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La Smart Grid y su dimensión TIC

Enrique Díaz-Plaza Sanz

Responsable Desarrollo de Negocio - Sector Energético

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La Smart Grid "está de moda"

IBM, Cable & Wireless to put customer data in 'cloud'

IBM and UK-based telecom giant Cable & Wireless Worldwide will create UK Smart Energy Cloud to support the UK's 50-million smart meter implementation, they told the press

Distributor-network operators will also get the data.

The centralized database means meters installed by one retailer can be more easily taken over by another

EUROPEAN COMMISSION

Brussels, 12.4.2011
COM(2011) 202 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Smart Grids: from innovation to deployment

{SEC(2011) 463 final}

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La Smart Grid como una necesidad

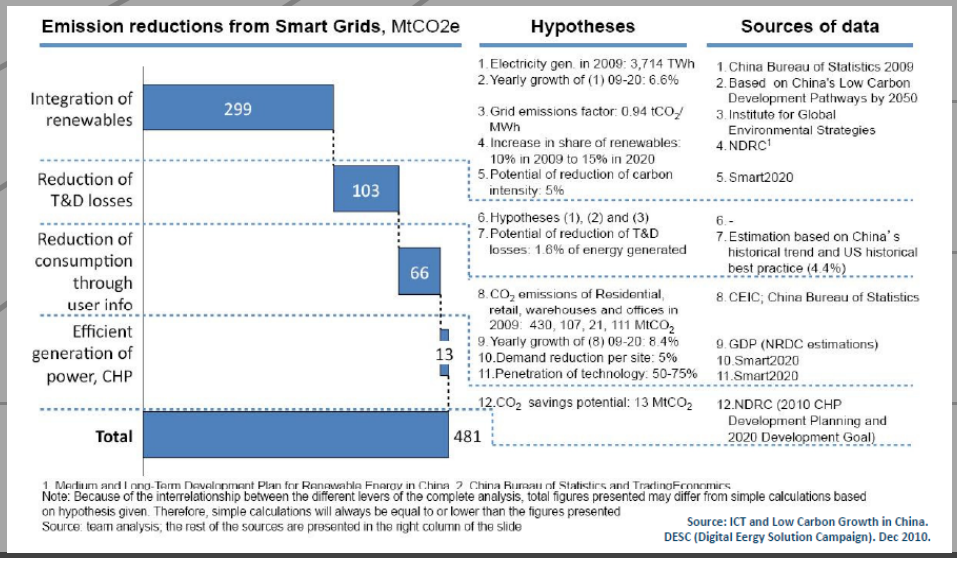
1980 ◁◁ Shenzhen (People's Republic of China) ▷▷ Today

January 13th, 2011:

"Led by GE, Siemens, and IBM China Smart Grid to Exceed $61B by 2015, Zpryme Reports"

http://www.zpryme.com/news-room/smart-grid-china-us-uk-australia-lead-smart-appliance-market-zpryme-reports-234.html

La Smart Grid podría reducir emisiones del orden de 481 $MtCO_2e$ en China



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La Smart Grid como una necesidad

Five carbon-reducing "buckets" of smart grid technology

Smart power

Utilities can optimize voltage and load, to eliminate overkill, prevent blackouts and avoid building new capacity

- Stabilize and optimize voltage
- Reduce peak demand
- Reduce transmission losses

Decentralized power

Power generation is localized, so transmission and distribution losses are lower

- Use software to aggregate distributed energy sources
- Reduce distribution losses
- Create micro-grids

Smart renewables

Energy storage and real-time data make renewables more reliable and reduce the need for fossil back-up power

- Continuously adjust power sources to solve the variability problem of renewables
- Store energy generated through renewable sources

Smart end-users

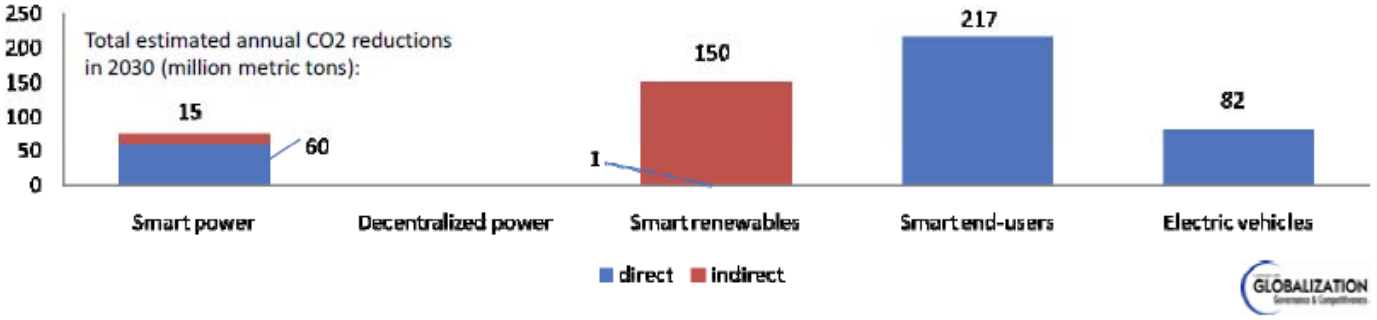
Commercial, industrial and residential energy users can reduce energy use and help utilities shift power loads from peak to non-peak times

- Automatically control and manage energy use
- Allow utilities to remotely turn up thermostats on air conditioners in peak times as needed

Electric vehicles

Vehicle batteries provide decentralized energy storage and help utilities even out power loads

- Accommodate plug-in hybrid and all-electric vehicles
- Charge vehicles in non-peak hours and sell energy back to the grid in peak hours



US Smart Grid: Finding new ways to cut carbon and create jobs - Globalization

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La Smart Grid como respuesta tecnológica a los nuevos retos de "negocio"…

Tendencias y necesidades de mercado ("market forces")

Las tendencias y necesidades de mercado impactan en la operativa de las "utilities", provocando la transformación de sus modelos de negocio industriales.

- **Irrupción de nuevas tecnologías**
- **Cambio climático y aspectos medioambientales**
- **Crecimiento en uso de energías renovables y generación distribuida**
- **Mejora en el uso y disponibilidad de activos**
- **Presión en eficiencia operacional y productividad**
- **Aumento del rol del consumidor (pasivo vs activo)**

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… y no sólo para el sector eléctrico

- En 1900, sólo el 13% de la población del mundo vivía en ciudades
- En 2007, por primera vez en la historia, la mayoría de la población mundial (3.300 millones) vivía en ciudades
- Para 2050, se espera que el 70% de la población viva en ciudades

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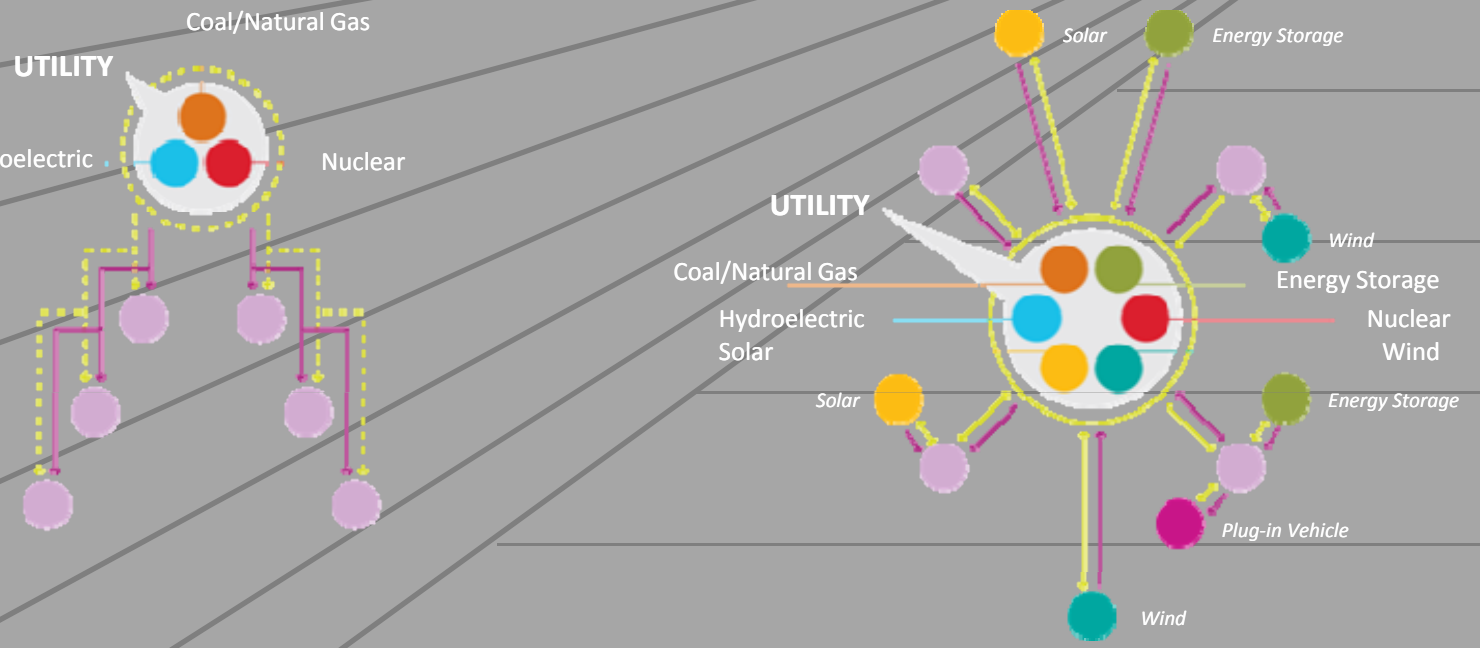
Las TIC como soporte al desarrollo del negocio energético: evolución en la cadena de valor energética



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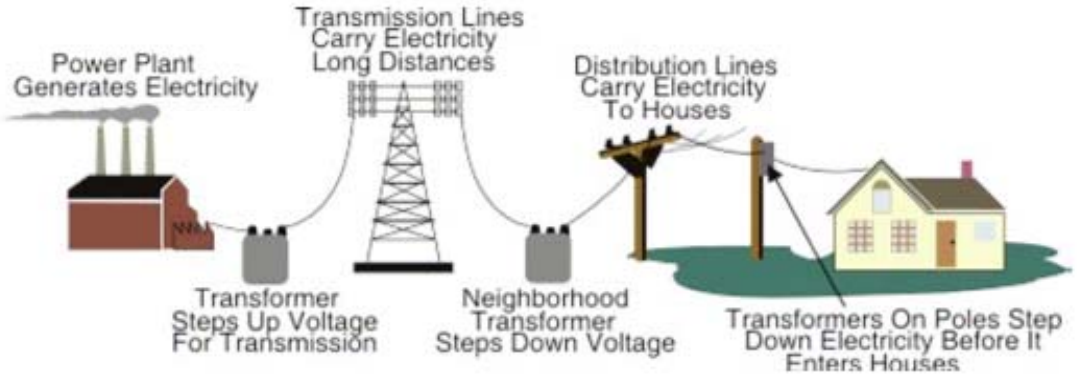
Smart Grids: Then & Now

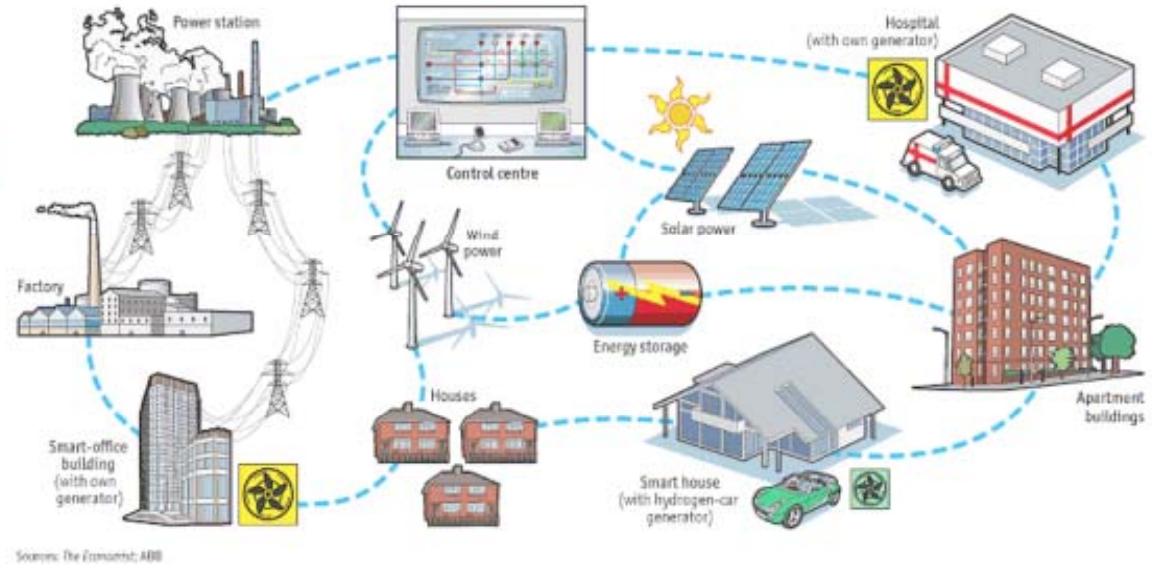
Before Smart Grid:

One-way power flow, simple interactions



After Smart Grid:

Two-way power flow, multi-stakeholder interactions



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¿Cómo evolucionará la Smart Grid? Características

Alto uso de renovables (entre 20% y 35% para 2020).

Generación distribuida y microrredes.

"Net" metering (venta de servicios de potencia y energía local a la red).

Almacenamiento distribuido.

Smart metering (información de uso near-real time).

TOUs (time of use) y dinamic pricing.

"Smart appliances" en comunicación con la red.

EMS (Energy Management Systems) en hogares e instalaciones comerciales e industriales, "conectados" a la red.

Vehículos eléctricos.

Sensorización y controles autónomos/automatizados a lo largo de la red.

Ciber-seguridad alrededor de las funciones y dominios de la smart grid.

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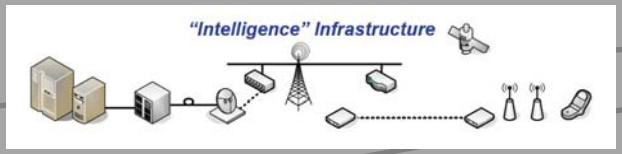
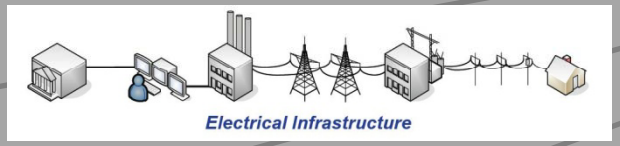
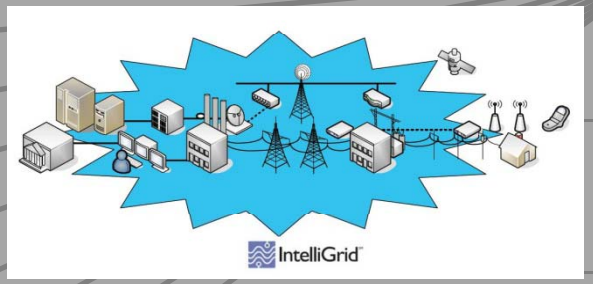
Soluciones tecnológicas que den respuesta a los retos

Smart Grids

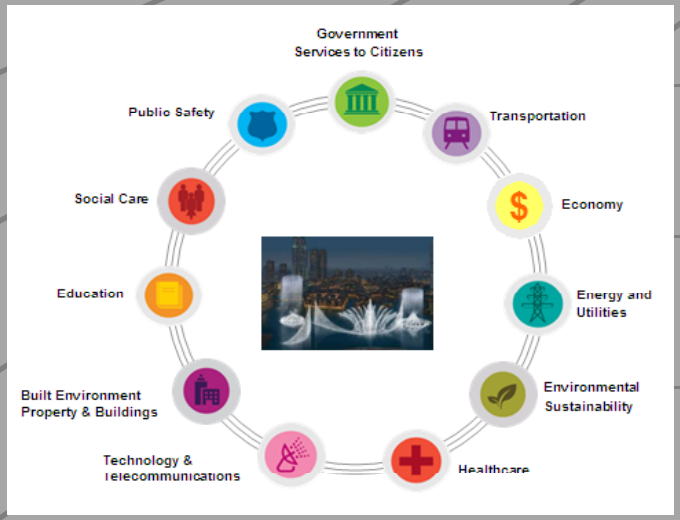


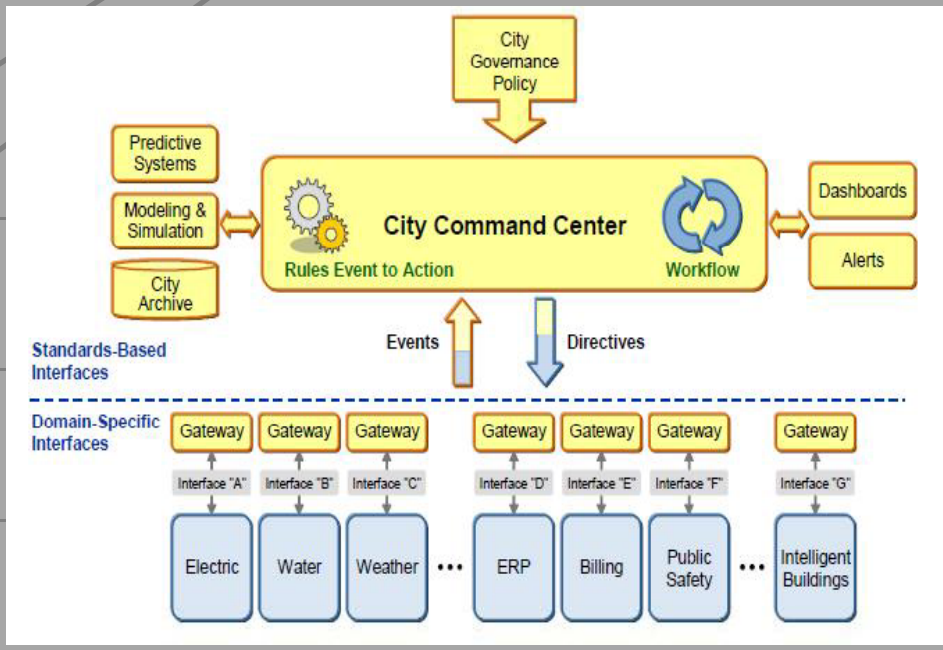




"La nueva infraestructura de distribución de energía eléctrica debe integrar los avances existentes en comunicaciones, procesamiento informático y electrónica, para dar respuesta a las necesidades energéticas del futuro" – EPRI Intelligrid

Smarter Cities





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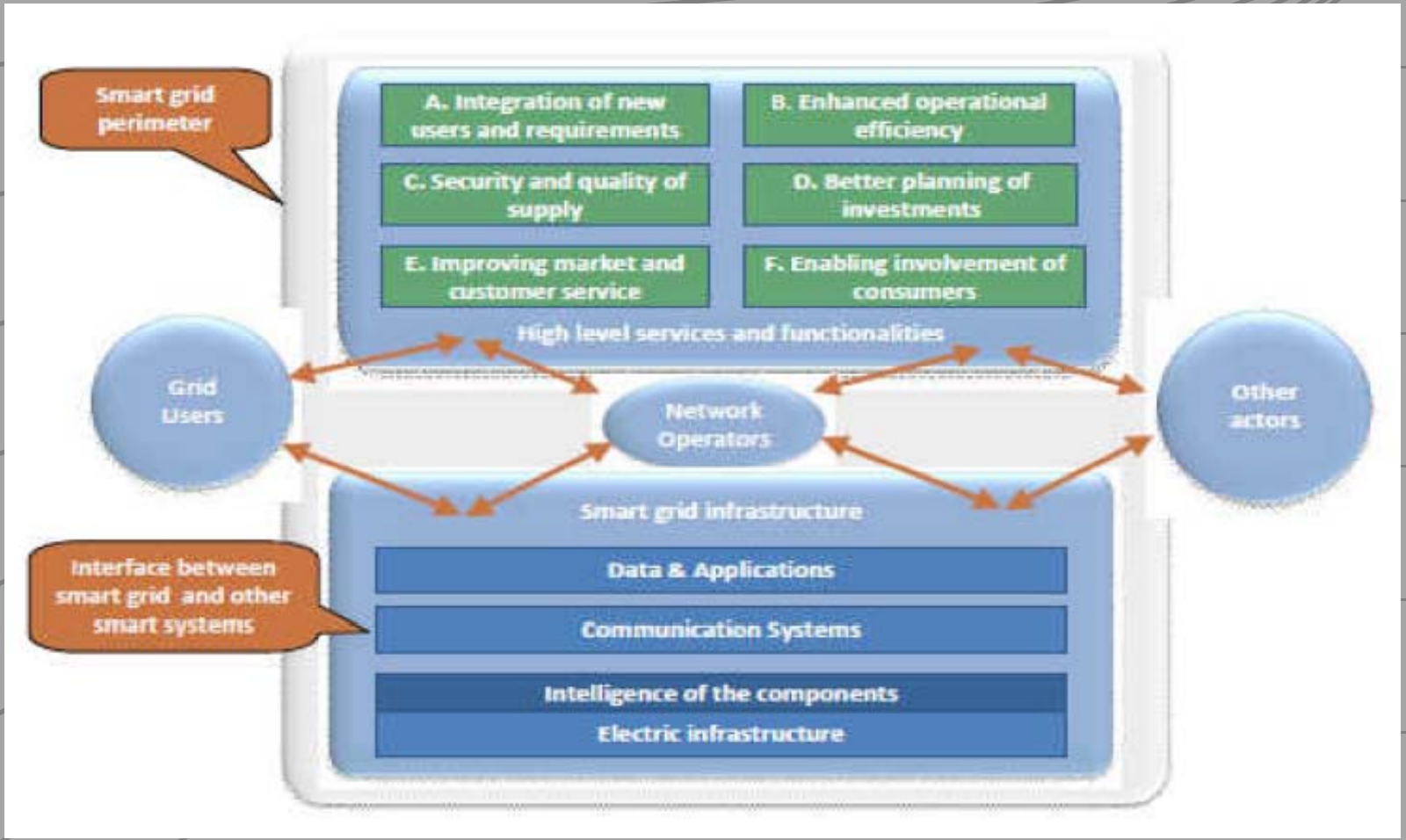
¿Cómo evolucionará la Smart Grid? Funcionalidades



SG Functionalities - Expert Group (EG1) European Commission Smart Grid Task Force

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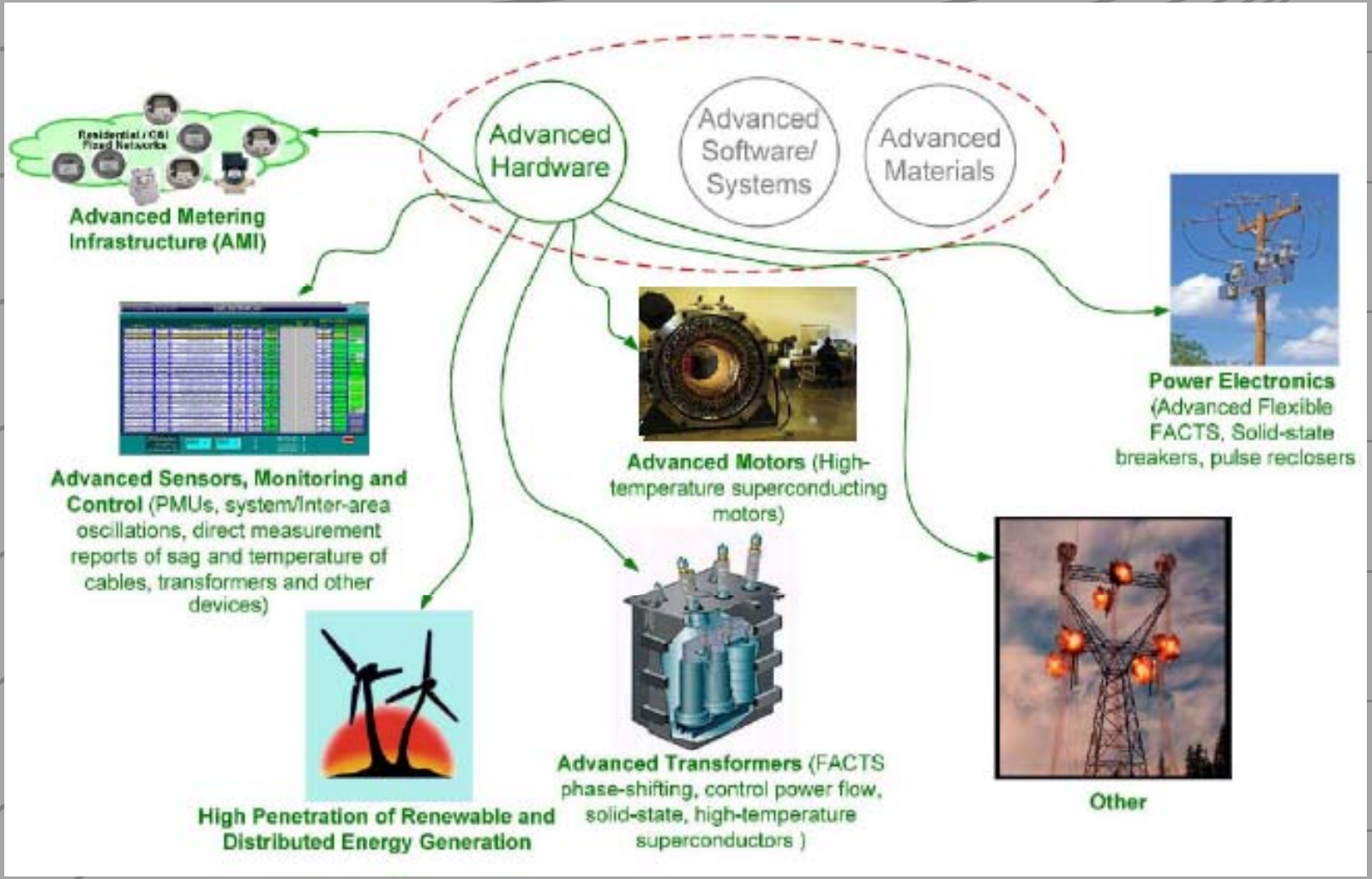
Tecnología asociada a la Smart Grid



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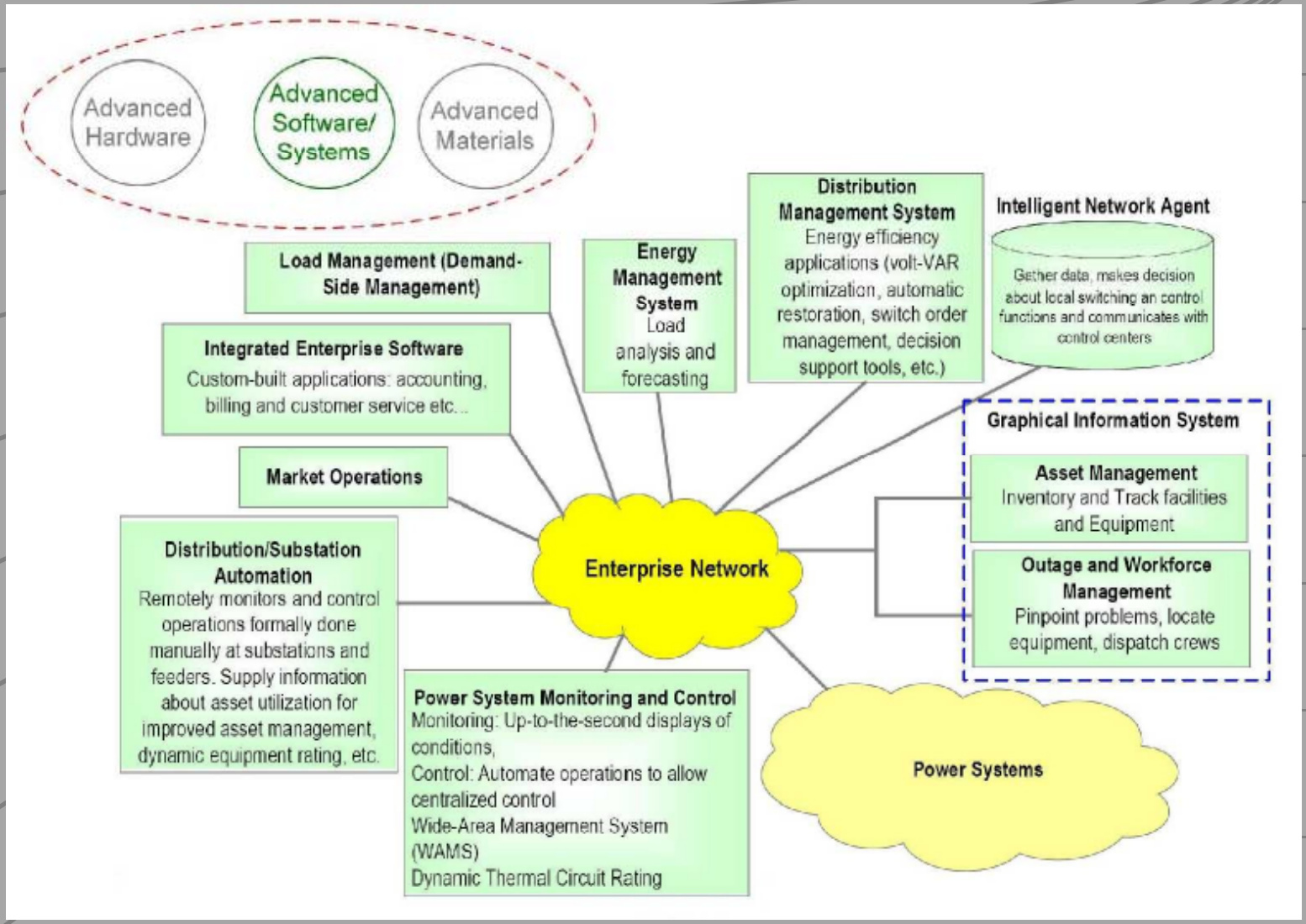
Tecnología asociada a la Smart Grid

Advanced Cables (composite conductors, high-temperature superconductors)

Advanced Energy Storage (Super-Conducting Magnetic Energy Storage (SMES), advanced flywheels, flow batteries charge and discharge fluid between tanks, liquid molten sulfur batteries built to utility scale

Tecnología asociada a la Smart Grid



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Dominios de Interoperabilidad

Más aplicaciones y tecnologías a considerar

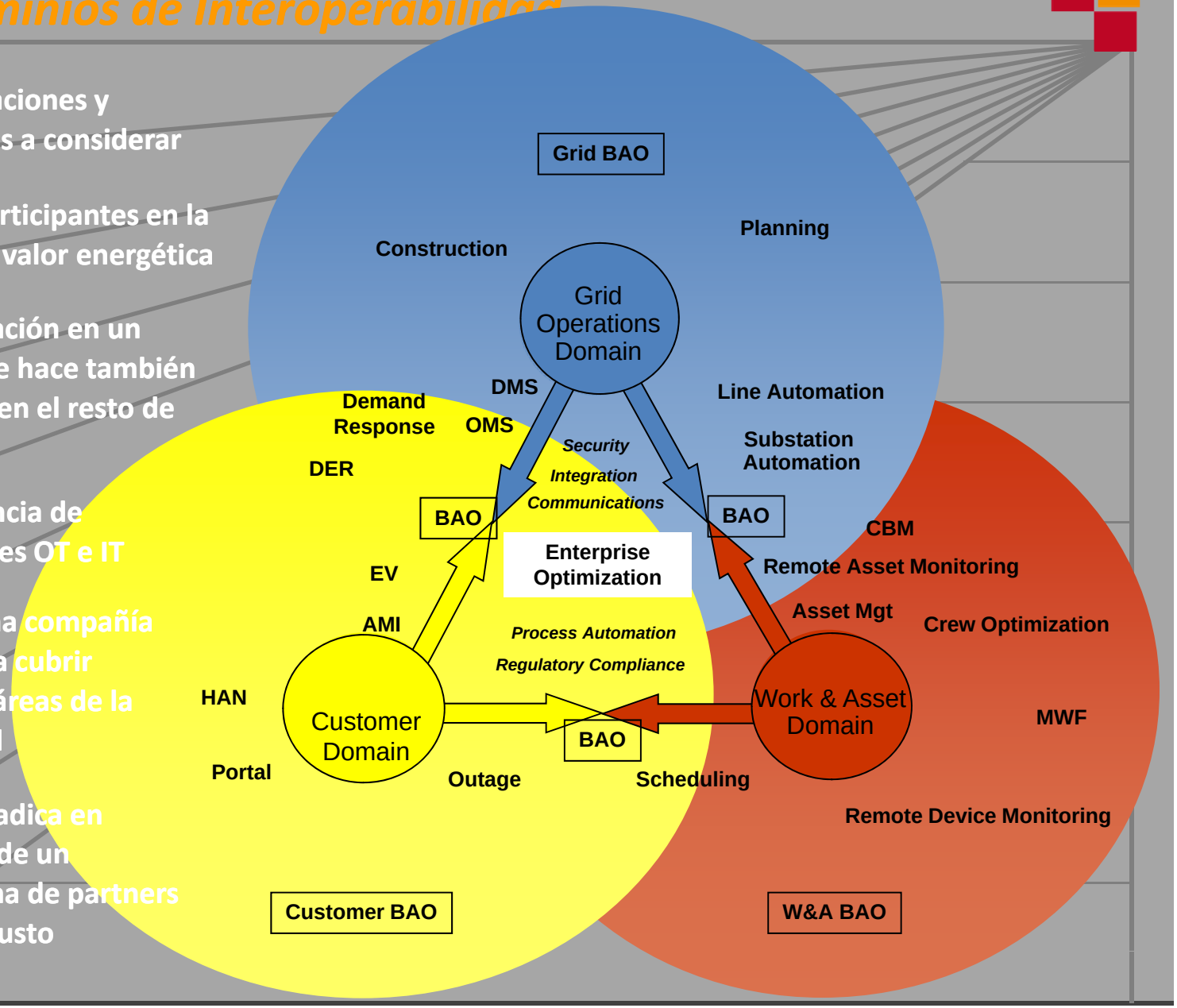
Nuevos participantes en la cadena de valor energética

La información en un dominio se hace también necesaria en el resto de dominios

Convergencia de aplicaciones OT e IT

No hay una compañía que pueda cubrir todas las áreas de la smart grid

La clave radica en disponer de un ecosistema de partners rico y robusto



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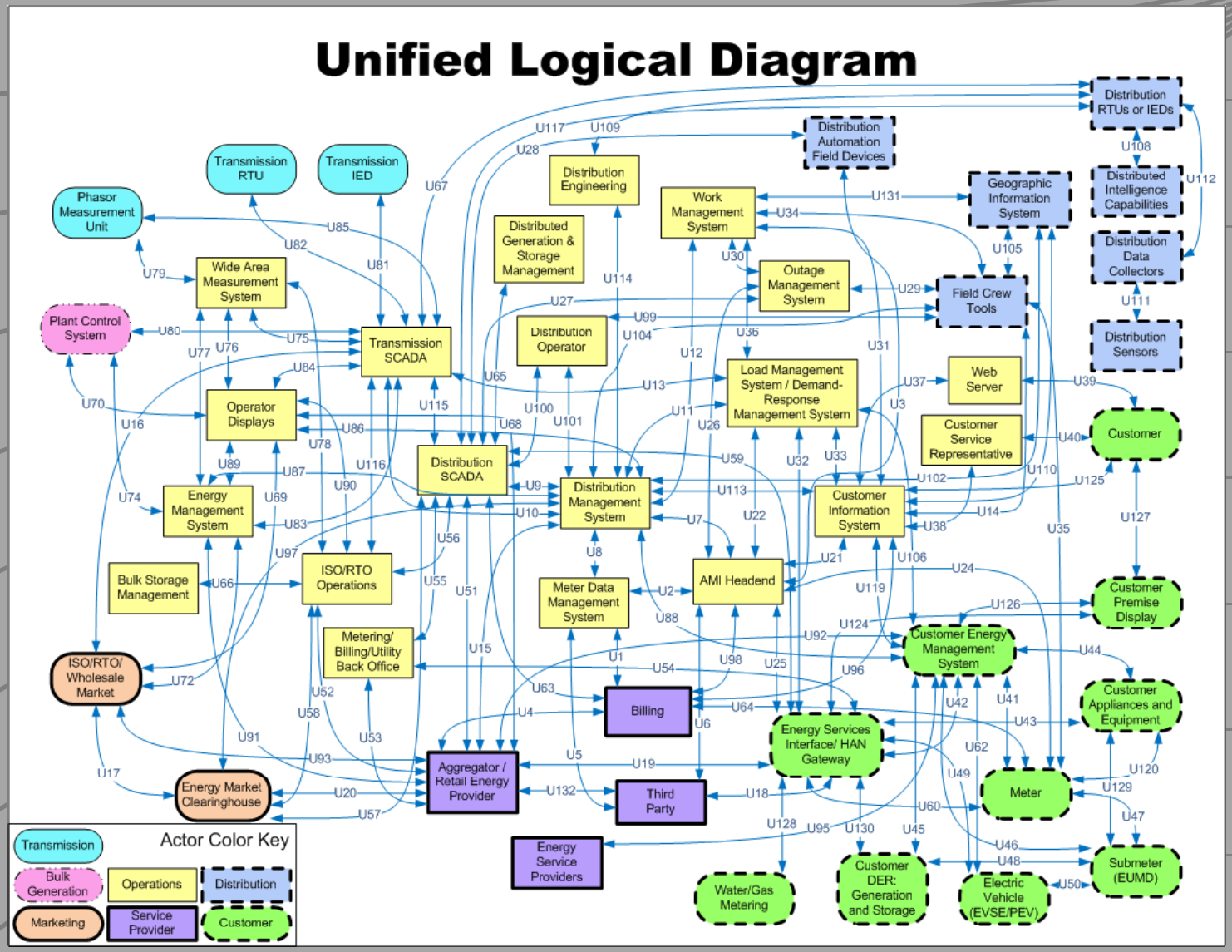
Dominios de Interoperabildad



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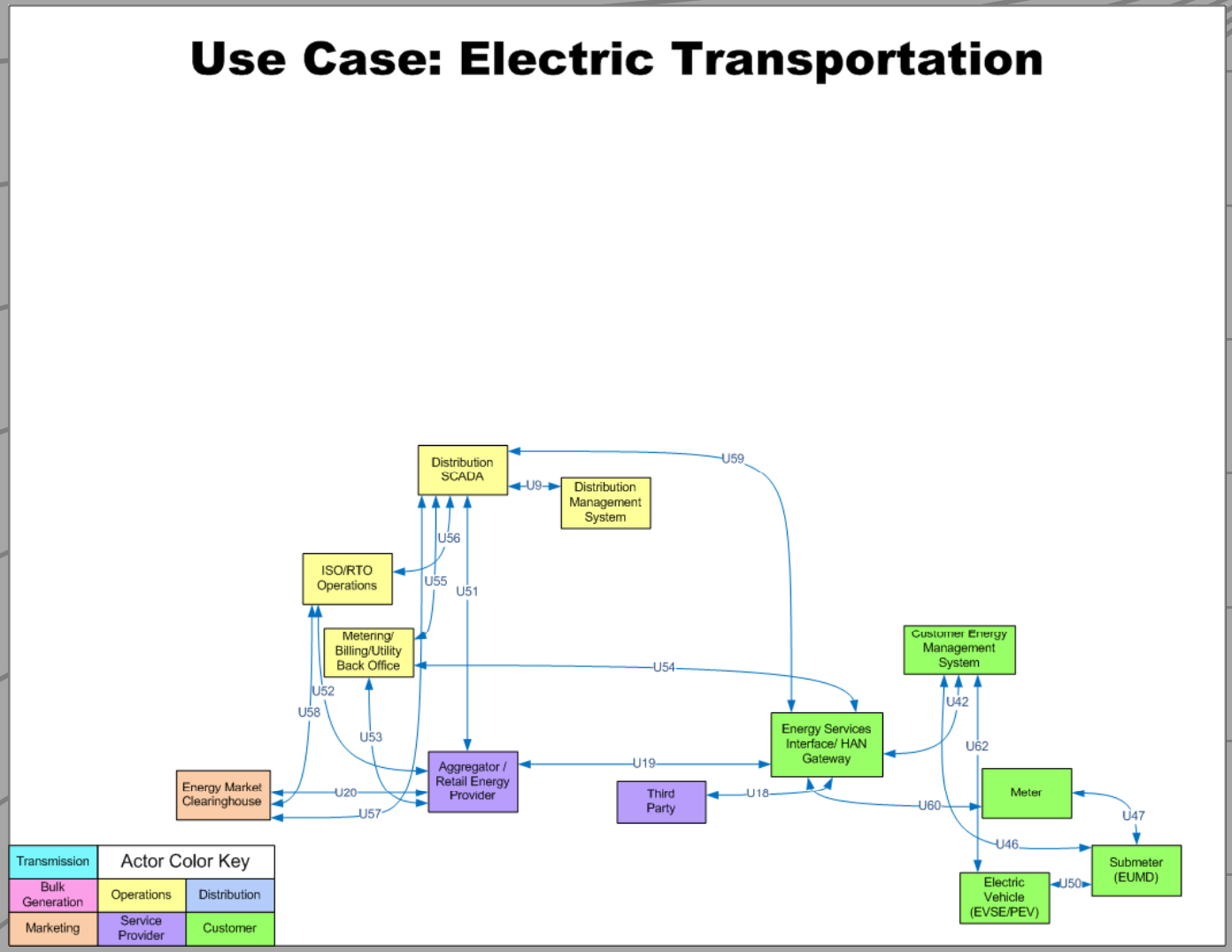
Dominios de Interoperabildad particularizados



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Smart Grid "building blocks"

Informed

Automated

Integrated

Connected

Intelligent

5. Presentation

- Customer Web
- Customer Mobile Devices
- Display Device Interface
- Field Employee Mobile Devices
- Employee Portal/Dashboard
- Paper Bills

4. Applications & Analytics

- WMS
- Network Analytics
- GIS
- Asset Management
- OMS
- CIS
- MDMS
- Call Management
- Meter Data Collection
- Load Control
- EMS
- DMS

3. System Integration Platform

- Servers
- Storage and Backup
- Security Management
- System and Network Management
- Business Process Management
- Messaging & Web Services

Computing Infrastructure | **Systems Management** | **Application & Data Integration**

2. Integrated Communication Networks

- Home Area Network
- Neighborhood Network
- Access Network
- Backhaul Network
- Office Network
- Extranet

1. Smart, Connected Devices

- Smart Appliances
- Personal Computers
- In-Home displays
- Load Control Devices
- Electric Vehicles Outlets
- Advanced Electric Meters
- Advanced Gas Meters
- Advanced Water Meters
- Switches
- Reclosers
- Condition Sensors
- Voltage Controllers
- Ruggedized Laptops
- Handheld Data Devices
- Cell Phones
- Solar Panels
- Wind Turbines
- CHP
- Energy Storage

In-home Devices | **Smart Meters** | **Substation & Grid Devices** | **Mobile Devices** | **Distributed Resources**

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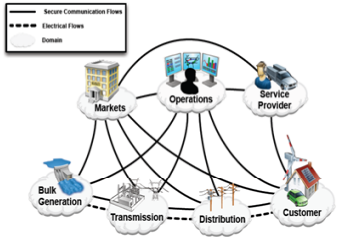
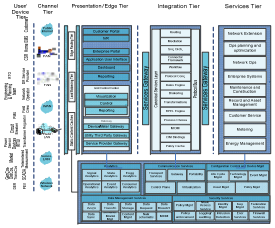
Desarrollo de Arquitecturas Smart Grid (IBM)

NIST SGAC
Reference
Architecture



Standards

SCE/Cisco/IBM
Smart Grid
Reference Architecture

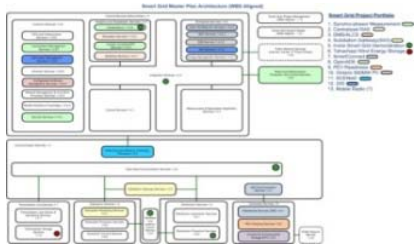


Services

Standards/industry
Groups
IEEE, IEC, IETF,
ANSI, etc.

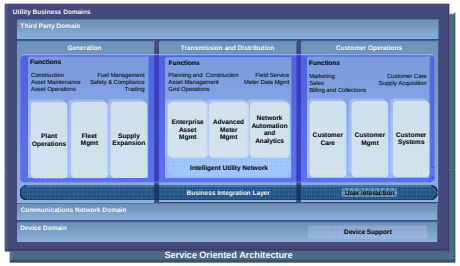
Interfaces

Client Smart Grid Architecture



Business Area architectures –
customer, transmission, distribution, etc

IBM Smart Grid Architecture



Design/build/manage SG services ;
Map SG services to SAFE

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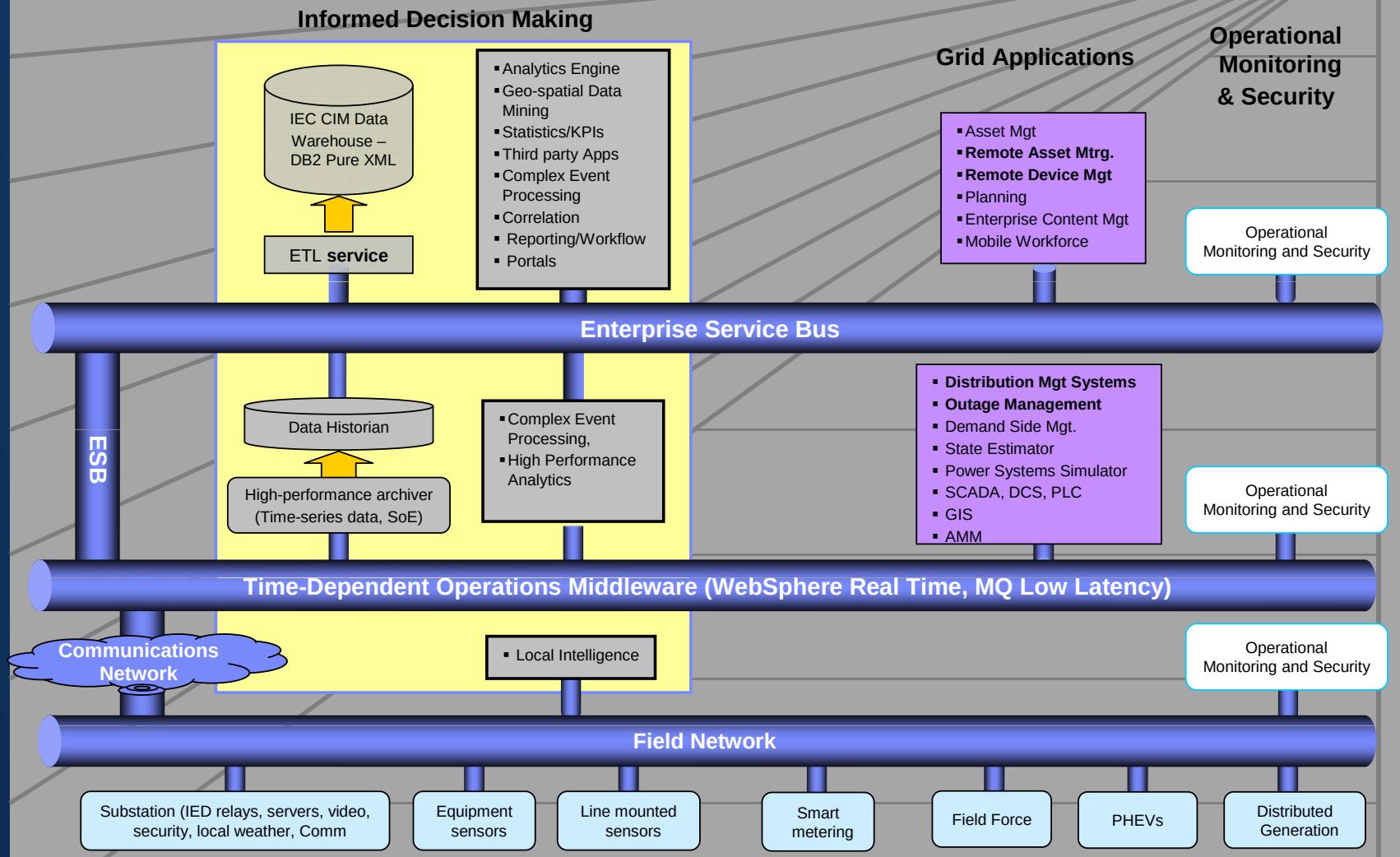
Arquitectura de Referencia Conceptual (IBM)



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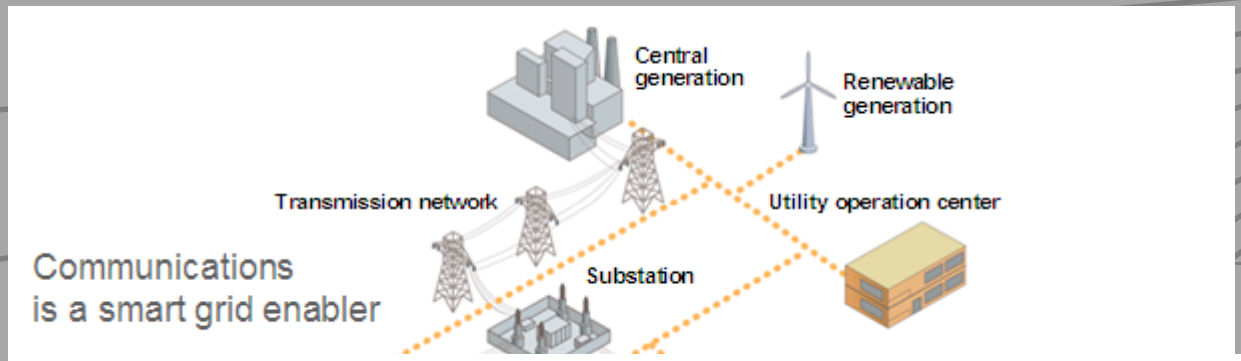

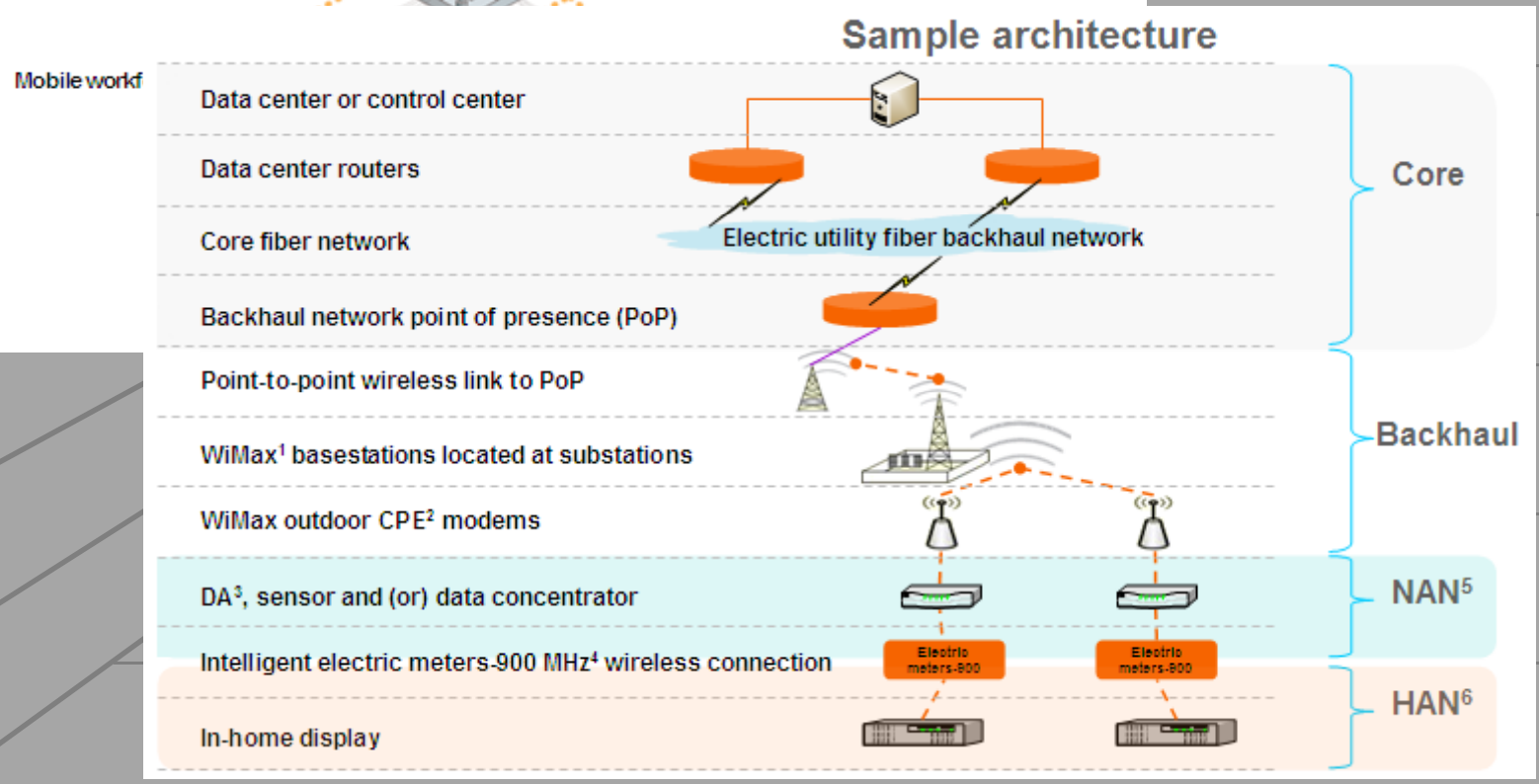

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Mapa de procesos y servicios (IBM)

	Grid Planning and Construction	Grid Maintenance	Grid Operations	Grid Field Service	Market Service	Customer Service	Billing and Collections	Strategy & Regulation	Finance, HR, and Administration	Information Technology	Marketing & Sales
Direct	Construction Strategy	Maintenance Strategy	Operations Strategy	Field Service Strategy	Market Service Standards, Policies and Procedures	Customer Service Standards, Policies, and Procedures	Network Use of System Pricing	Business Strategy	Corporate Governance	IT Strategy	Marketing & Sales Strategy
	Capital Program Management		Asset Strategy				Regulated Network Services & Product Development	Regulatory Strategy			Product Development
	Network Load Growth Analysis	Metrology	Emergency Planning				Unregulated Network Services & Product Development	Operational Strategy and Planning	Policies and Procedures	IT Architecture	Customer Relationship Management
			Media and Public Relations					Media and Public Relations			Pricing
			Demand Side Management Strategy								
Control	Construction Performance Management	Maintenance Performance Management	Operational Performance Management	Work Scheduling Management	Allocation & Reconciliation Management	Customer Service Performance Management	Network Billing Exception Management	Business Portfolio Management	Performance Management	Performance Management	Marketing Campaign Monitoring and Management
	Construction Financing	Maintenance Sales	Asset Operations Planning	Field Service Quality Management	Connection Information Management		Accounts Receivable	Business Performance Management	Management Accounting		Sales Performance Management
	Construction Sales	Maintenance Planning	Demand Side Management Monitoring	Operations Performance Management	Market Service Delivery Management	Customer Information Management	Dunning and Collection	Regulatory Compliance	Workforce Analytics	Project Management	
	Construction Permissions	Maintenance Management	Contractor Management		Exception Management		Customer Account Information Management	Market Compliance	Revenue Forecasting		Delivery Management
	Construction Design and Planning	Inventory Management	Meter Information Management	Connectivity Information Management	Dispute Management	Customer Connection Point Management	Credit Management	Risk Management	Facilities Management and Maintenance	Architecture Review	Contract Management
	Construction Management	Procurement									
	Contractor Management	Contractor Management									
		Meter Testing Management									
Execute	New Asset Construction	Asset Maintenance	Asset Operations	Initiate Work Order	Allocation & Reconciliation	Customer Interaction Management	Intercompany Data Exchange	Regulatory Interaction	Financial Accounting	Production Support	Product Execution
	Augmented Asset Construction		Outage Management	Assign and Dispatch Work	Market Service Delivery	Customer Event Management	Network Bill Creation		Procurement	Project Delivery	Marketing & Sales Execution
	Asset Renewal/ Replacement	Meter Testing	Demand Side Management Execution		Connection Information Services	Emergency Response			Business Administration		
			Meter Data Processing	Execute and Complete Work	Unmetered Supplies	Customer Field Activities	Payment Processing		Workforce Administration	Database Administration	Customer Enrolment and Transfers

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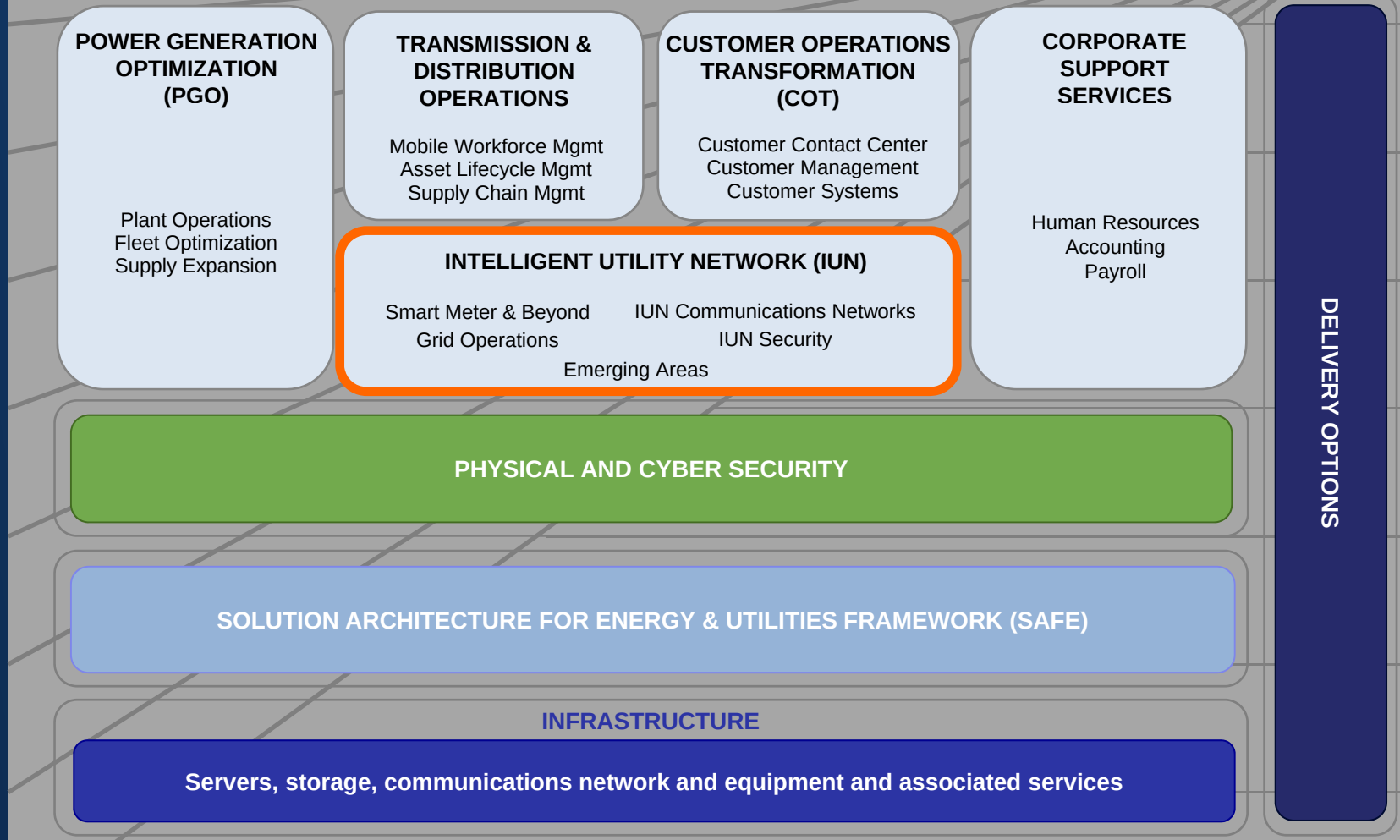
Soluciones aplicadas al sector Energy & Utilities (IBM)



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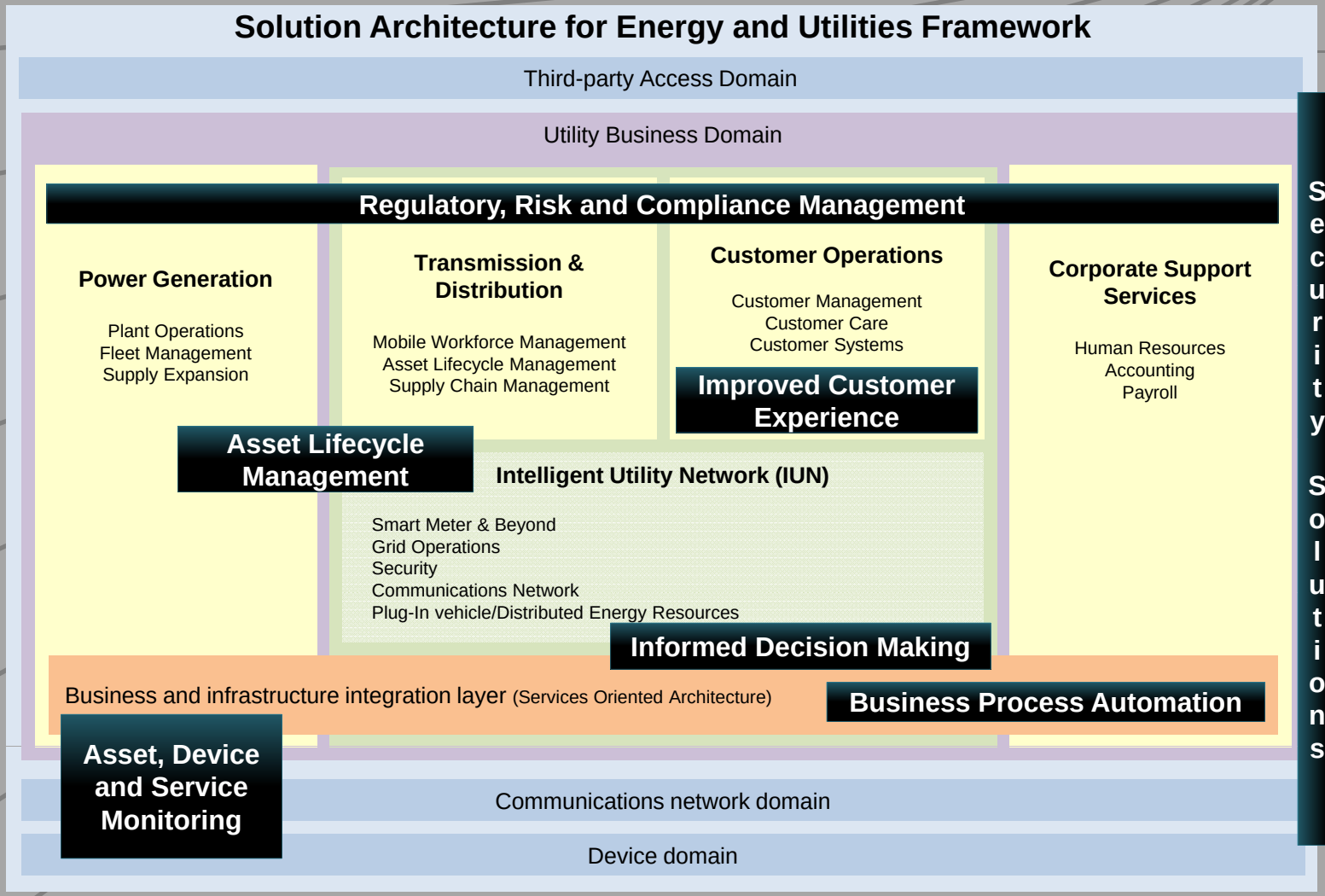
Marco de referencia SAFE de soporte a soluciones (IBM)



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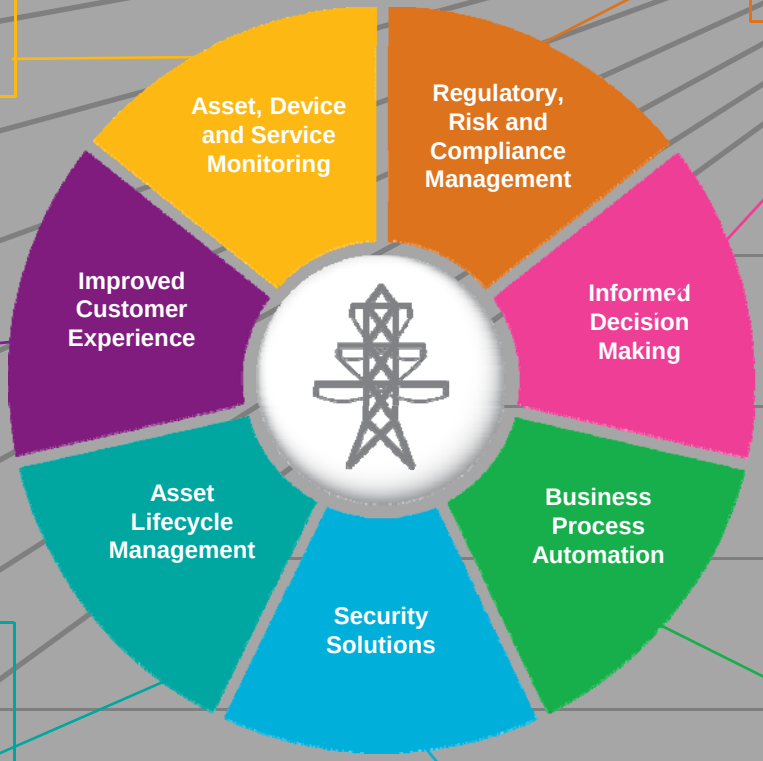

Visualize network performance and provide real-time control and analysis to speed time to resolution.

Comply with regulations and manage risk by accurate and timely management of large quantities of utility documents

Turn business intelligence into actionable insight. Improve business flexibility and performance by analyzing events and correlating reactions to change

Enable interactive communication that provides consumers with information about and control over their energy sources and usage.

Track and make decisions about the procurement, deployment, operation, maintenance and disposal of plant, field and meter assets.

Model, manage and optimize business processes resulting in faster time to market, increased customer satisfaction, and higher productivity.

Comprehensively manage and prevent security risk across all utility business domains.

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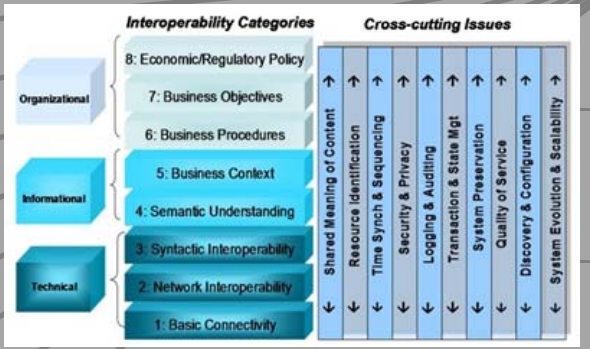
Arquitectura soportada por la estandarización

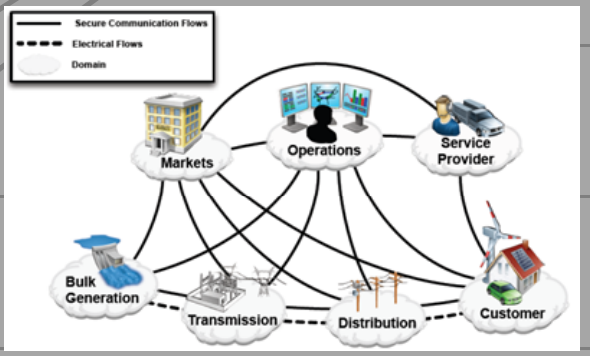
GridWise® Interoperability Context-Setting Framework

- ✓ Focus is on inter-operability categories
- ✓ and Cross cutting issues



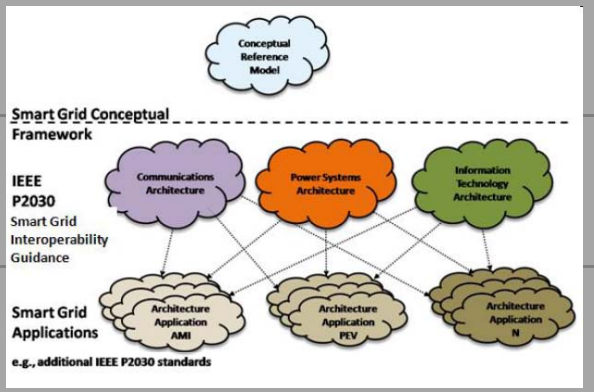
NIST Framework and Roadmap for Smart Grid Interoperability Standards

- ✓ Divide smart grid into seven domains
- ✓ A utility can have all seven domains or only some of the domains.



IEEE P2030 working group

- ✓ Guide for Smart Grid Interoperability of Energy Technology and Information, Technology Operation with the Electric Power System (EPS), and End-Use Applications and Loads



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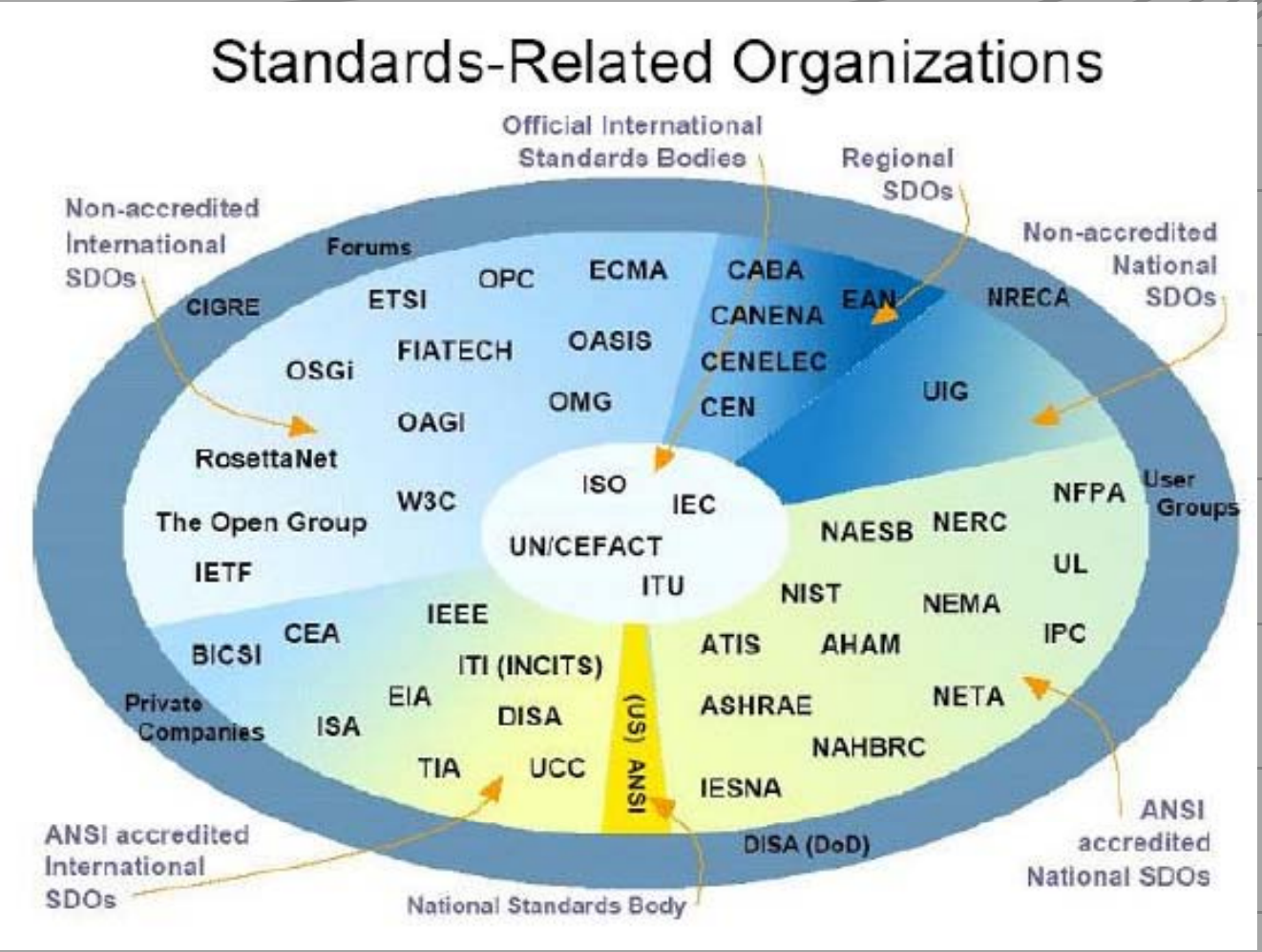
Arquitectura soportada por la estandarización



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Arquitectura soportada por la estandarización

Five families of standards sent to FERC:

- **IEC 61970 and IEC 61968:** Providing a Common Information Model (CIM) necessary for exchanges of data between devices and networks, primarily in the transmission (IEC 61970) and distribution (IEC 61968) domains.
- **IEC 61850:** Facilitating substation automation and communication as well as interoperability through a common data format.
- **IEC 60870-6:** Facilitating exchanges of information between control centers.
- **IEC 62351:** Addressing the cyber security of the communication protocols defined by the preceding IEC standards.

http://www.ferc.gov/EventCalendar/Files/20101119155511-Arnold,%20NIST.pdf

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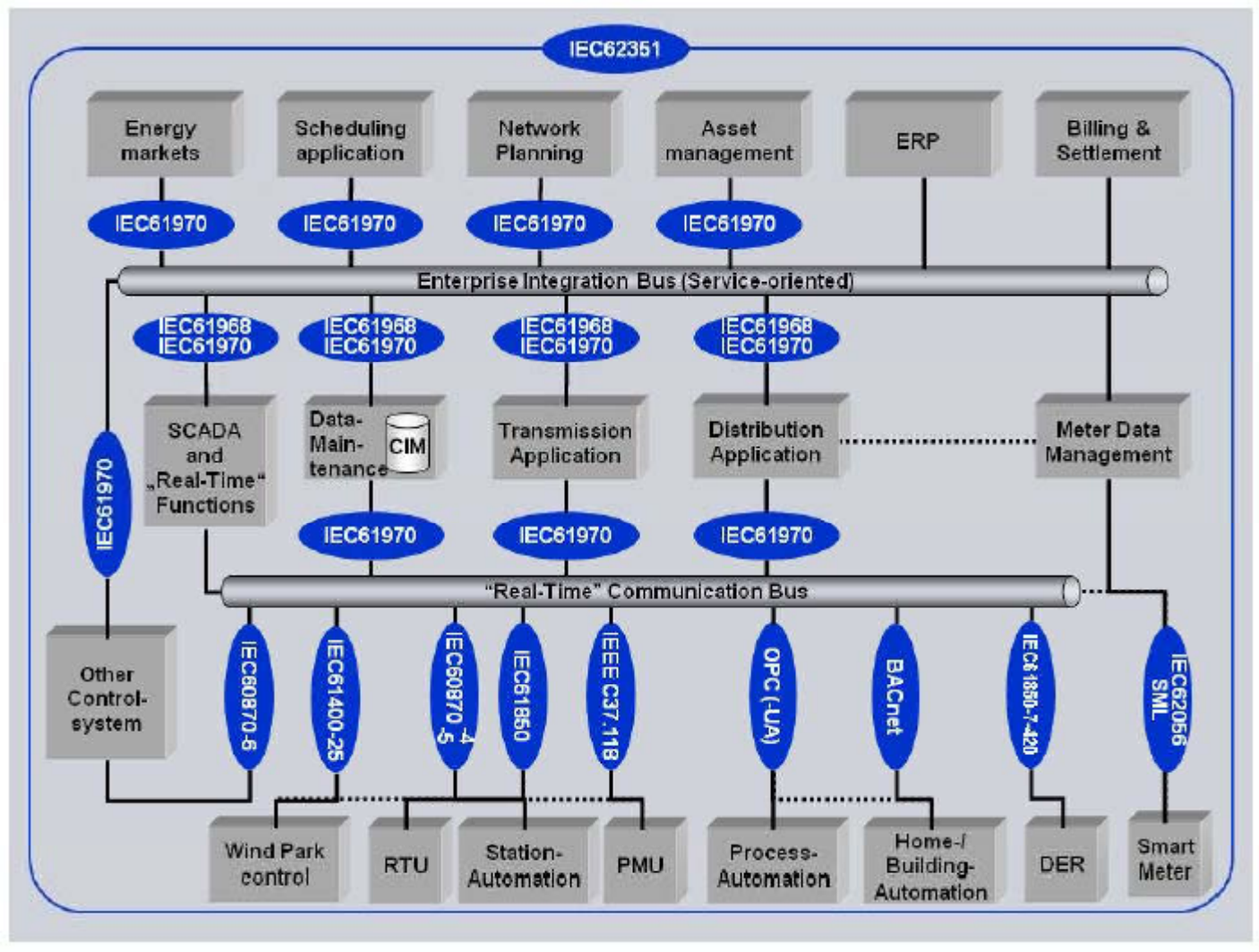
Arquitectura soportada por la estandarización



Ejemplo de arquitectura de EMS avanzado bajo IEC 62357 (dominio de interoperabilidad)

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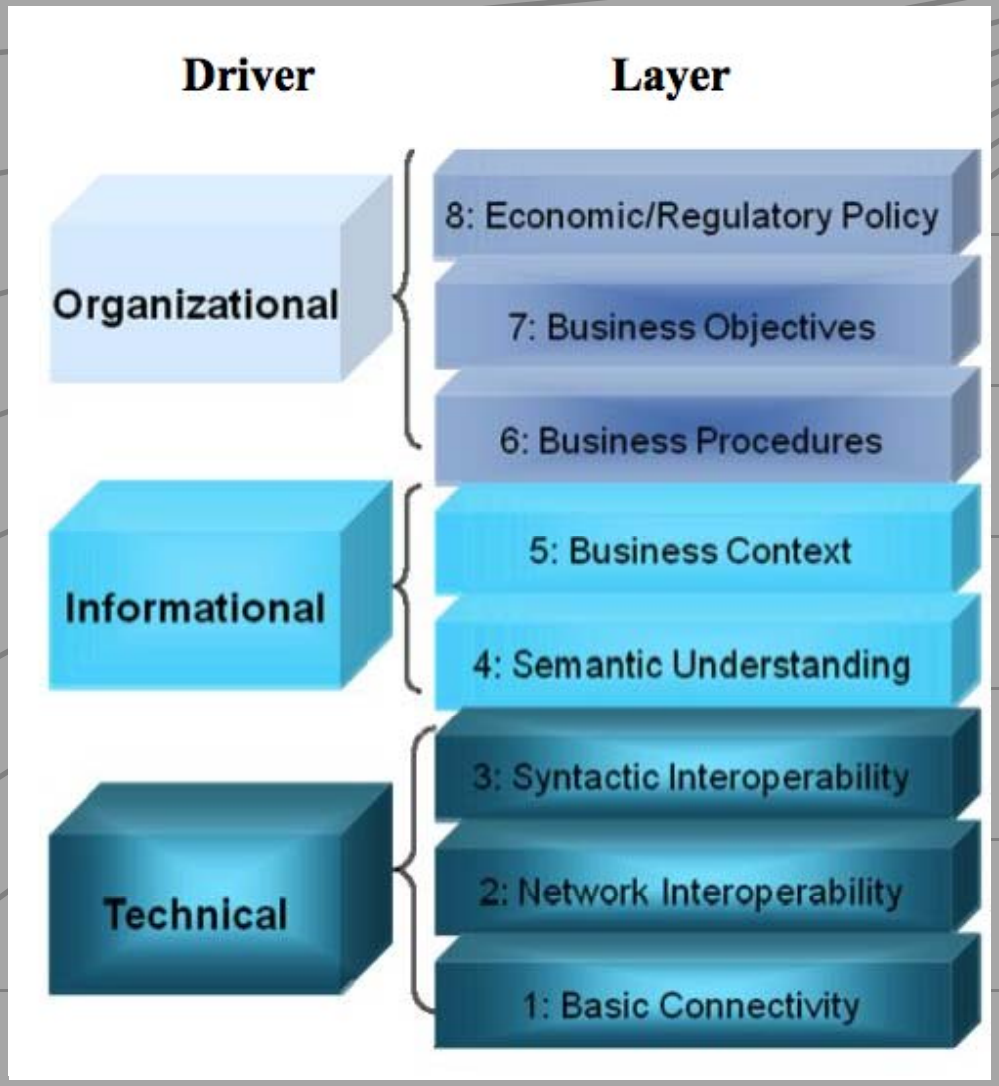
Aproximación "top-bottom"



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Distintos proyectos significativos: ENEMALTA

- *Ensure efficiency and quality of installations*

- *Set-up and organize control room*
- *Ensure successful operations of communication technology*

- *Deliver fully functional and comprehensive Automated meter management system*

- *Guarantee availability and quality of devices*
- *Manage Vendor relationships*

Deployment
Control room
Project Management
Procurement & Logistics
Central system

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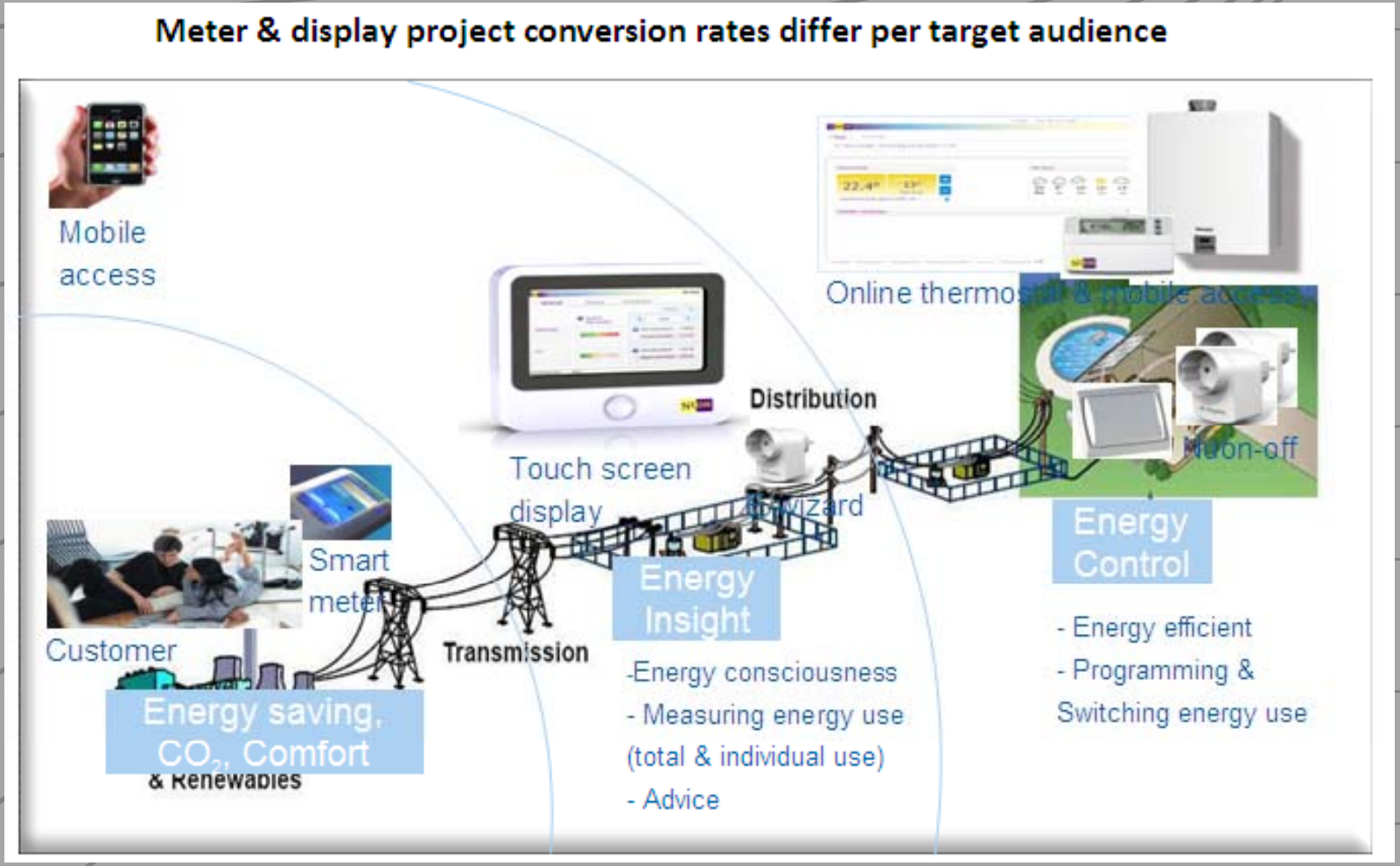
Distintos proyectos significativos: Amsterdam SC



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Distintos proyectos significativos: Smart Grid Smart City

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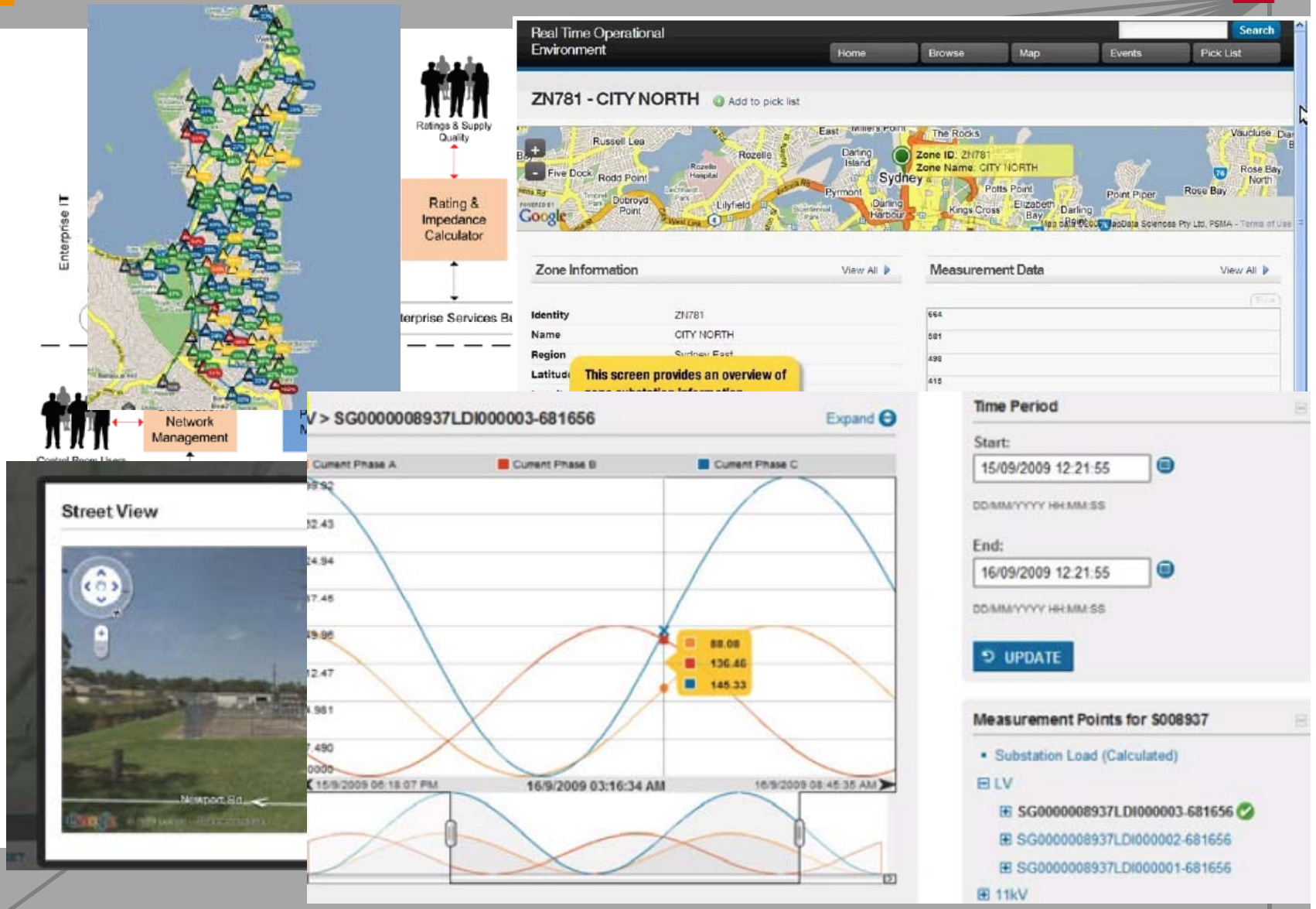

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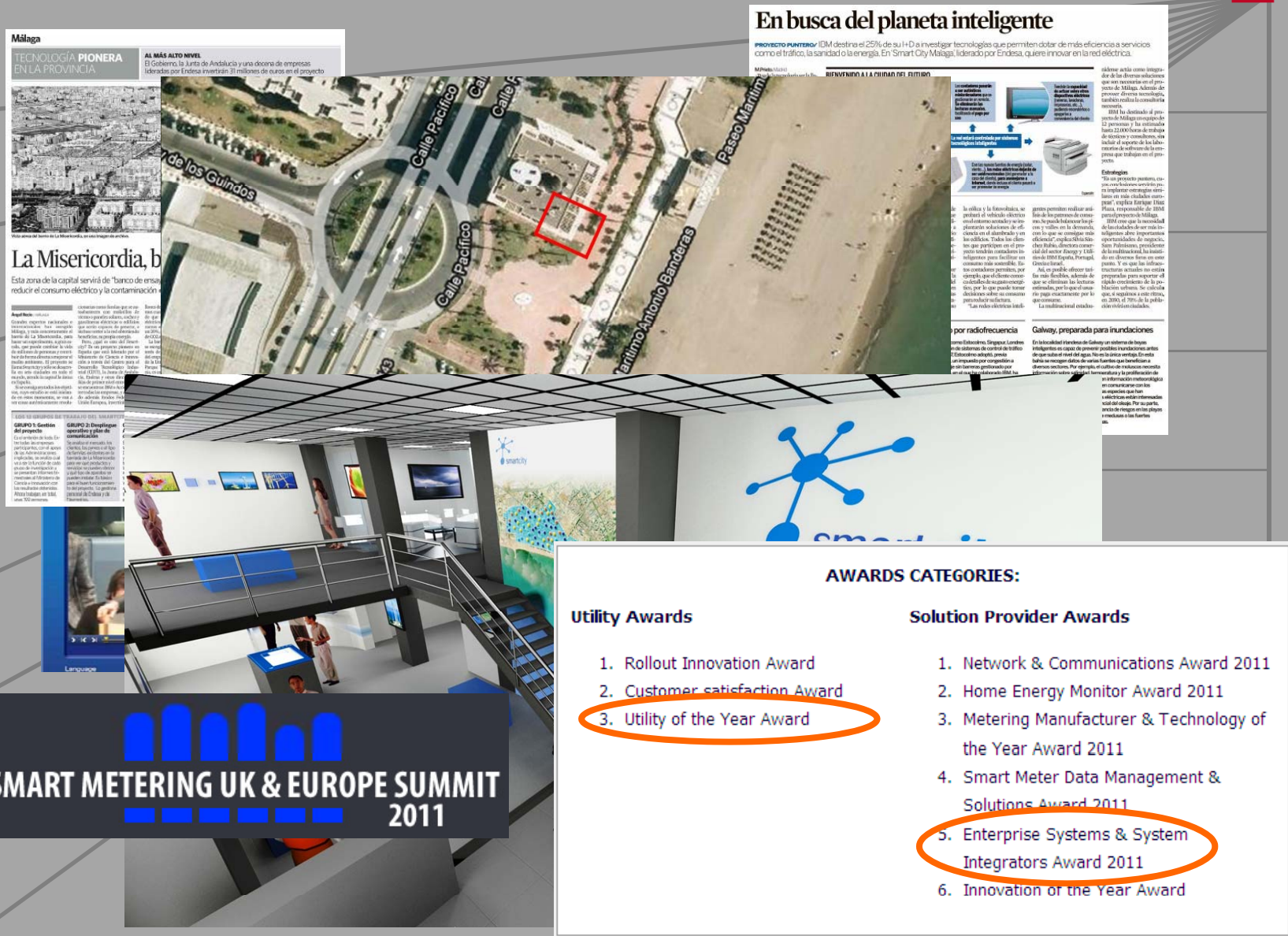
Distintos proyectos significativos: Smart City Málaga



AWARDS CATEGORIES:

Utility Awards

1. Rollout Innovation Award
2. Customer satisfaction Award
3. Utility of the Year Award

Solution Provider Awards

1. Network & Communications Award 2011
2. Home Energy Monitor Award 2011
3. Metering Manufacturer & Technology of the Year Award 2011
4. Smart Meter Data Management & Solutions Award 2011
5. Enterprise Systems & System Integrators Award 2011
6. Innovation of the Year Award

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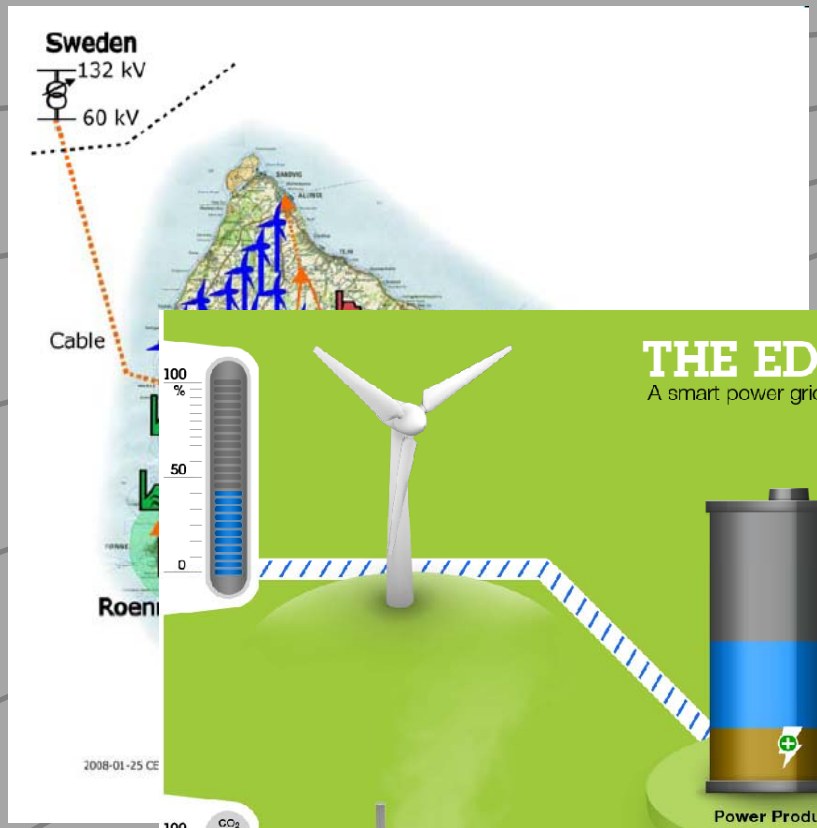
Distintos proyectos significativos:



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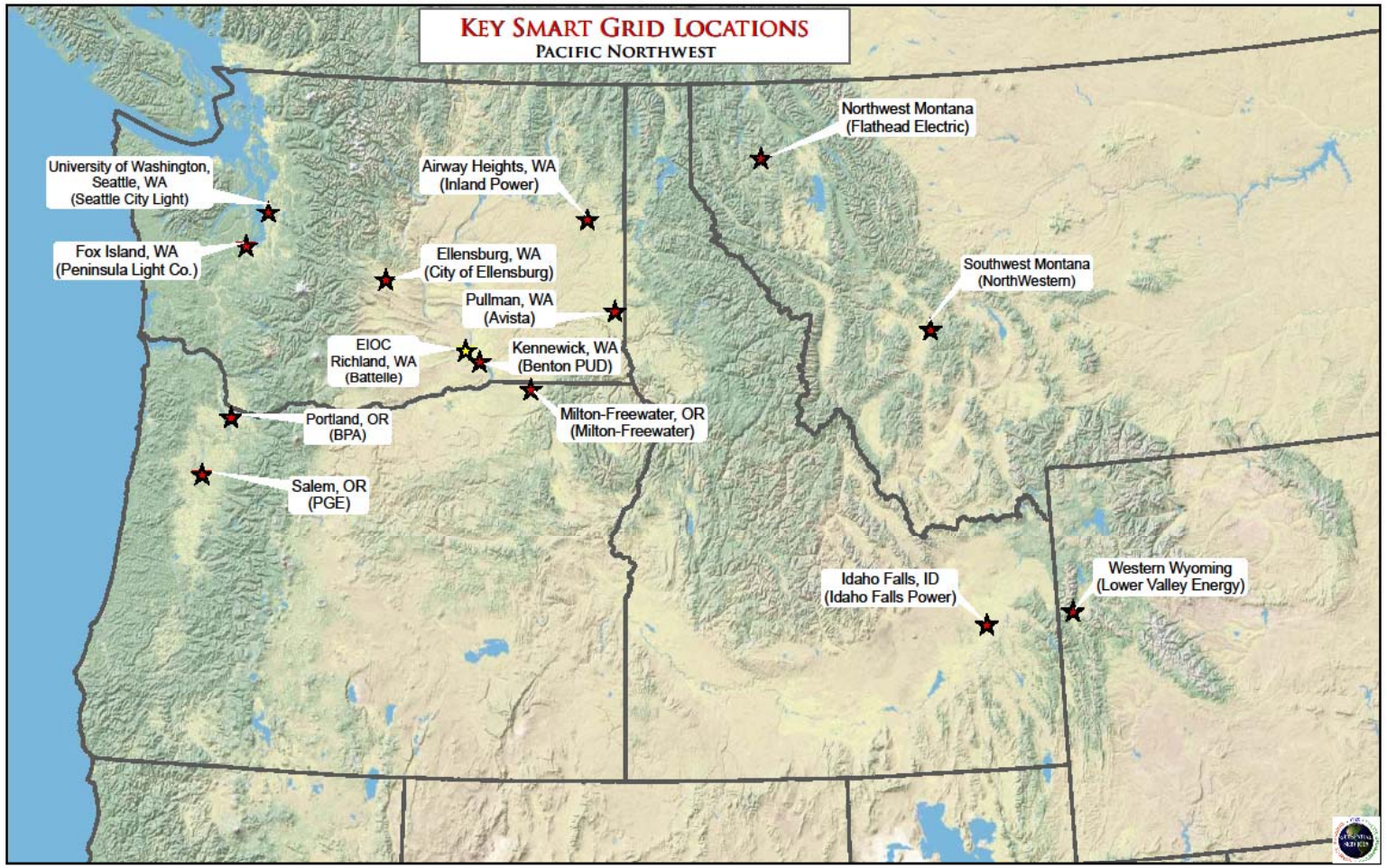
Distintos proyectos significativos: ARRAs

Pacific Northwest Smart Grid Regional Demo



¿Y el consumidor final?

knowledge 

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Insufficient knowledge to understand the changes underway and form opinions about them is widespread

- **Over two-thirds** of respondents admit that they **do not know** whether their local providers or governments have smart meter or smart grid deployment plans in place – and that does not even count those who "know", but are wrong
- **Over half** of the respondents **do not know** if their energy provider has a green energy program that is available to them, a recurring theme over the past three surveys
- **Almost a quarter** of those who participate in green energy programs **have no idea** if they pay a premium for that power, or how much more they pay
- **Thirty-five percent** of respondents are not yet sure whether they will consent to share data on their household energy use
- When asked about specific benefits or concerns about smart meter and smart grid programs, **40-50% do not yet have an opinion** of whether those benefits or concerns are in store for them
- Even basic knowledge is surprisingly absent – about **one-third** of respondents **do not recognize** the basic billing unit for power consumption, and **at least five percent do not know** who their provider is

2011 IBM Global Utility Consumer Survey

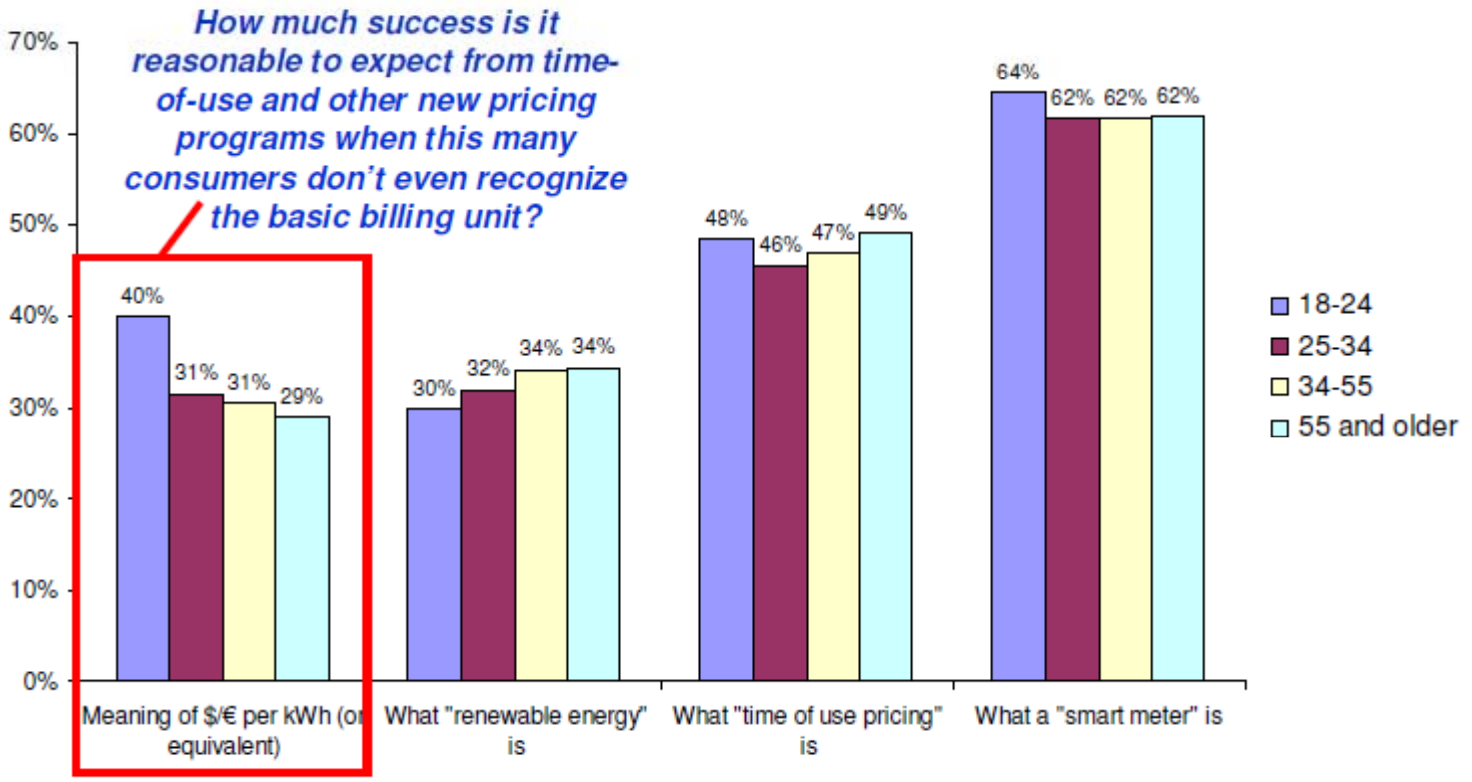
¿Y el consumidor final?

knowledge

IBM

With a few exceptions, different age groups did not show deviations in knowledge gaps or areas of uncertainty

Percent of respondents that did not know the answer to the specified question or statement



2011 IBM Global Utility Consumer Survey

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