

# IEEE-PES Smart Grid Super Session

# Agenda

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|   |                                  |                             |
|---|----------------------------------|-----------------------------|
| <b><i>Introduction</i></b>                          | <b><i>Moderator</i></b>          |                             |
| <b><i>Smart Grid – Europe</i></b>                   | <b><i>Mamo, Xavier</i></b>       | <b><i>EdF</i></b>           |
| <b><i>Thoughts on Smart Grid</i></b>                | <b><i>Moderator</i></b>          |                             |
| <b><i>Smart Grid – Asia</i></b>                     | <b><i>Yoshizumi Serizawa</i></b> | <b><i>CRIEPI</i></b>        |
| <b><i>E-Cars and the Grid</i></b>                   | <b><i>Moderator</i></b>          |                             |
| <b><i>Smart Grid – North America</i></b>            | <b><i>Erich Gunther</i></b>      | <b><i>EnerNex</i></b>       |
| <b><i>Quick Review of the Rest of the World</i></b> | <b><i>Moderator</i></b>          |                             |
| <b><i>Smart Grid – Organizations</i></b>            | <b><i>Steve Pullins</i></b>      | <b><i>Horizon Group</i></b> |
| <b><i>Closing Comments</i></b>                      | <b><i>Moderator</i></b>          |                             |
| <b><i>Questions and Answers</i></b>                 | <b><i>All</i></b>                |                             |

# Drivers for Change

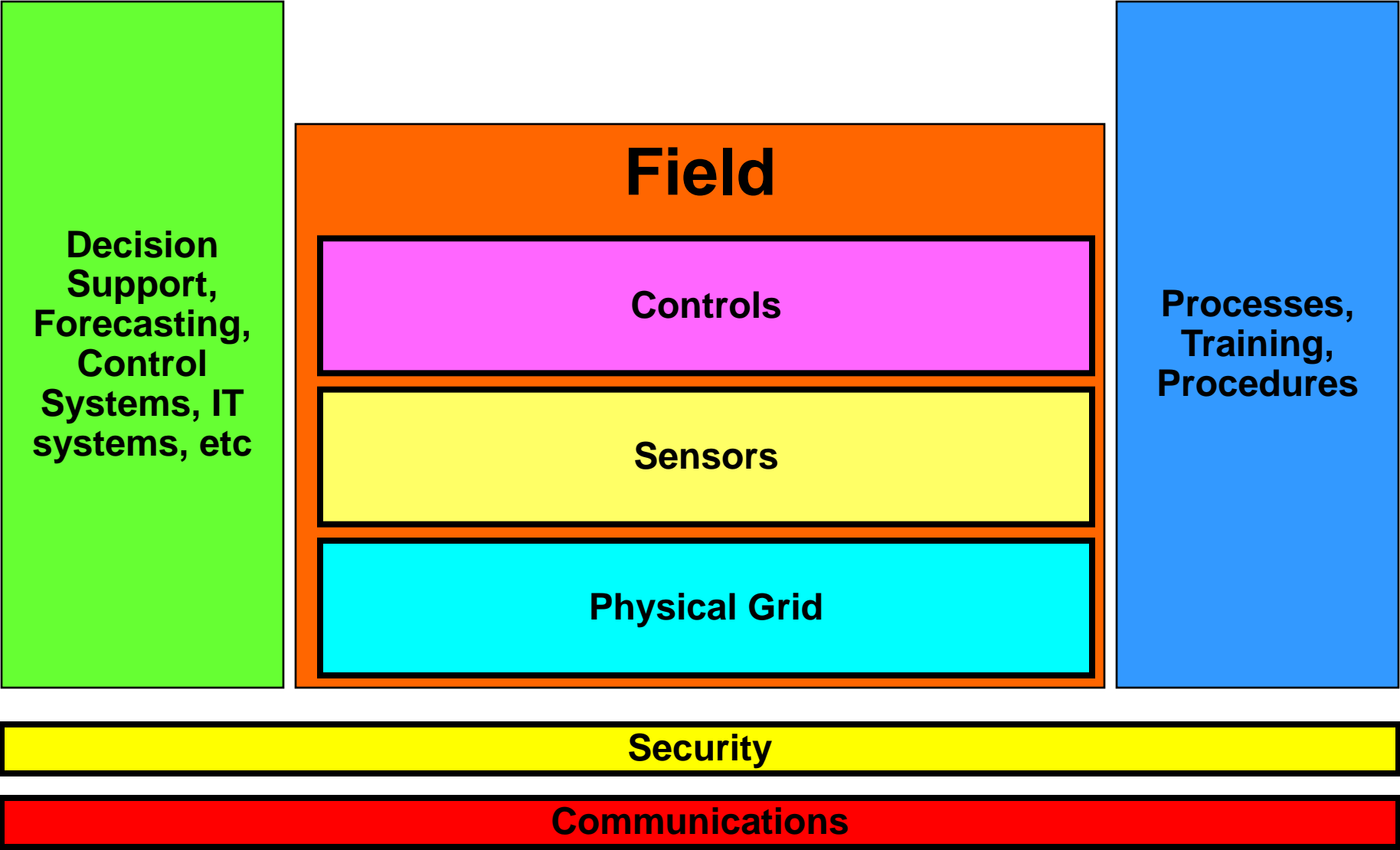
| Internal Drivers  | External Drivers   |
|---|--|
| <p> <b>Workforce aging</b><br/> <b>Cost of assets</b><br/> <b>Drive to control costs (Capital and O&amp;M)</b><br/> <b>Assets stranded by movement of industry and population to green fields</b><br/> <b>Separation of P&amp;Ls (generation, distribution, transmission, etc)</b><br/> <b>Cost containment</b><br/> <b>Aging Assets</b> </p> | <p> <b>Merger Failures</b><br/> <b>Market expectation for higher dividends</b><br/> <b>Distributed generation</b><br/> <b>Push by service companies to move up the food chain</b><br/> <b>Increase in services delivered to customers</b><br/> <b>Private Equity</b><br/> <b>Growth in energy consumption</b> </p> |
| Regulatory Drivers  | Environmental Drivers  |
| <p> <b>Focus on service levels</b><br/> <b>Performance Based Rates</b><br/> <b>Demand for fewer and shorter outages</b><br/> <b>Demand for more buried wires, less overhead</b><br/> <b>Re-regulation of the markets</b><br/> <b>Emissions (Carbon, NOx, etc)</b> </p>  | <p> <b>911 Security concerns</b><br/> <b>Movement outward of cities (3<sup>rd</sup> generation suburbs)</b><br/> <b>Increased drive from renewable energy</b><br/> <b>Aging of the US population</b><br/> <b>Improvement in renewable technology</b> </p>  |

# Smart Grid of the Future

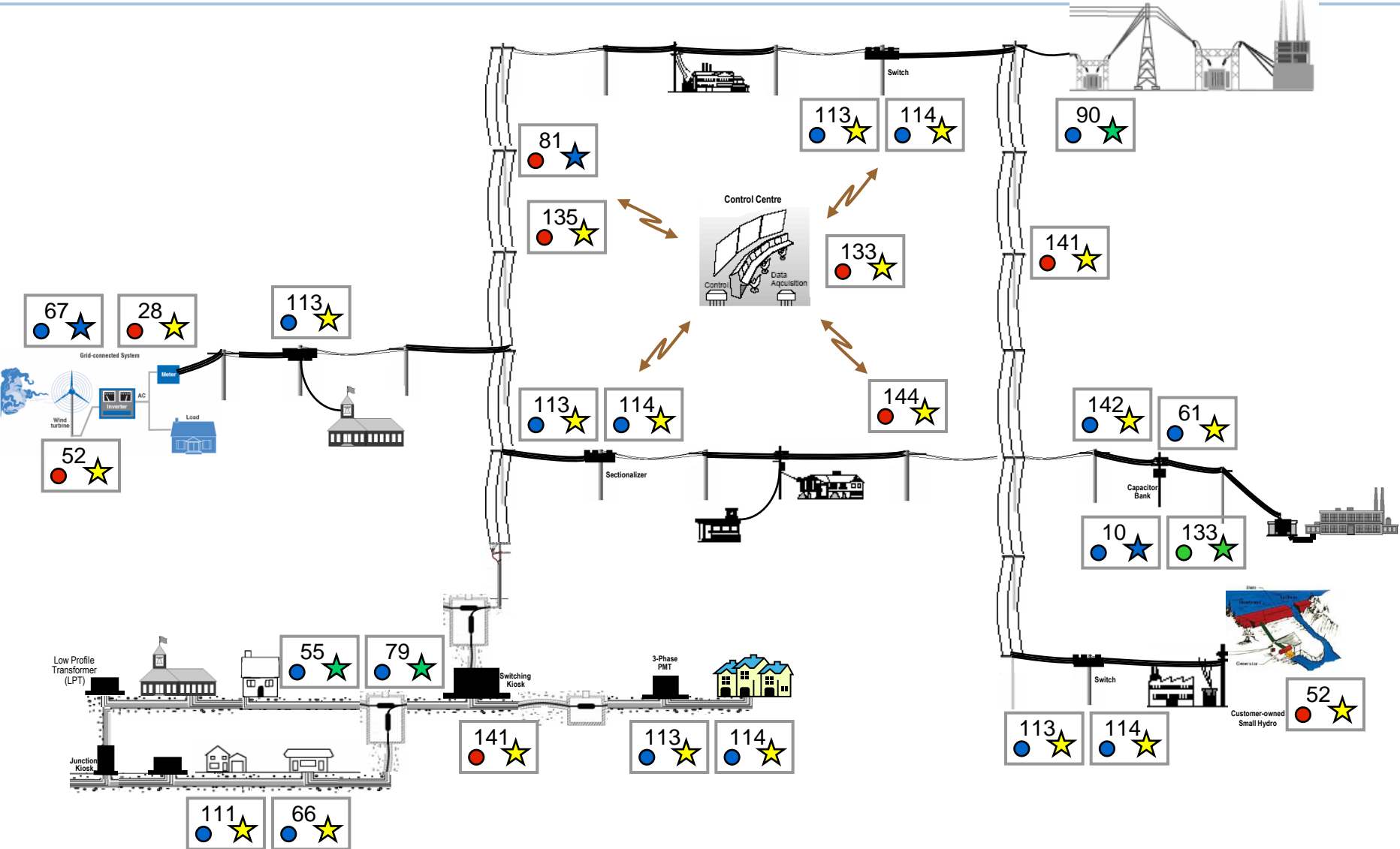
| <b>20<sup>th</sup> Century Grid</b>        | <b>21<sup>st</sup> Century Grid</b>                      |
|--|--|
| Electromechanical                          | Digital  |
| One-way communications (if any)            | Two-way communications                                   |
| Built for centralized generation           | Accommodates distributed generation                      |
| Radial topology                            | Network topology   |
| Few sensors                                | Monitors and sensors throughout                          |
| “Blind”                                    | Self-monitoring  |
| Manual restoration                         | Semi-automated restoration and, eventually, self-healing |
| Prone to failures and blackouts            | Adaptive protection and islanding                        |
| Check equipment manually                   | Monitor equipment remotely                               |
| Emergency decisions by committee and phone | Decision support systems, predictive reliability         |
| Limited control over power flows           | Pervasive control systems                                |
| Limited price information                  | Full price information                                   |
| Few customer choices                       | Many customer choices                                    |

Source: Wikipedia

# Smart Grid - Conceptually



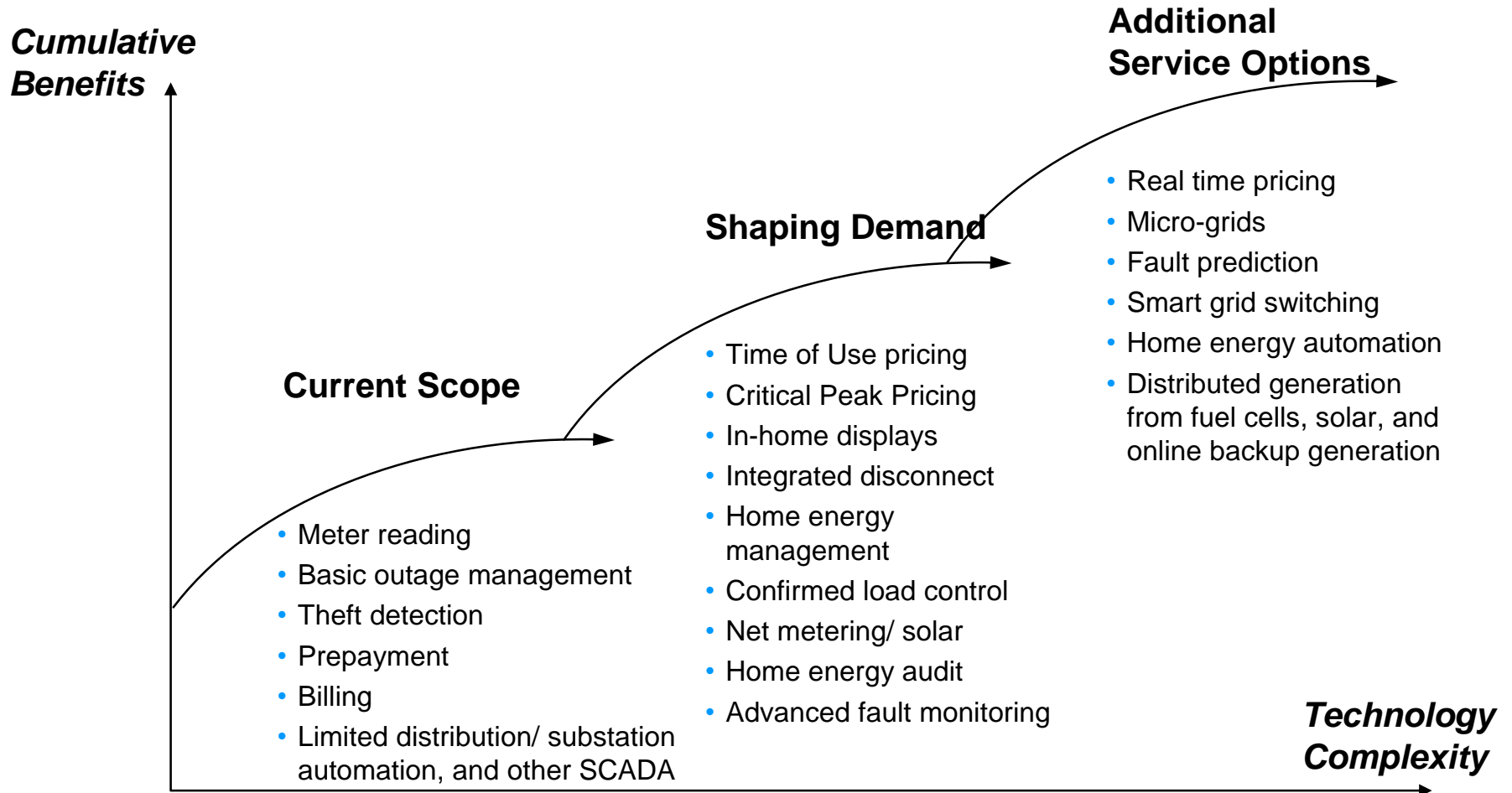
# Suburban Customer Density



# Sensors

| Smart Grid Enabling Hardware Technologies - Sensors              | Location | Communication Frequency | Permissible Latency |
|--|----------|-------------------------|---------------------|
| Smart Metering - Fixed Read System                               | Meter    | As & When               | Non-issue           |
| Circuit Breakers for Feeders with Automatic Sensing & Re-closing | Line     | As & When               | Specified Window    |
| Metering - Two Way   | Meter    | Constantly              | Near real-time      |
| Metering - Pre-Paid  | Meter    | As & When               | Specified Window    |
| Distributed Resource Interconnection                             | Resource | Constantly              | Near real-time      |
| Smart Metering - Fixed Network                                   | Meter    | As & When               | Near real-time      |
| Second Generation Remote Load Control Devices                    | End User | As & When               | Near real-time      |
| Management of Supply Remote                                      | Resource | Constantly              | Near real-time      |
| Smart Metering - using Broadband                                 | Meter    | As & When               | Near real-time      |
| Appliance Reporting  | End user | As & When               | Specified Window    |
| Fault Anticipators   | Line     | As & When               | Near real-time      |
| Device Control via Remote  | End user | As & When               | Near real-time      |
| Device to Manage Load Shapes - Remote Control                    | End user | As & When               | Near real-time      |
| Device - Self Reporting  | End user | As & When               | Near real-time      |
| Fault Detecting and Reporting - Automated                        | Line     | As & When               | Near real-time      |
| Intelligent Building   | End user | As & When               | Near real-time      |
| SCADA Network Penetration  | Line     | Constantly              | Near real-time      |
| Sensors - Wireless   | Line     | As & When               | Near real-time      |
| Wireline Sensors   | Line     | As & When               | Near real-time      |
| Auto Sensing Grid Segmentation Devices                           | Line     | As & When               | Near real-time      |
| Smart Metering – Networked                                       | Meter    | As & When               | Near real-time      |
| Matrix Fault Current Limiter                                     | Line     | As & When               | Near real-time      |

# Smart Grid



**Utility Challenge**



**Integrate** existing services to new platform



**Transform** existing services using advanced communications capability



**Enable** future services and innovation



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| <i>Questions and Answers</i>                 | <i>All</i>                |                      |

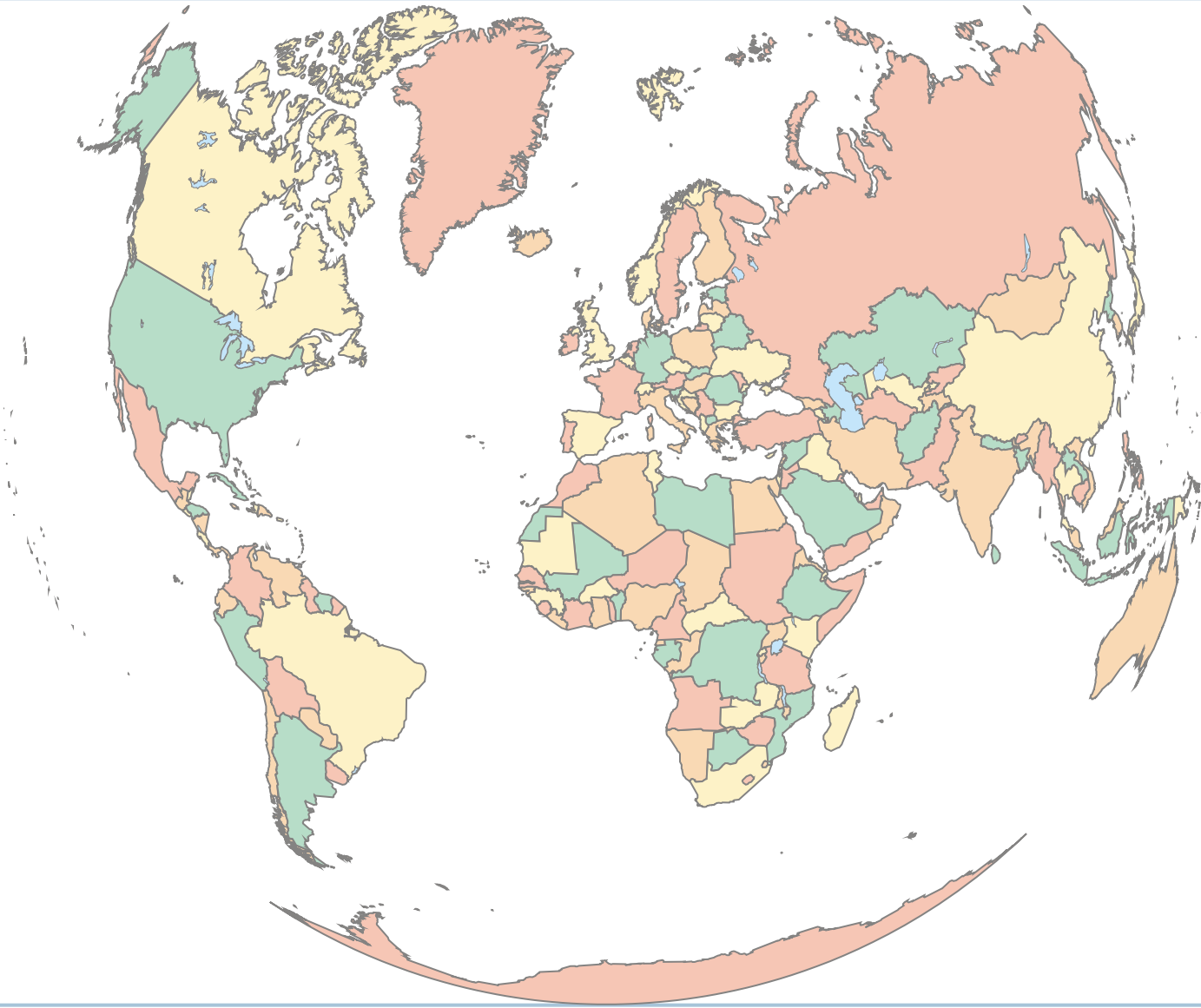
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# The Rest of the World



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# Logical IT Systems for Smart Grid

- ***Distribution Monitoring and Control System (DMCS)***
- ***Distribution Substation Monitoring System (DSMS)***
- ***Automated Feeder Switch System (AFSS)***
- ***Distributed Generation Monitoring System (DGMS)***
- ***Automated Meter Operations System (AMOS)***
- ***Meter Data Management System (MDMS)***
- ***Distribution Forecasting System (DFS)***
- ***Smart Grid Work Management System (SGWMS)***
- ***Communications Network Monitoring System (CNMS)***
- ***Minor Equipment Monitoring System (MEMS)***
- ***Smart Grid Planning System (SGPS)***
- ***Smart Grid Operational Data Store (SGODS)***

# A Few Key URL

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## **NIST ROADMAP**

<http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGridInterimRoadmap/InterimRoadmapFinal>

## **Google Map**

<http://maps.google.com/maps/ms?ie=UTF8&hl=en&msa=0&msid=115519311058367534348.0000011362ac6d7d21187&ll=53.956086,14.677734&spn=23.864566,77.519531&z=4&om=1>

## **IEA**

<http://www.iea.org/>

## **EPRI**

<http://www.epri.org>

## **Wiki**

[www.smartgridipedia.org](http://www.smartgridipedia.org)