OPTIMAL TECHNOLOGIES

Finally, real-time optimization and ranking meets real-time information

A Breakthrough in Smart Grid Technology

Rethinking Transmission & Distribution Architecture for Distributed Energy Resources

From:

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This presentation is designed as support material and is normally a part of a verbal or on-site presentation by an officer of Optimal Technologies.

Industry Challenges: Why is it needed?

External Challenges

- Regulatory Compliance (SQRA)
- Environmental Restrictions/Costs
- Managerial Compliance
- Increased Load
- Increased Customer Expectations

Internal Challenges

- Expected Return on Capital
- Aging Assets/Infrastructure
- Departing Expertise “Brain Drain”
- Lack of the Right Information
“Actionable Intelligence”

Utilities need to balance between internal and external challenges

Expert Opinions: Why is it needed?

Reduced Budget/Increased Load:
"Over the next 10 years construction of new transmission lines will meet 1/3 of energy demand growth"
– ***Spencer Abraham, Former Secretary of Energy***

Compliance-Overloading/Reliability:
"Violations of reliability standards of line overloading and voltage reductions by 2011"
– ***NERC***

Take Action or ...

Aging Assets:
"75% of Lines/Transformers are 26+ years of age, 60% of CB are 30+ years of age"
– Spencer Abraham, Former Secretary of Energy

Departing Expertise:
"Technology is a means to mitigate risk for our Brain Drain problem"
– ***Don Cortez - Centrepoint***

The Goal: Modernization of the Power System

Encourages and maximizes clean, green, end-user support

- Removes classic restrictions of traditional "one-way" power grid to allow for numerous, new, typically small, generators to use the grid in the greenest and most efficient and cost effective manner.
  - Traditional grid systems cannot accept "back-flow" of power from end-users and therefore cannot accept many small generators such as from solar or wind.

Works within present Utility control paradigms

- Easy integration into traditional centralized dispatch methodology.
  - Offers new de-centrally managed distributed control under centralized hierarchy.

Smart Grid: What is it?

Bi-directional grid system that dynamically "knows and shows" where, when, why, and by how much its parts are deficient or wasteful so as to be able to rank how best to improve its deficiencies and minimize waste.

- Few "smart grid" initiatives actually meet this requirement.
- New analysis, optimization and ranking technologies are critical to making "Smart Grids", truly smart.
  - MUST be able to maximize value for BOTH local and system-wide benefits.

Smart Grid: What Does it Do?

A Smart Grid provides for optimized local and system-wide:

- **Bi-directional power flows** where power is sent from any-size generator to end-users using the greenest approach.
  - Allows for easy integration of small and renewable energy resources.
    - Changes one-way distribution systems into two-way distribution systems for plug & play interconnection at any point in the network.
    - Uses tools that allow smaller generating units to be visible/controllable by operators.
    - Uses tools that allow for the addition of millions (or more) distributed energy resources.
    - Uses tools that optimize the local and system-wide operation of these units.
  - Provides direct feedback and ranking as to the locational benefit/value of each device in the system, regardless of size, so as to encourage open and robust markets.
- **Bi-directional information flows** where information sent to the...
  - System operator can be used with scale and accuracy.
  - End-user is automatically actionable.
    - Every point provides value data that can be used to optimize the electric system or any subset thereof.
    - End-users are engaged toward smart power system actions (e.g., demand response)

Smart Grid: What Does it Enable?

MARKETS

- Open markets and increased competitiveness for lower prices.
  - Open access and liberalization.
- Clear, long lasting regulatory policies that encourage and support investment toward innovation.
- Open markets and increased competitiveness for lower emissions.
  - Carbon trading enabled.

ENVIRONMENT

- Reduced climate change/impacts.
- Carbon neutrality and/or reduction.
- Reduced pollution.
- Nature and wildlife preservation.

Smart Grid: What Does it Enable?

SUPPLY SECURITY

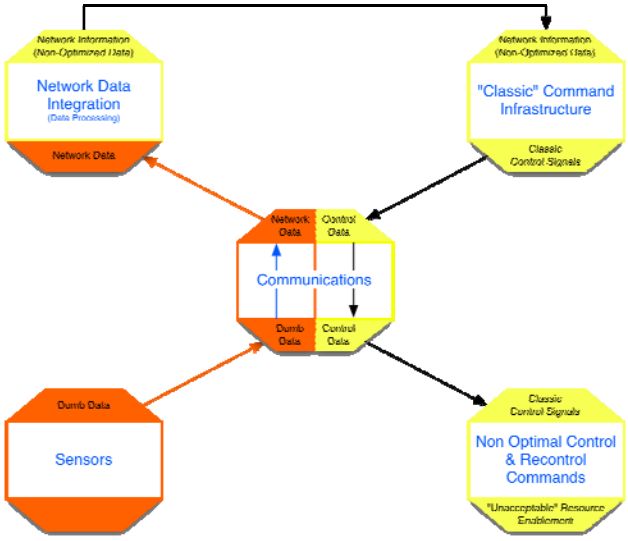
- Maximum availability.
- Maximum reliability.
- Maximum power quality requirements.
- Maximum integration of renewables.
- Maximum integration of Demand Response.

Smart Grid: What Does it Enable?

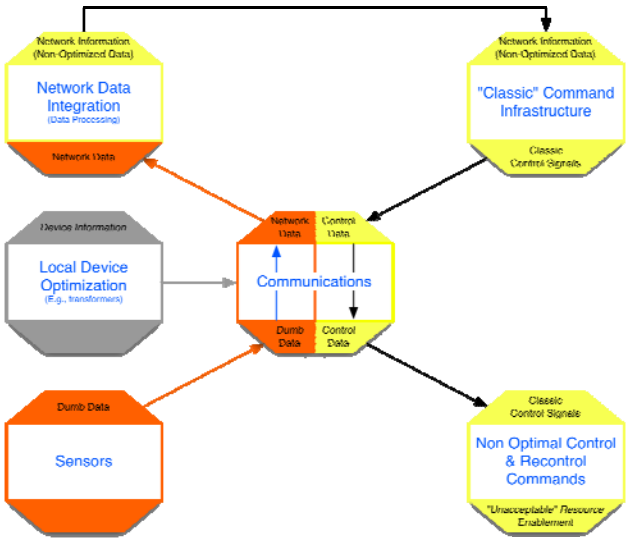
END-USER ENGAGEMENT

- Drive toward improved energy efficiency measures.
- “Grid Friendly” buildings and end-users.
- Sustainable engagement for carbon neutrality.
- Greater deployment and sustainability for Demand-Response.
- Drive toward new “Value-Added” business models.
- Drive toward innovation.

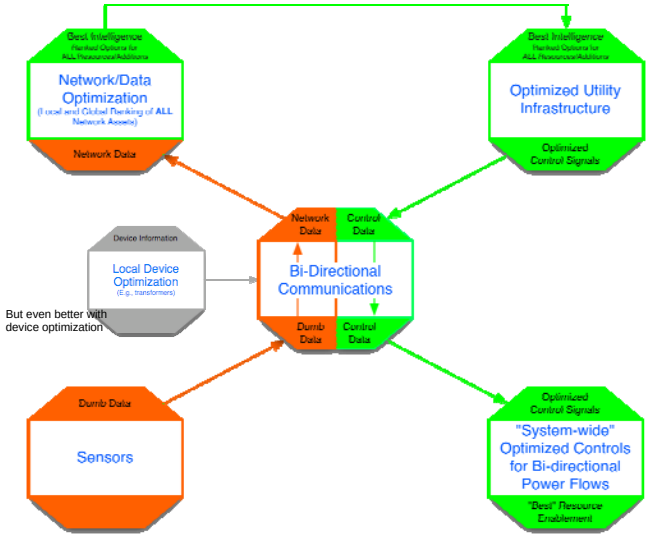
Smart Grid: This isn’t it (but it is a good start)



Smart Grid: This still isn't it (but it is better)

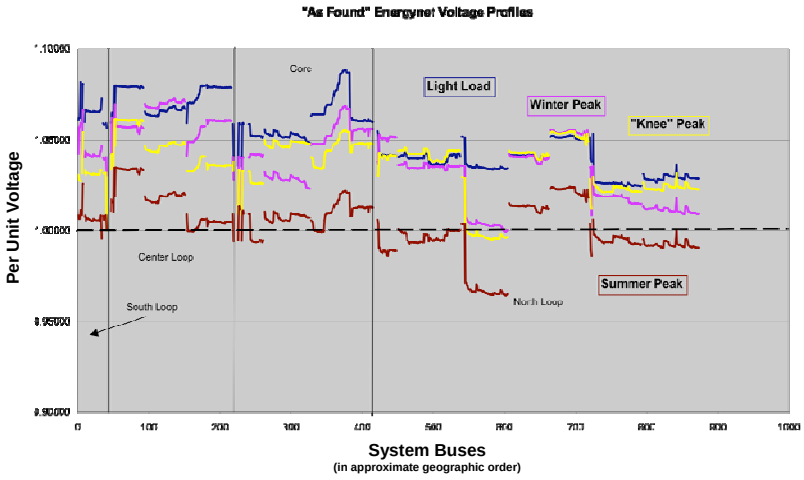


Smart Grid: This is (even without the local device optimization)

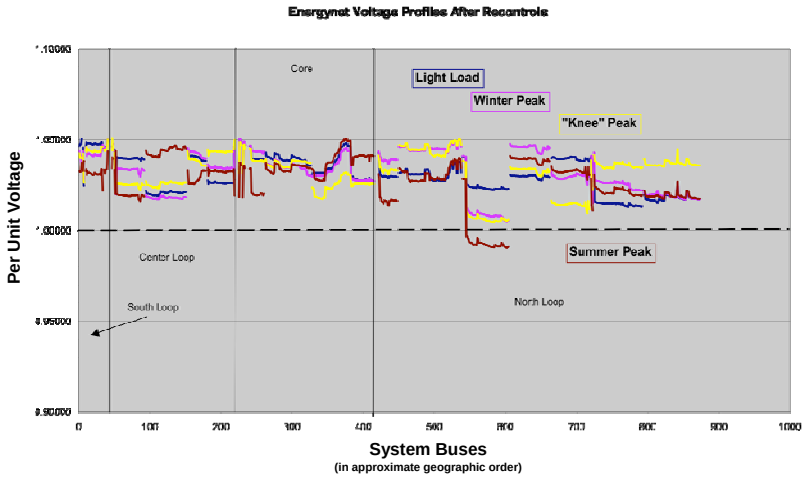


Smart Grid: The Key Parts

"As Found" Voltage Profiles for Different Load Conditions for Small Utility



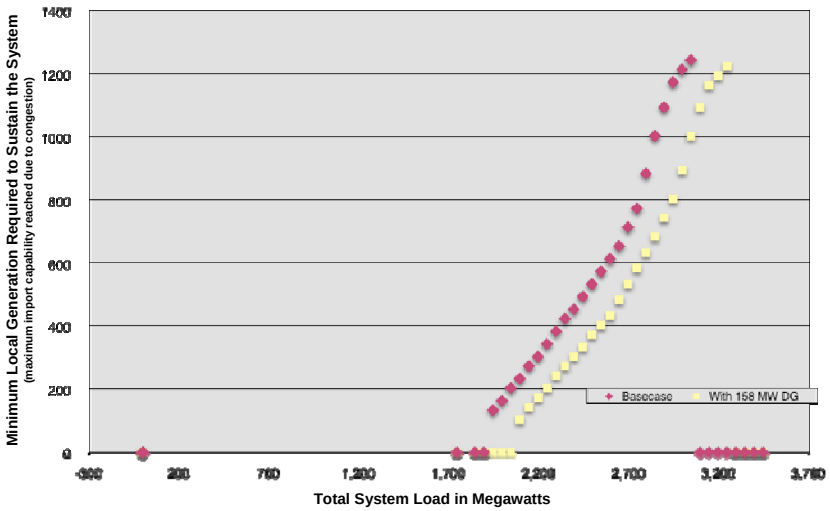
New Technology: Optimized Voltage Profiles for Same Small Utility



Active power losses are reduced by 31%, Reactive power requirement is reduced by 30%.

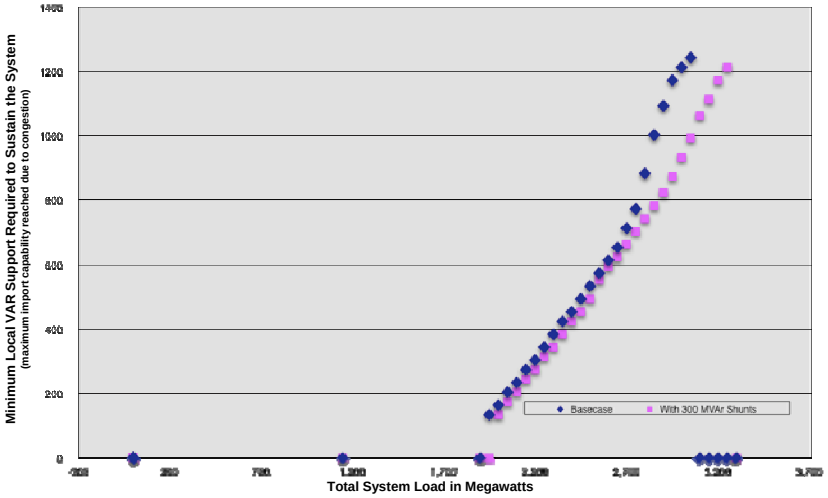
AEMPFAST RSIs rank over 340 locations for improvement using DER.

Optimal Placement of DG: Increases Load Serving Capability



158MW DG Addition Increases Load Serving Capability by 240MW (90 MW comes from Congestion Reduction)

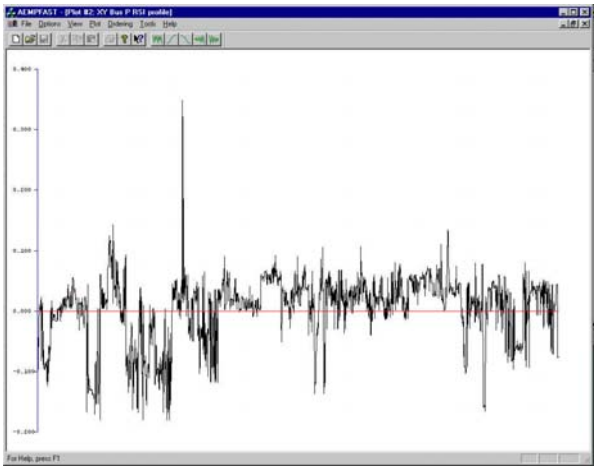
Reactive Optimization: Increases Load Serving Capability



300 Properly Placed Transmission MVAr Increases Load Serving Capability by 250MW
(Note No MW Added)

New Technology Example: Generation RSI

Actual Data: Heavy Summer 1999



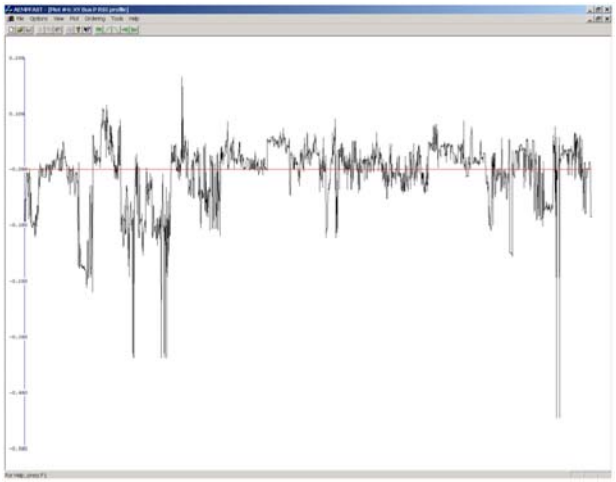
This plot shows the Resource Sensitivity Index (RSI) or system "stresses" for each generator in the network as a "snapshot" of all generators at the same time. It is an effective way of ranking the net system-wide benefit of each generator.

Generally speaking, generators shown to be above the red line are having a net positive impact on the power system while generators shown below the red line are making the system worse. In all cases, since current tools are only effective on small areas of the grid, local benefits are assumed positive.

AEMPFAST has the unique ability to not only rank each generator to its system-wide benefit, it also has the ability to quickly and accurately determine how to change negative impacts into positive ones.

AEMPFAST

New Technology Example: Shows Best Load and/or DG Management
(Small Subset of Total Capabilities)



Actual Heavy Summer Load Case

This plot shows the Resource Sensitivity Index (RSI) or system "stresses" for each load bus in the network as a "snapshot" of all **loads** at the same time. It is an effective way of ranking the net system-wide impact of each load.

Generally speaking, loads shown to be above the red line are having a net positive impact on the power system while loads furthest below the red line are making the system worse. These points are the most valuable toward system improvement and risk reduction.

AEMPFAST has the unique ability to not only rank each load to its local and system-wide impact, it also has the ability to quickly and accurately determine how to change negative impacts into positive ones.

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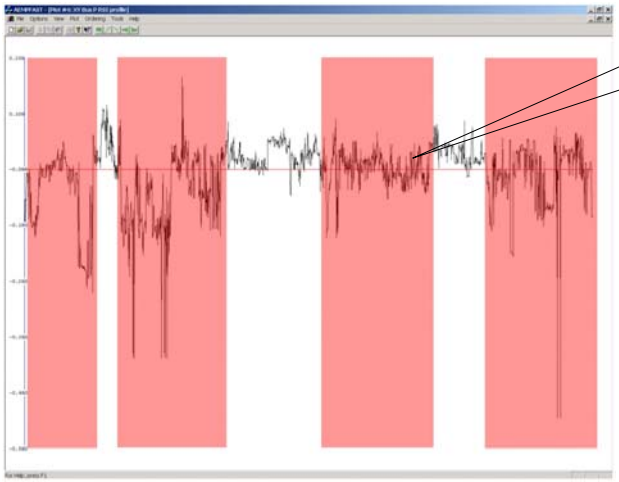
New Technology Example:
Shows Traditional Load Management Methods Don't Work Well



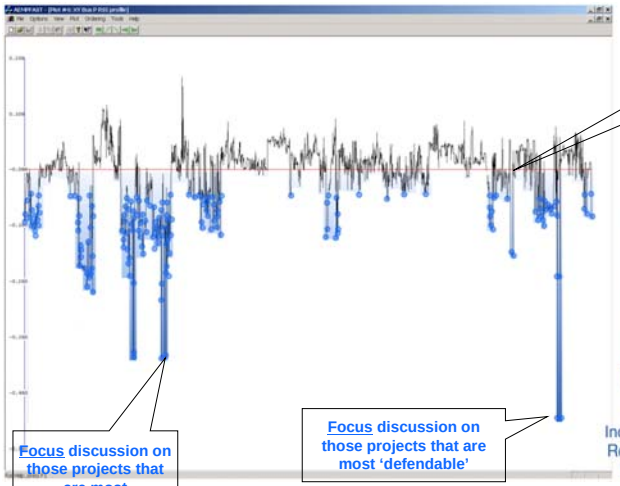
Loads above the red line help the system (e.g., by pulling power from congested lines) and should NOT be curtailed.

Traditional Demand Response methods do not surgically target the most valuable areas for demand management and therefore must use revenue-reducing approaches that also must include areas that should not be managed.

The red bars indicate logical utility "regions" (neighborhoods, areas, districts, feeders, buses, sub-divisions, etc.).

New Technology:

Accurately Shows Best Location For Load or DG Management



Projects that are on or near the line indicates insufficient value to the system and not worth the cost

Focus discussion on those projects that are most 'defendable'

Focus discussion on those projects that are most 'defendable'

Optimal's unique approach surgically targets only those geographic points that provide "real" value (points below the red line) and can show which will provide the *most value* for the *least cost*.

Optimal dramatically and uniquely reduces utility risk while maximizing utility revenues.

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Thank you!

Questions?

We Optimize Your World!

The SMARTGRID Company

www.smartgrid.com