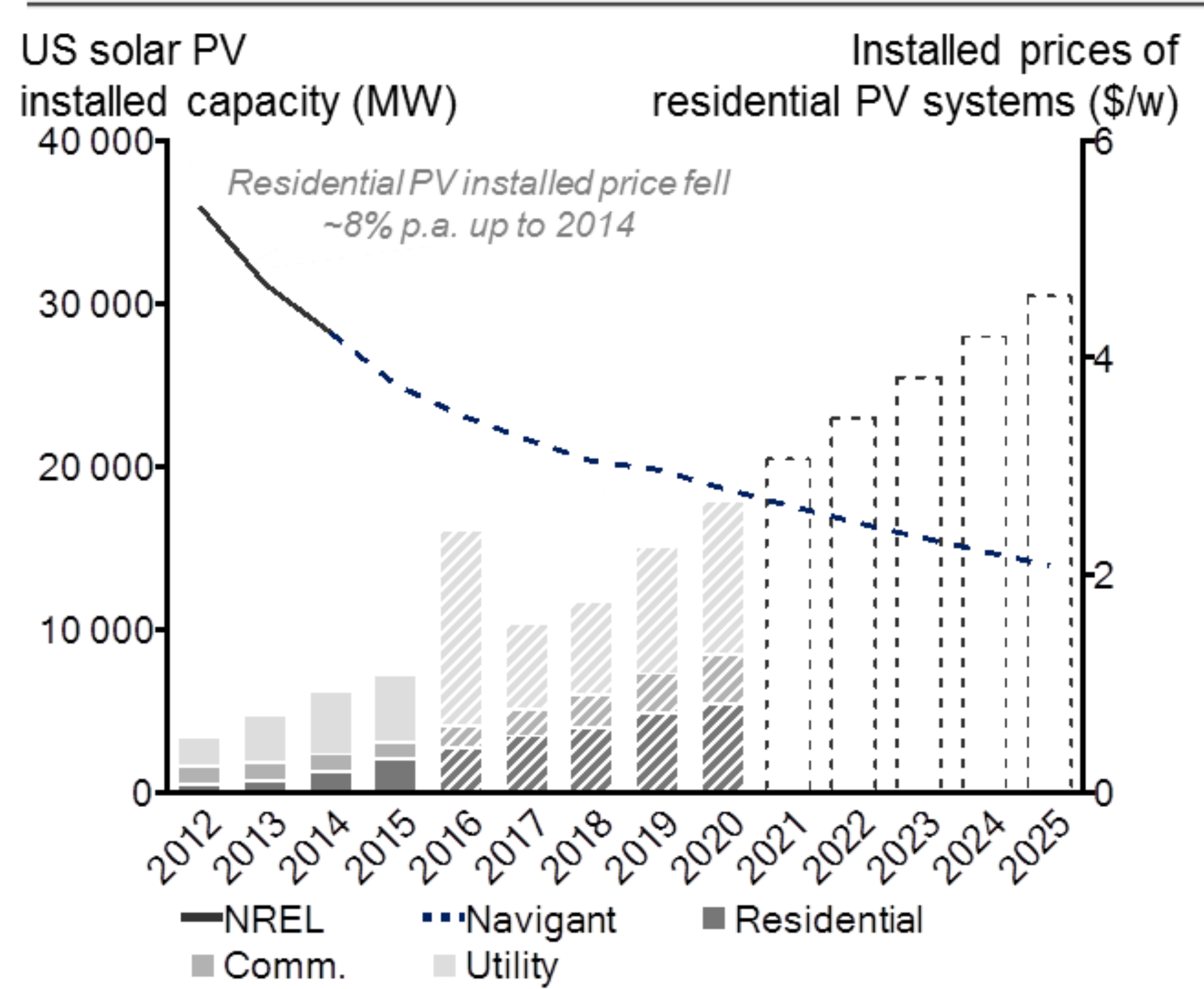


## Potential for disruption fueled by

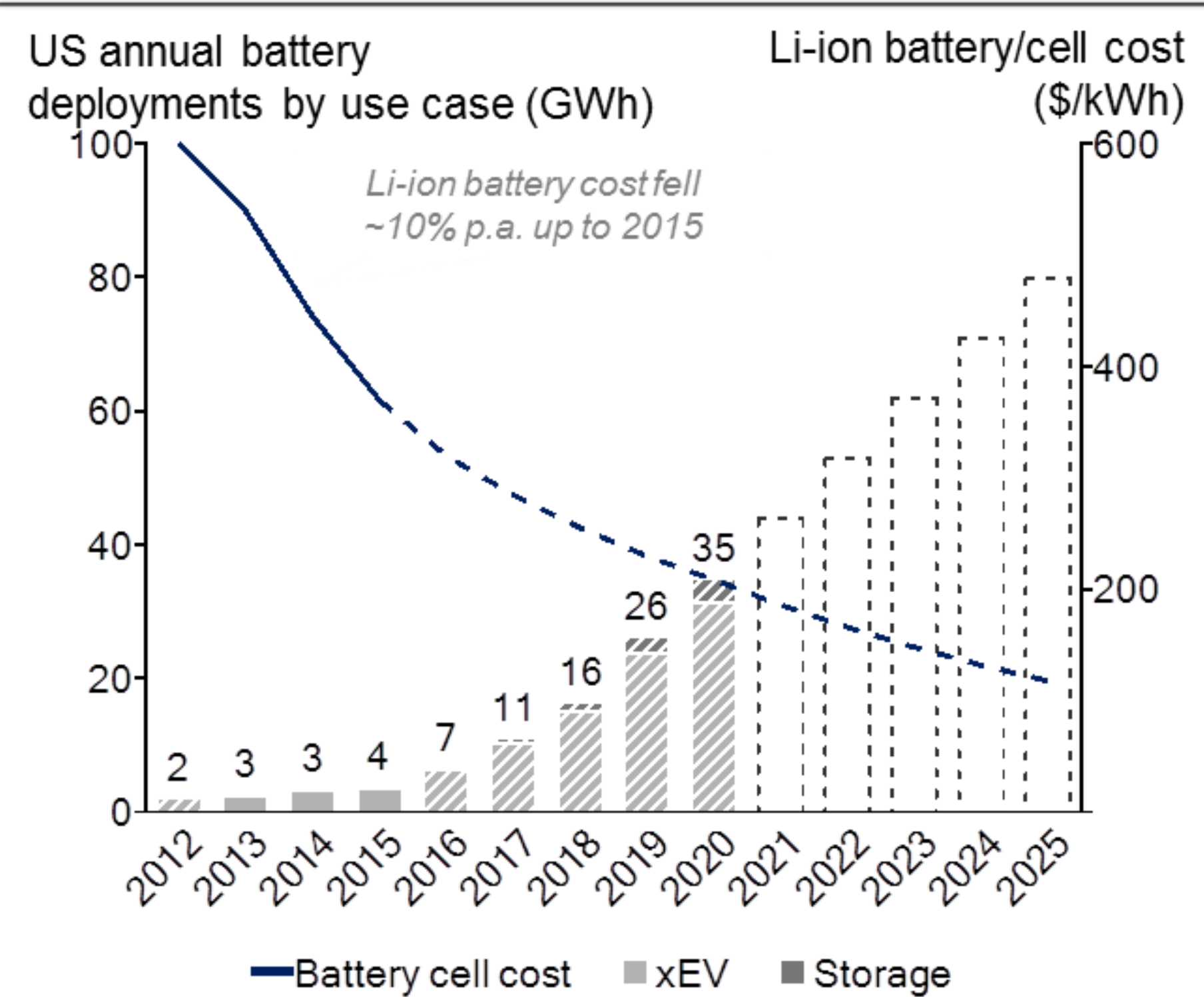
- 1 Exponentially decreasing technology costs
- 2 Innovative new business models
- 3 Low asset utilization of the electricity grid

# Costs of distributed generation and storage are decreasing significantly – and will continue to do so

## 1 DISTRIBUTED GENERATION (RESIDENTIAL SOLAR PV)



## ENERGY STORAGE

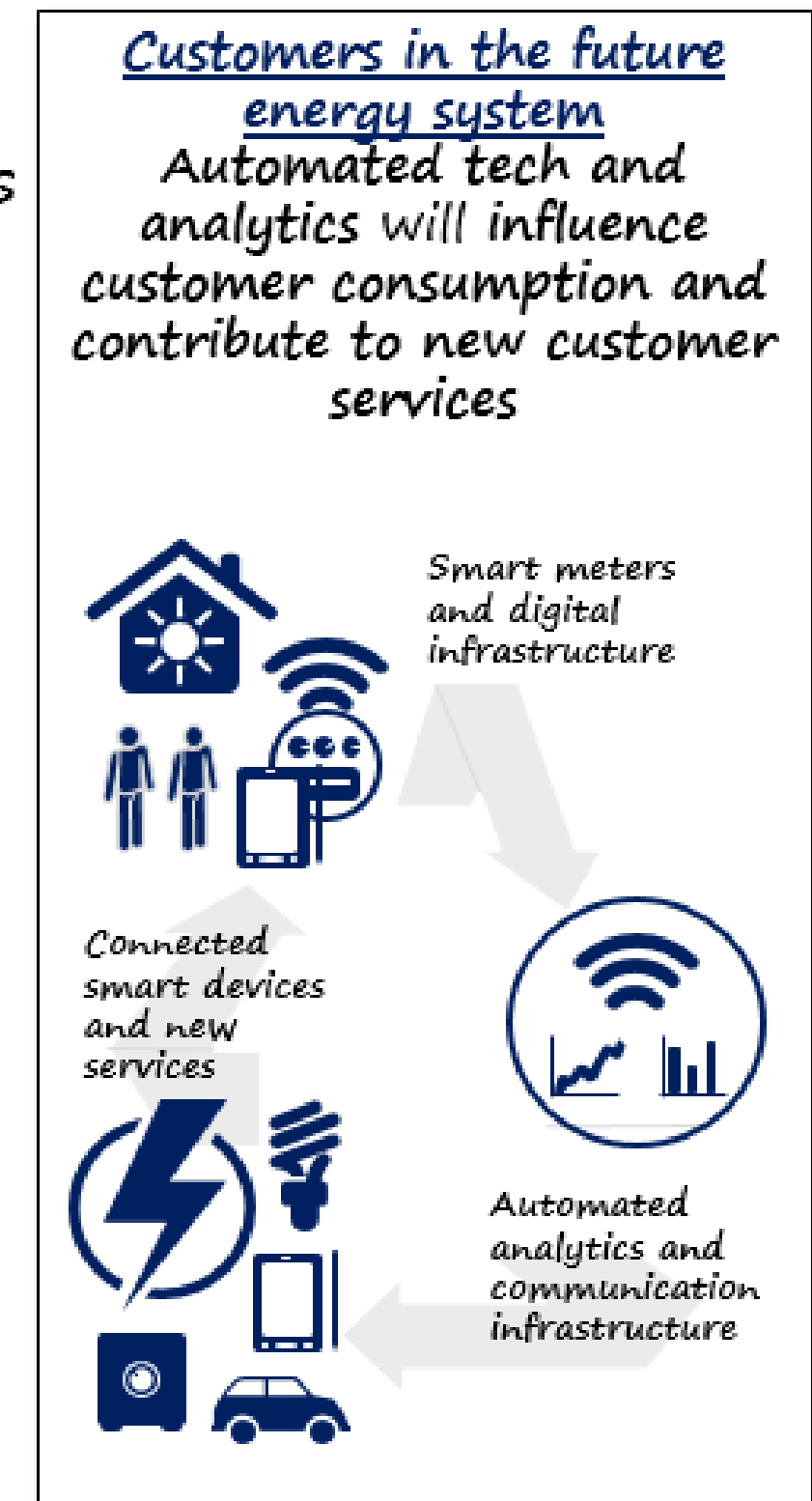
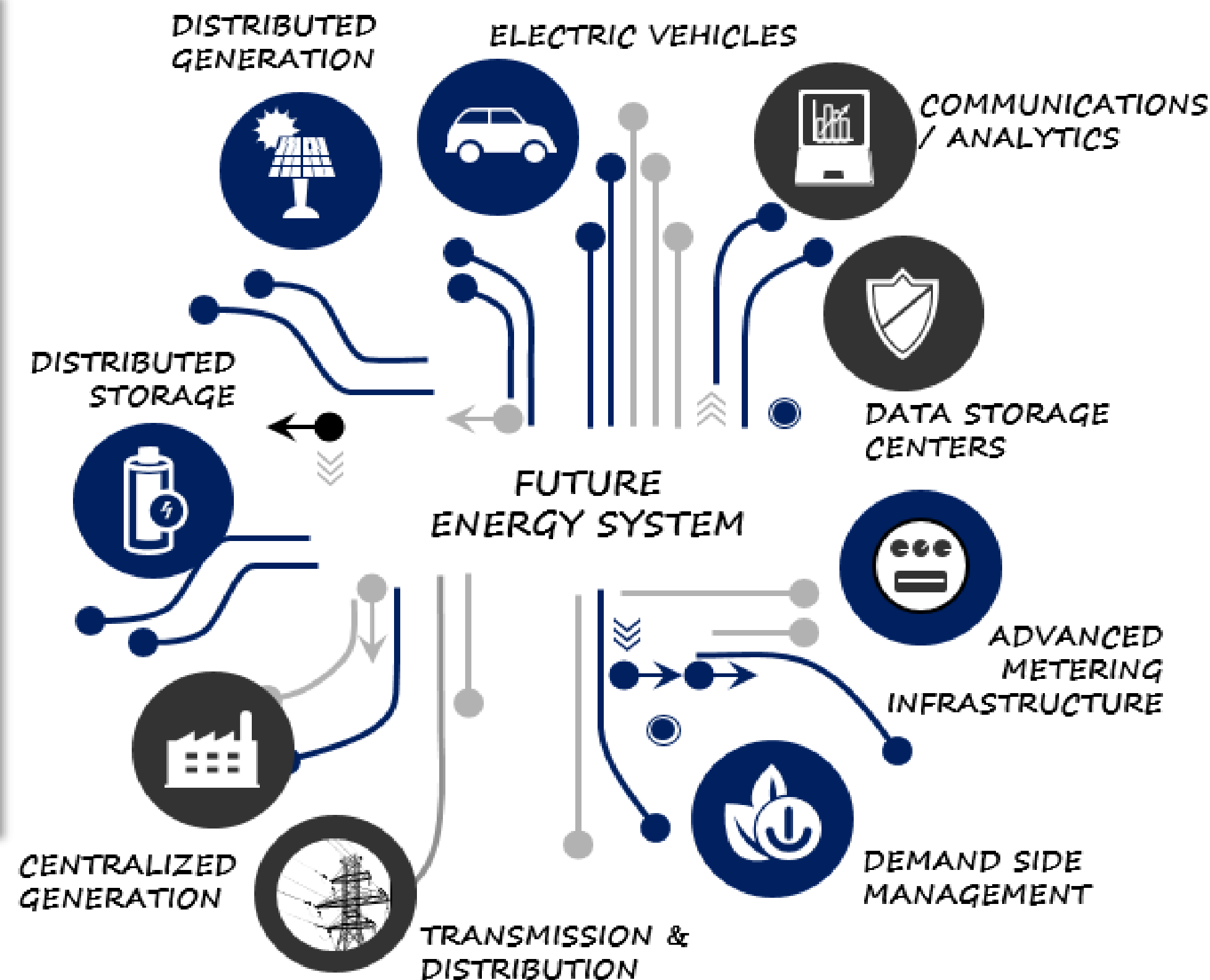
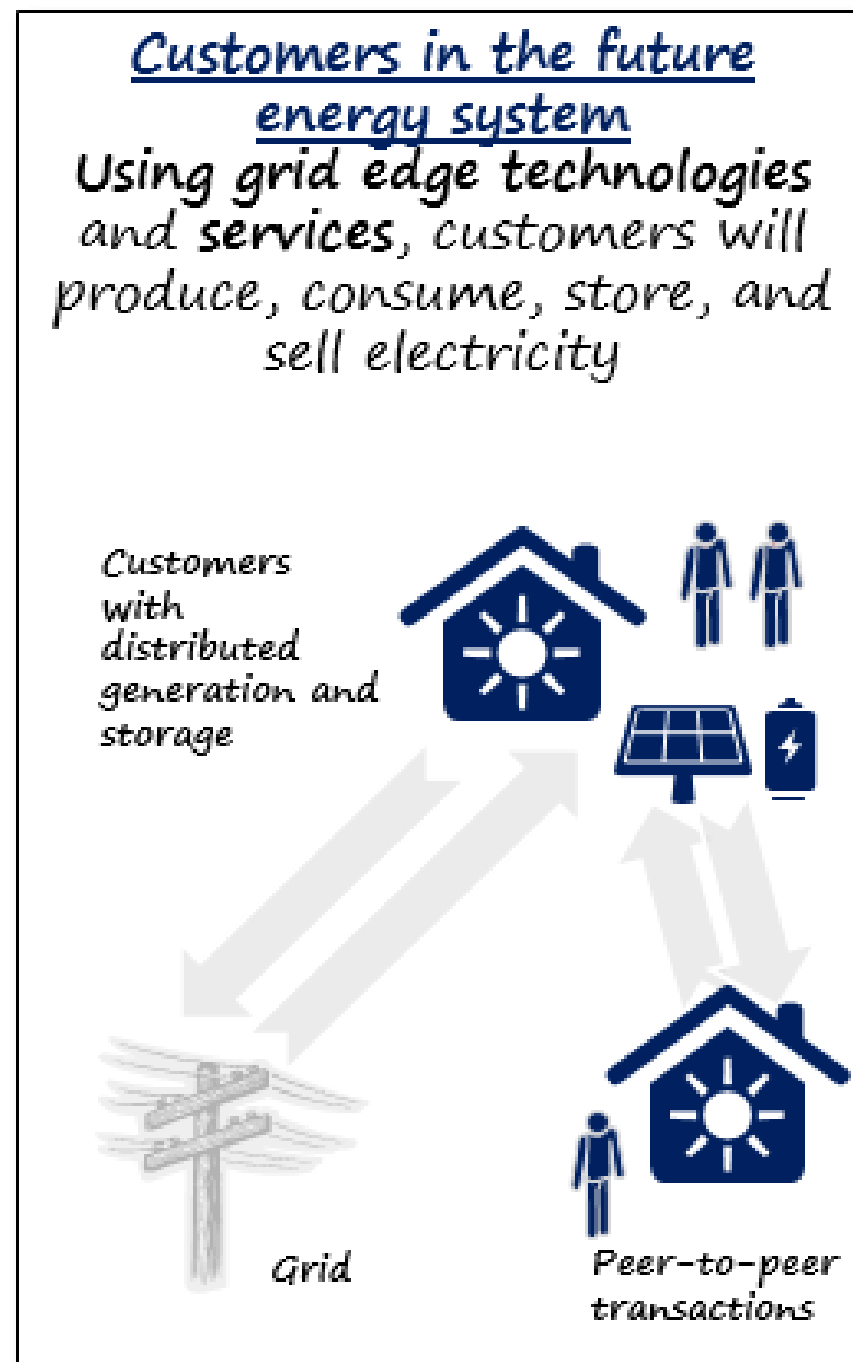


Note: Shaded bars from 2016 to 2020 are forecasts, while 2021-2025 are illustrative projections using similar forecasted trends; 2012 energy storage deployments is estimated based on 2013-2015 actual historic values; Battery costs only one part of total cost of storage, which includes balance of plant costs  
Source: NREL, Navigant, BNEF, Deutsche Bank, Goldman Sachs, Business Insider; Greentech Media; SEIA; Bain analysis



# The future electricity system will see new business models emerge, built around empowered customers

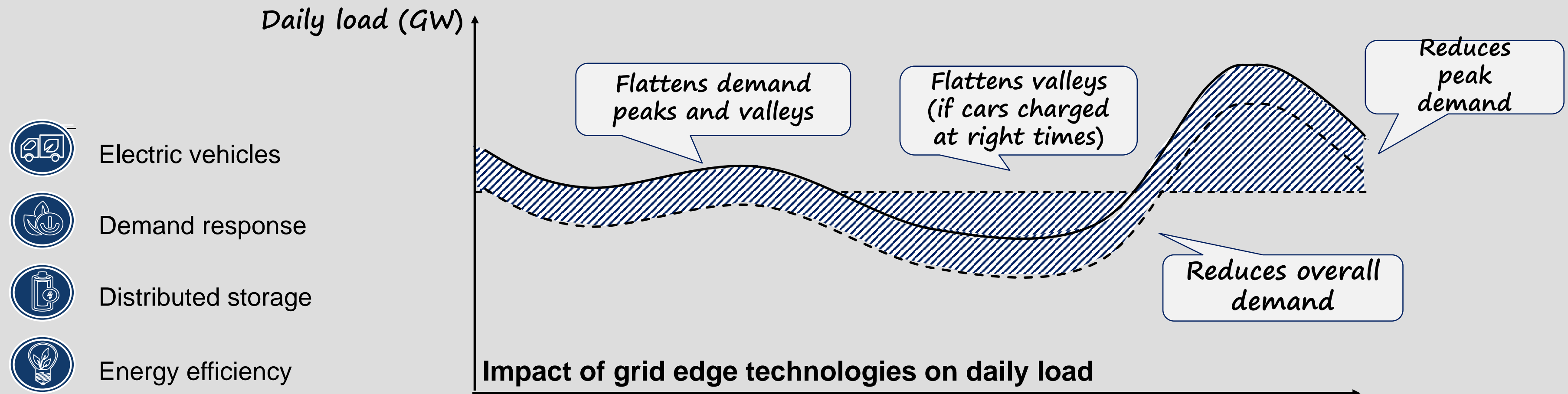
2



# Grid edge technologies have the potential to significantly improve the utilization of electricity system assets

3

Electricity system built to cope with peak demand, and thus has an average system utilization rate of 54-55% (in the US)

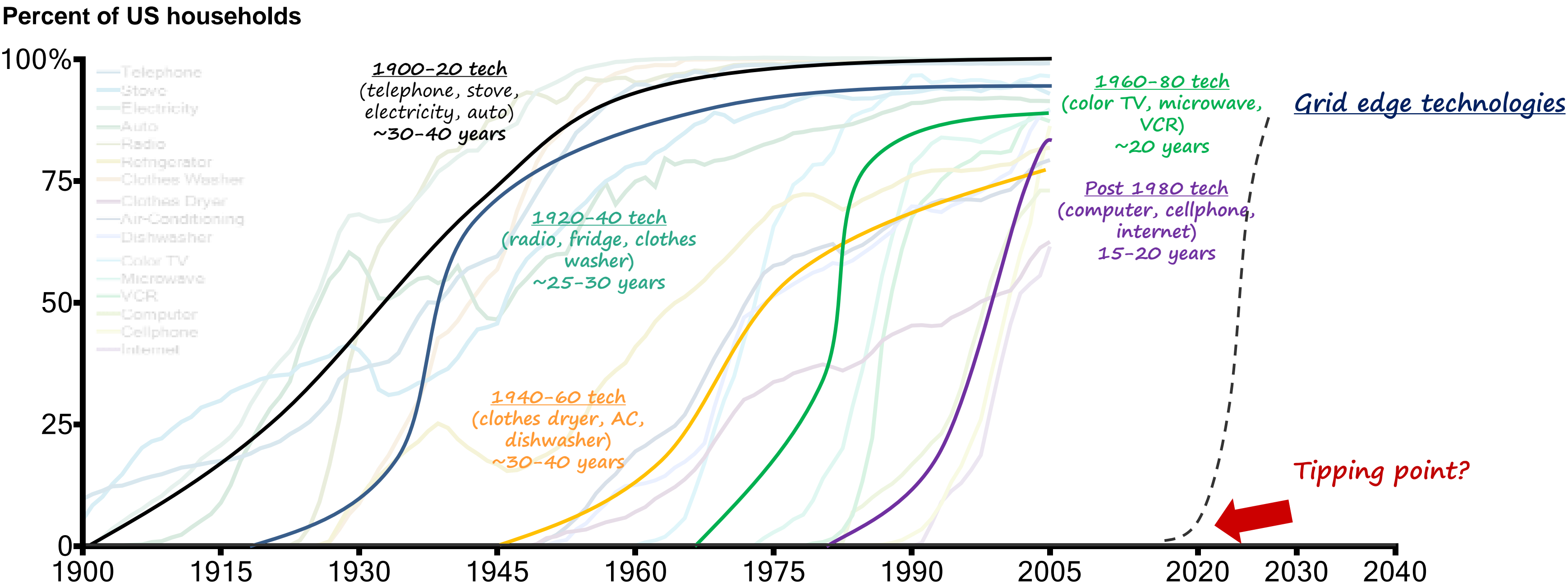


**Grid edge technologies could support peak demand reduction** (through overall reduction and shifting/flattening) – a 10% decrease in peak demand equates to ~\$80B of value in the US alone

Note: Average US asset utilization rate of 54-55% is from the EIA showing values for 2015 for coal and natural gas fired combined cycle plants; peak demand in the US is ~710,000 MWh (in late July 2016); EIA estimates \$1,110 per kW for combined cycle natural gas plants installed in recent years; value creation is equivalent to savings from cost avoidance of building traditional peaking plants, savings on energy costs (~\$40/MWh), and savings from avoided transmission costs;  
Source: EIA; Bain analysis

# Grid edge technologies will likely follow an adoption s-curve similar to other innovative products

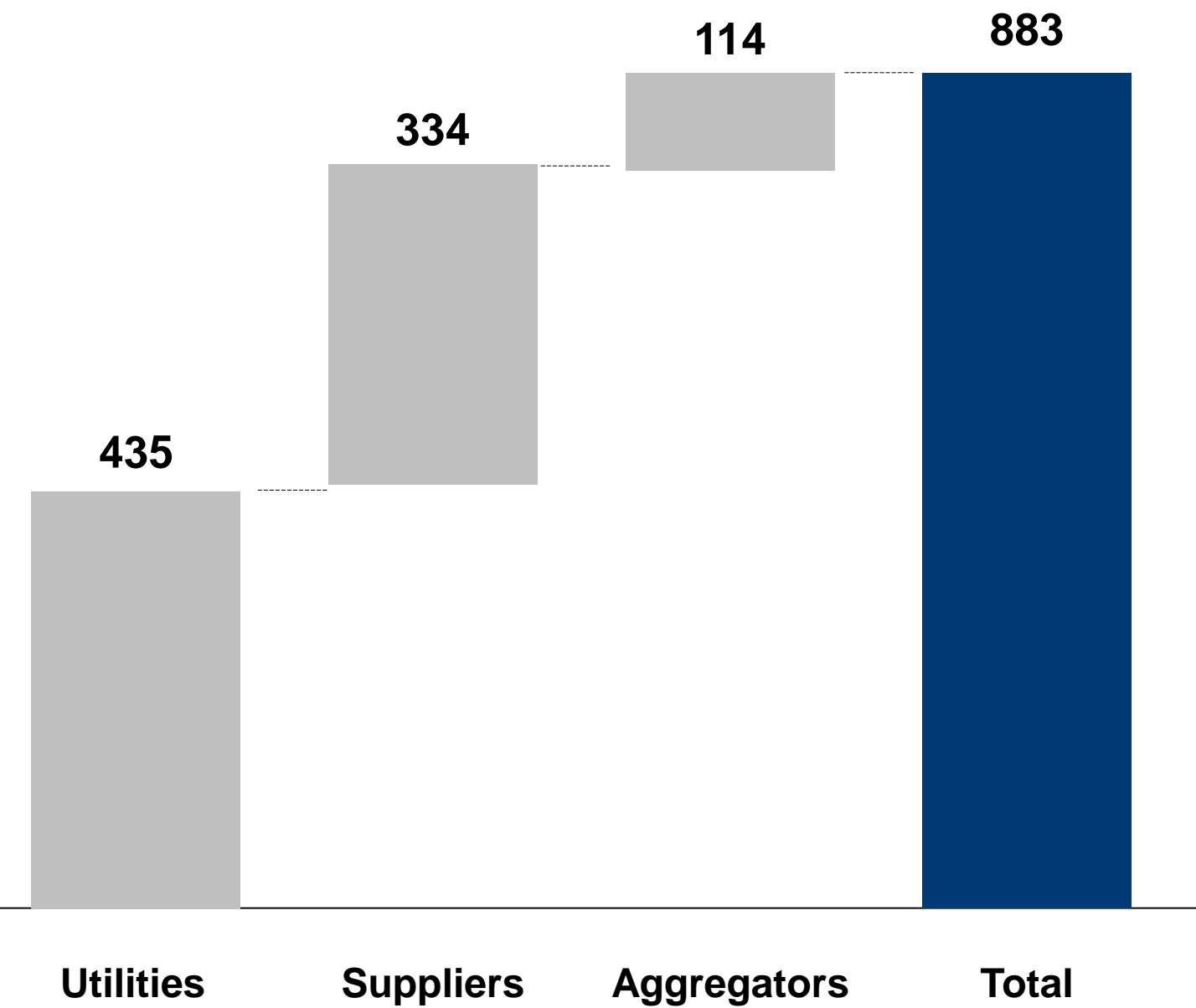
## TIME FOR TECHNOLOGIES TO REACH 80% PENETRATION



**How do we ensure this transformation creates value for the electricity system and broader society?**

# \$ 2.4 trillion is the value that can be captured globally by the electricity industry and society in 2016-2025

Cumulative Industry Impact – 2016-2025 – USD bn<sup>12</sup>



Cumulative Customer Impact – 2016-2025



**\$976.4 bn** reliability, affordability and efficiency

Cumulative Societal Impact – 2016-2025



**\$191.1 bn** impact of job creation



**~1,979 k** jobs created



**\$338.4 bn** from fuel emissions avoided



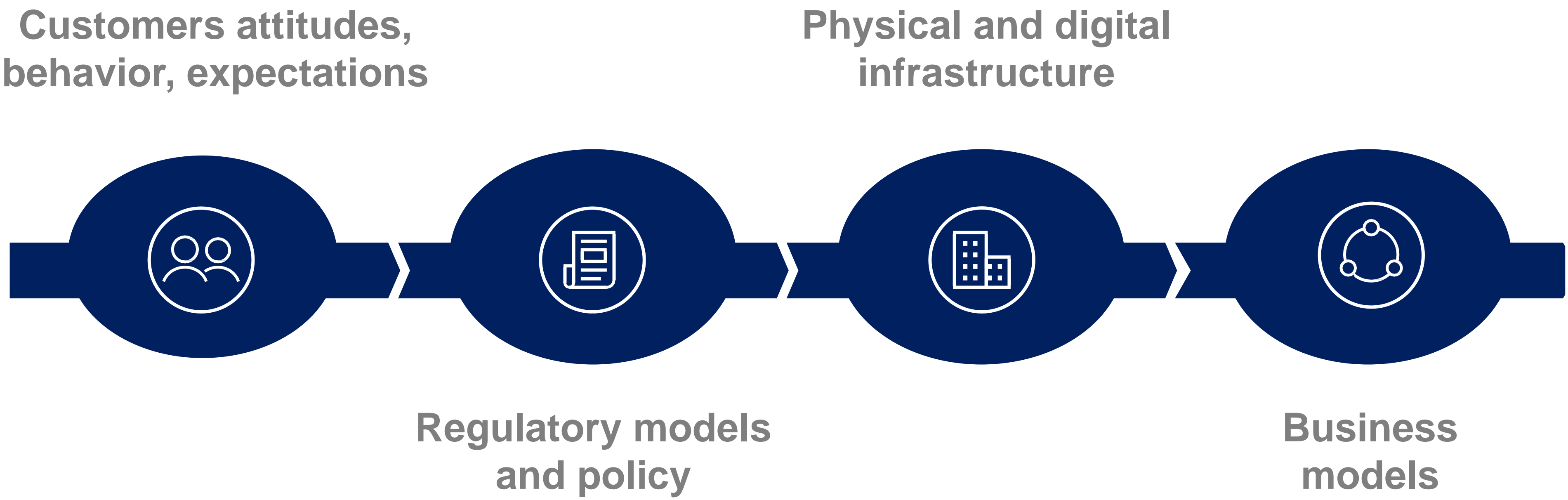
**7,130.3 mn tonnes** CO<sub>2</sub> emissions avoided

(1) Impact to Earnings before Interest and Taxation (EBIT); Source: World Economic Forum, Accenture Analysis – The digital transformation of industries

(2) Reduced T&D losses, breakdowns and downtime; capital and operational efficiency, new sales of HW/SW; new services

# To realize the value potential, innovative approaches and paradigms are necessary in four areas

---





## Example – Performance-based regulation and total-expenditure approach to foster innovation, efficiency, digitalization and cultural change

---

- RIIO (UK) is one of the most comprehensive examples of performance-based regulation. The regulatory model, which stands for “revenue = inputs + incentives + outcomes” implies that policy focus on reaching policy goals (such as energy efficiency, peak shaving, data sharing), instead of picking specific technologies.
- This regulatory paradigm stimulates a cultural change, it removes the incentive for utilities to invest only in additional network infrastructure and encourages them to invest also in alternatives, including network digitalization or procurement of services from distributed energy resources



## Example – Electricity networks as the service platforms for active customers and their distributed energy resources (DER)

---



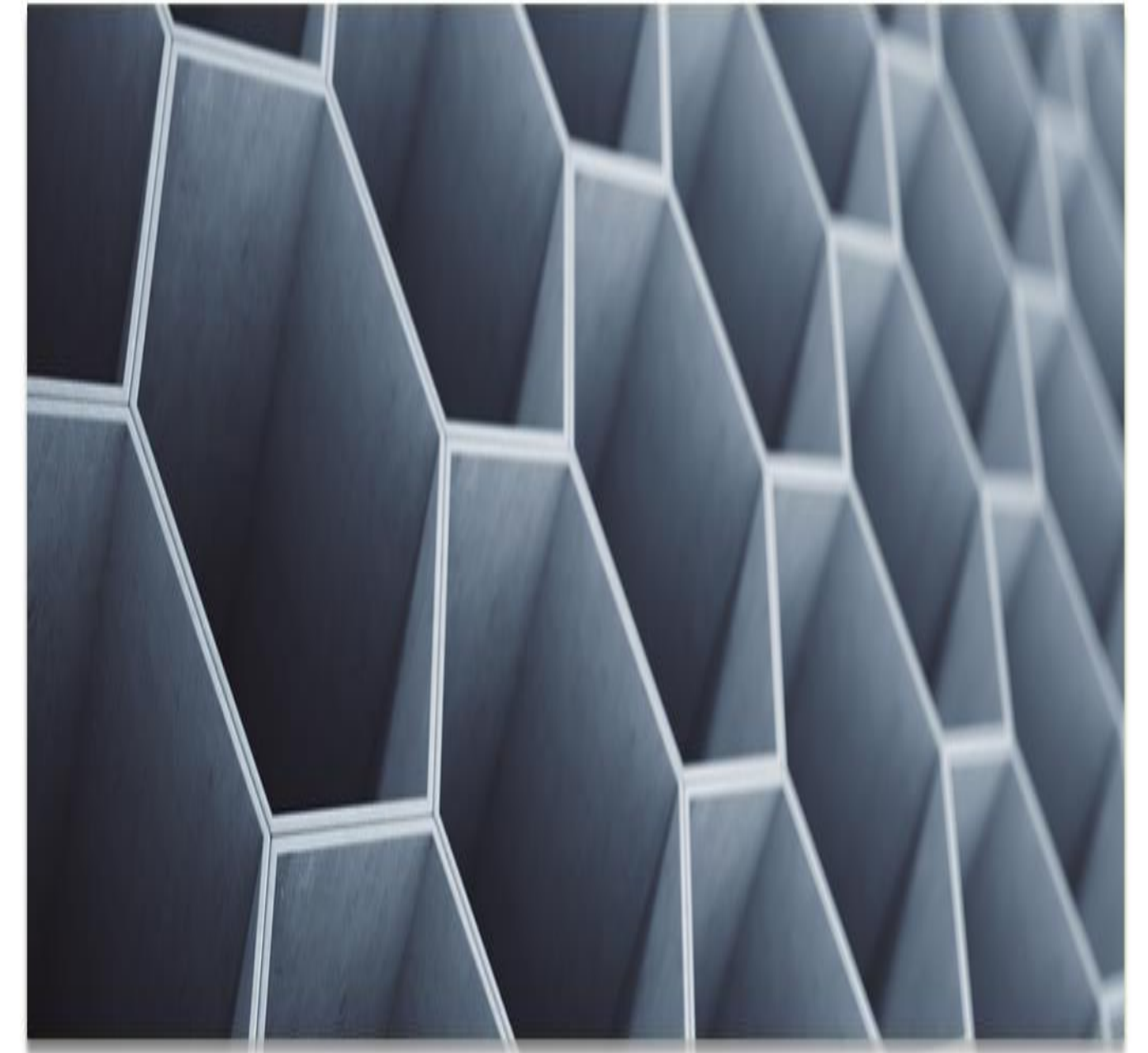
- Grids to become transactive platforms for DER (Reforming the energy vision – REV NYS)
- Clearly defined in terms of DER's role, asset type and ownership (mitigate as much as possible any risk of conflicting interests between the development of the system and its management)
- Adequate market design, allowing independent aggregation, network operators to procure services from DER, time and location-based valuing of DER and improved connection speed and economics



# Example – Redesigning the customer experience through dynamic pricing and new customer segmentation

---

- Time-sensitive dynamic pricing is an essential component of a decentralized energy system, as it provides an economic signal for customers to interact with the electricity system.
- Dynamic pricing encourages customers to reduce electricity consumption during high-cost periods, reducing electricity system costs.
- Identify new customers segments by how much they adopt new technologies (digital services, EVs, PVs, Batteries)



# Call to action to drive the grid edge transformation

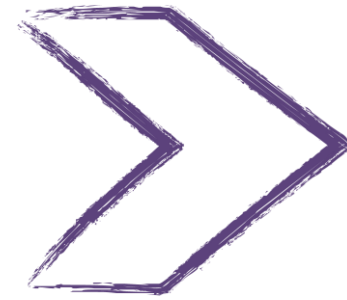
---

**Policy makers**



**Re-design the regulatory paradigm**, adapting the network revenue model, planning the electricity system around distributed energy resources, and introducing dynamic pricing

**Regulators**



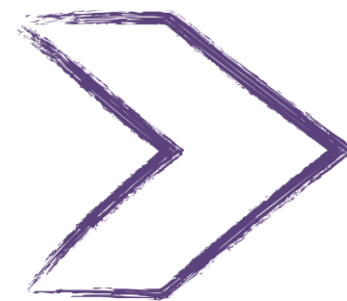
**Adopt faster reaction cycles, involve more stakeholders** and include an urban regulatory dimension

**Private sector**



**Transformation is inevitable**, status quo is not an option - **embrace the new reality** of a fully digital, customer-empowered, transactive electricity system

**All stakeholders**



**Deploy enabling infrastructure** that is **flexible, open and interoperable**. **Consider public private partnerships** to build enabling infrastructure that is not yet commercially viable and requires initial public intervention



# A general framework of recommendations on policy, business models, infrastructure and customer engagement

**Change the rules of the game, enabling new roles for network operators, innovation and full integration of distributed resources**

**Redesign regulatory paradigm**

**Deploy enabling infrastructure**

**Ensure the infrastructure enabling new business models can be timely deployed**

**Incorporate the new reality of a fully digital, customer-empowered, interactive electricity system**

**Redefine customer experience**

**Embrace new business models**

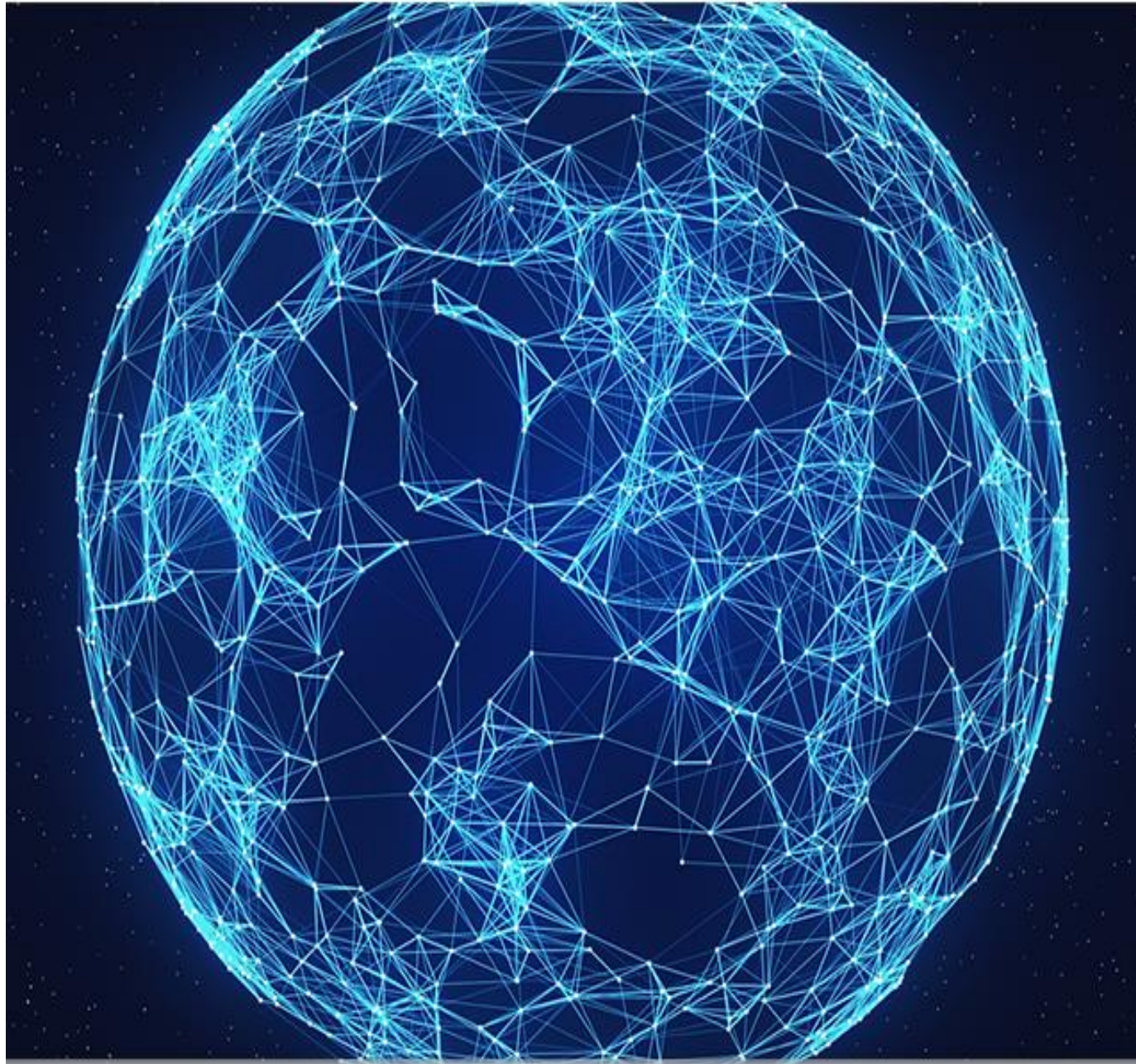
**Pursue new revenue sources from innovative distribution and retail services**





# How to turn this general framework into action, driving and accelerating the grid edge transformation

---



The World Economic Forum facilitates the establishment of national public-private working groups, under the leadership of Energy Ministries, to adapt the general framework to the specific market priorities for deployment.

In 2017 a working group in Colombia, under the leadership of the Minister of Energy and Mines, and including the most relevant stakeholders of the private and public electricity sector, developed a grid edge transformation framework for Colombia.

# The GET framework

## For Colombia / Business Models



### VISION

Un sector eléctrico distribuido y digitalizado	Un cliente informado y consciente	Un sistema eléctrico como plataforma transaccional
<ul style="list-style-type: none"> <li>• Eficiente, sostenible e interoperable</li> <li>• Proveedor de confiabilidad flexible</li> <li>• Portable y transable para la oferta y acceso de servicios convergentes multi-producto</li> <li>• Habilitador de competencia</li> </ul>	<ul style="list-style-type: none"> <li>• Activo en el mercado de oferta y demanda servicios a través de la red</li> <li>• Tomador de decisiones</li> <li>• Acceso en tiempo real desde dispositivos digitales</li> </ul>	<ul style="list-style-type: none"> <li>• Habilitador de iniciativas empresariales</li> <li>• Prestador de servicios de valor agregado</li> <li>• Habilitador de diferentes tipos de transacciones con los clientes</li> <li>• Proveedor de información para la toma de decisiones</li> </ul>

Bajo ese contexto, se han identificado los siete elementos más significativos que caracterizan la situación actual de la prestación del servicio de energía eléctrica y que representan los principales aspectos que implicarán un retraso a la transformación del sector eléctrico en Colombia y sobre los cuales se considera necesario actuar:

### Contexto actual del servicio

El mercado en competencia es reducido	Señales distorsionadas y falta de incentivos a la demanda	Medición convencional	Limitaciones al despliegue tecnológico	Actitud pasiva/reactiva de los usuarios frente al servicio	Exceso de regulación	Inter-Institucionalidad desarticulada

### CONTEXT



# The GET framework For Colombia

## 1. MODELOS DE NEGOCIO

1. Habilitar infraestructura y plataformas tecnológicas para soportar los modelos de negocio
2. Brindar señales eficientes a la demanda
3. Un cliente empoderado de la tecnología
4. Un mercado abierto a los clientes
5. Fortalecer la cultura de la energía eléctrica como habilitador del desarrollo socioeconómico

## 2. DESPLIEGUE TECNOLÓGICO

1. Generar programas estratégicos de corto y mediano plazo para apoyar la planeación y el control del sistema eléctrico
2. Generar programas estratégicos de corto y mediano plazo relacionados con el mercado y usuario final
3. Establecer una política de modernización tecnológica de la red (*grid edge/top-down*)
4. Actualizar normas y códigos técnicos

## 3. ELECTRIFICACIÓN DEL TRANSPORTE

1. Condiciones normativas y de política nacional en torno a la electrificación del transporte
2. Promover modelos de negocio alrededor de la electrificación del transporte
3. Desarrollo de Infraestructura estándar
4. Fortalecer la investigación, habilidades y capacidades técnicas

## 4. MICROREDES PARA LA SOSTENIBILIDAD ZNI

1. Promover e incentivar el uso integral y eficiente de tecnologías
2. Fortalecer el marco normativo y la coordinación inter-institucional
3. Promover los encadenamientos productivos e iniciativas empresariales
4. Empoderamiento y desarrollo de habilidades y capacidades tecnológicas



# The transformation of the energy system

## Digitalization, Decentralization and Electrification

---



### **The Digital Transformation of Industries: Electricity Industry**

White Paper - January 2016

**Estimated the global value potential - for industry, society and environment - of digitalizing the electricity industry in 2016-2025:**

- Asset lifecycle management
- Network optimization and aggregation
- Integrated customer service

### **The Future of Electricity: New Technologies Transforming the Grid Edge**

Insights report – March 2017

Explored the impact of decentralization, electrification and digitalization of the electricity sector. Provides a general framework of policy and business modes to deploy grid edge technologies into the energy systems



### **NEXT TO COME**

### **The Future of Energy and Mobility: Electric Vehicles for Smarter Cities**

Insights report – February 2018

It will provide a vision and framework to accelerate electrification of transport in cities, at the convergence of energy, mobility and urban transformation



# Thank you!

---