Brookhaven National Laboratory Smarter Grid Centers

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Global & Regional Solutions

Smarter Grid R&D April 12th, 2012

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a passion for discovery

Office of Science
U.S. DEPARTMENT OF ENERGY

Outline

- DOE's Smarter Grid

- BNL's strategic plans for energy research

- Smarter Electric Grid Research, Innovation, Development, Demonstration, Deployment Center – SGRID[3]

  - Development of AEGIS (Advanced Electric Grid Innovation and Support Center) at BNL

  - Development of SGIC (Smart Grid Innovation Center)

Smart Grid enables 21st Century Economy and *Creates Need for SGRID³*
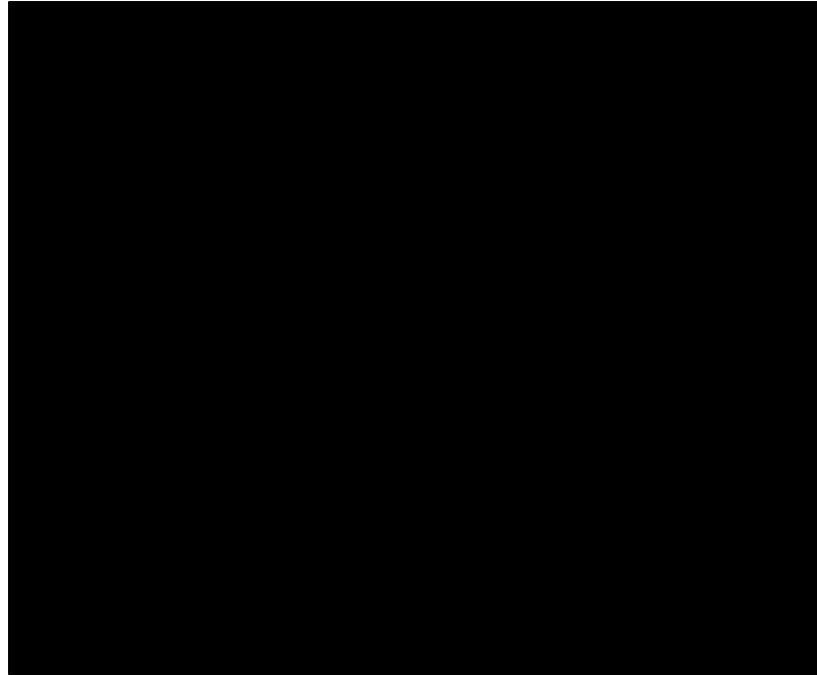
BNL's research on renewable energy & the electric grid are key elements of BNL's energy strategy

1. Sustainable Chemical Conversion

2. Electric Grid Infrastructure

   - De-carbonized Generation

   - Renewables Integration in the Northeast

   - Cost Effective Grid Scale Storage

   - A Robust and Effective Distribution Infrastructure
     - How does Smarter Electric Grid Research, Innovation, Development, Demonstration, Deployment Center – (SGRID³) fit all these together into a powerful energy R&D?
       - Existing - Advanced Energy Research &Technology (AERTC) Center is designed to nurture creation of new technologies for Smart Grid
       - New - Development of SGIC (Smart Grid Innovation Center) at SBU
       - New -Development of AEGIS (Advanced Electric Grid Innovation and Support Center) at BNL

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Good things begin with a COMPELLING proposal!

The SGRID3 Project:

❖ involves significant, measurable collaboration to achieve the ultimate objective of lowering the cost of electricity.

❖ supports LI's vision of a national and global center for innovation, via use of knowledge-based economy to create new high-paying jobs and improve the quality of life for all residents. We want LI to become "the Silicon Valley of Smarter Grid."

❖ be fully operational in three to four years, and early operations can begin within the first year.

❖ leverages $5.3M in private investments, local and federal funds, including $4.5M of construction support.

❖ an early-win project at BNL is supported by an internal R&D project and the DOE is supporting the LI Smart Energy Corridor Project through an ARRA project.

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Smarter Electric Grid Research, Innovation, Development, Demonstration, Deployment Center SGRID³

A Proposal To the
Long Island Regional Economic Development Council
October 14, 2011

SGRID³ Vision

AEGIS Center

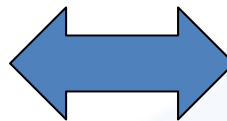- Enable grid-performance info collection and modeling to optimize transmission/distribution

NYS

Smart Grid Innovation Center (SGIC)

- Stakeholders can develop and demonstrate grid technologies

Prospective site Smart Grid Innovation Center

Advanced Energy Research and Technology Center

Foster invention, development, testing, deployment of SGIC

Model technologies with grid performance info from AEGIS

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SGRID³ Meets Smarter Grid Needs

- *Existing* Advanced Energy Research &Technology (AERTC) Center is designed to nurture creation of new technologies for Smart Grid

- *New* Smart Grid Innovation (SCI) Center will test and validate new grid technologies at SBU

  - Grid support technologies - storage

  - Renewable energy technologies – solar, wind

  - New customer technologies – PHEV

- *New* Advanced Electrical Grid Innovation & Support (AEGIS) Center at BNL models, analyzes and develops new control systems for integration of new technologies into the Smarter Grid

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Expected Impact of the Smarter Electric Grid Research, Innovation, Development, Demonstration, Deployment Center – SGRID^3

- SGRID^3 Goals
  - Lower the cost of electric power by 5-10%
  - Improve the quality and reliability of electric power
  - Ensure the security of the Smart Grid and implement the biggest energy technology revolution in 100 years
  - Develop capabilities to advance future utility investments in the electrical transmission and distribution systems in New York State and the Northeast
- SGRID^3 is a unique facility filling an unmet need to:
  - Create a development, demonstration, and deployment infrastructure for new grid technologies, including renewables

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In the meantime . . . BNL is collaborating on modeling the Smarter Electric Grid

Data & Modeling with Orange & Rockland Utility (ORU)

- Data model includes all grid/system components including poles & wires
- GPS for positioning the grid components is important to doing the math
- Physics-based algorithms can be applied without making assumptions that compromise the modeling of the real grid
- An integrated system model (ISM) brings all the data components together into a concept where
- ORU can apply advanced algorithms running on distributed processing
- Distributed processing provides real-time speed for automated operations

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Orange & Rockland's Grid **. . . Then taking it circuit by circuit and making them smarter**
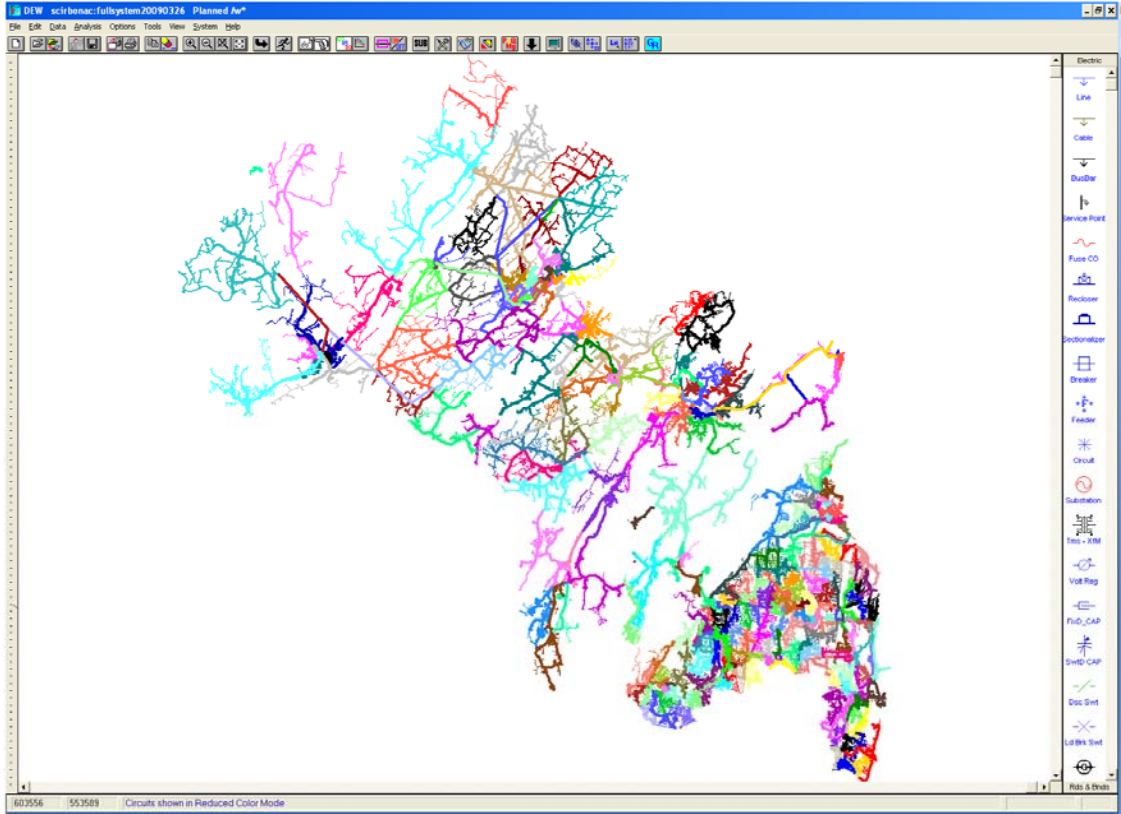
Optimization Results Circuit 23-1-13
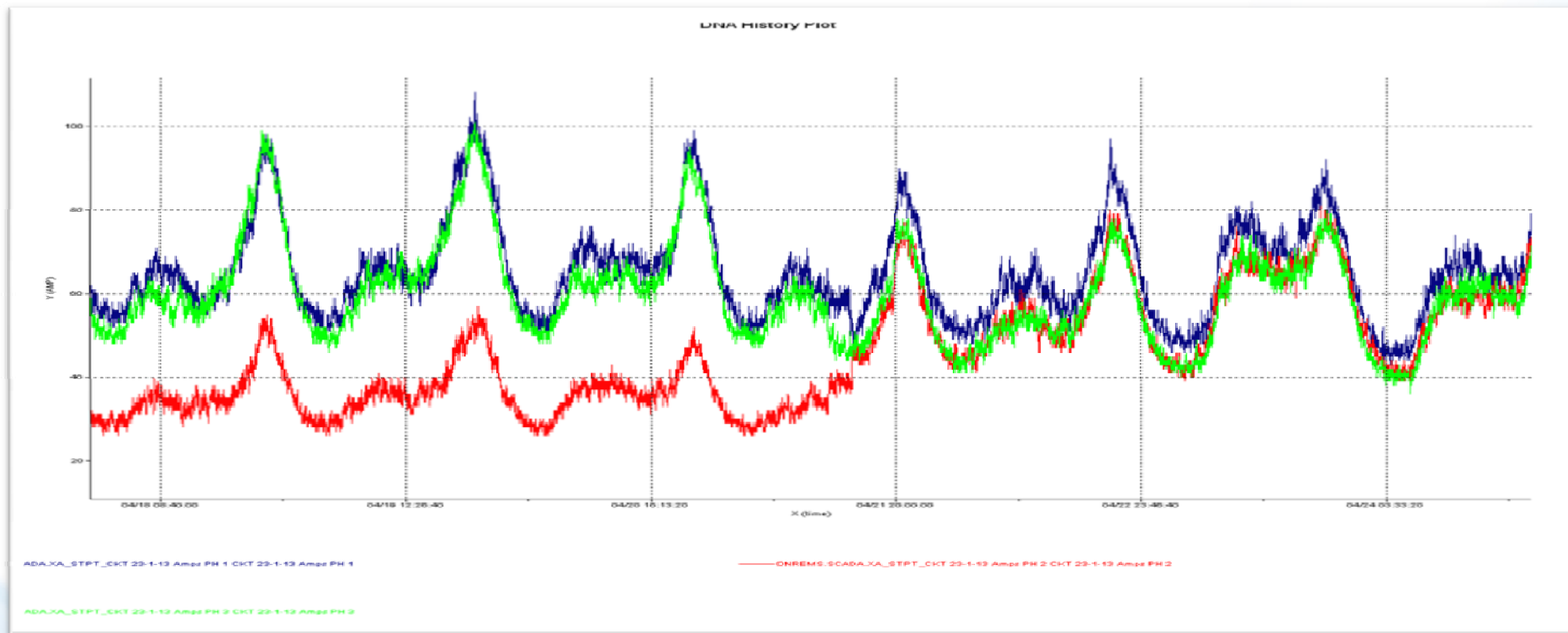
Next chapter. . .
*B*NL is understanding how Smarter Grid pays off via cost-benefit analyses

By using the model-concentric concept, ORU can operate their system more effectively and sets the stage for "hard-dollar" cost savings by:

PRIOR TO SMARTER Grid Simulation

S/S

S/S

New S/S

S/S

S/S

New Substation????
Utility Engineer Dream – Stephanie's Sub!

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New Substation????
My customer, Nora's Reality -- *Uhmm!*

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Next chapter. . .
*B*NL is understanding how Smarter Grid pays off via cost-benefit analyses

This instance, with *Smarter Grid circuits' Simulation*

S/S

S/S

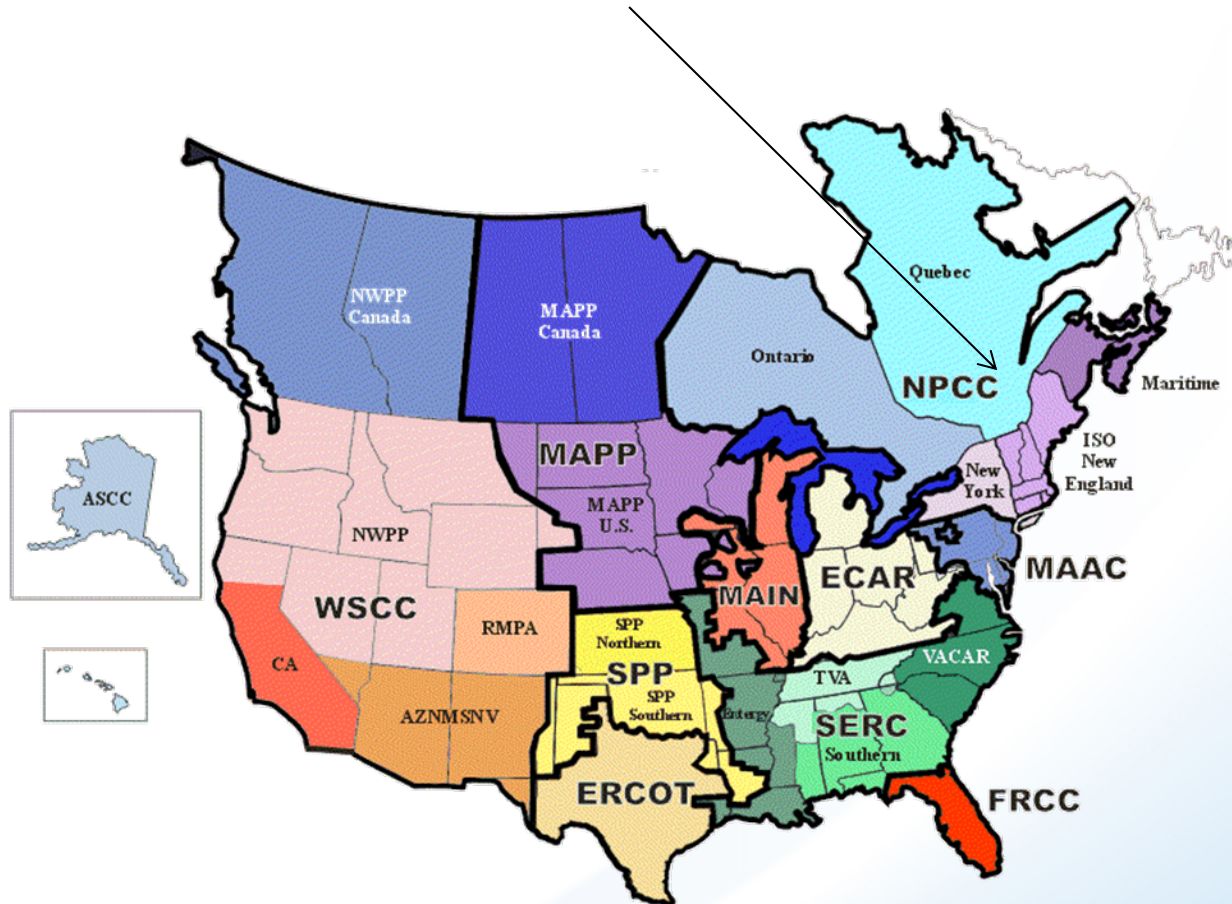New $40Million S/S (substation) deferred for 12 years.

Savings to:
Utility customers = **$14.7Million**
Utility investors = **$8.3Million**

S/S

S/S

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Smarter Grid for our Neighborhood!

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Thank You and Comments!

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