Advanced Metering Systems
(Project Set 161F)
2015 Rollout Webcast

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Advanced Metering Systems: Program 161F

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2015 Information & Communication Technology (ICT) Program

ICT Emerging Technologies & Tech Transfer (161A)
Enterprise Architecture & Integration (161E)

ICT for Transmission (161B)
ICT for Distribution (161C)
ICT for DER (161D)
Advanced Metering Systems (161F)

Primary Focus
AMI is among the utility’s largest investments and serves a mission-critical role.

Research drivers:

- The fast-changing landscape of available systems, technologies, and standards
- Diverse and evolving regulatory expectations
- Discovering new AMI system uses and value streams
- Newness of AMI ownership and associated organizational and operational challenges
- Uncertainty regarding solid state meter performance and reliability
Project Set F - Advanced Metering
Organized into Four Project Areas

Standards & Interoperability
- Strategic, industry leadership
- Bringing about the marketplace options that utilities need

Optimizing Value
- Identifying and proving system uses
- Documenting algorithms for new data uses

Meters and Devices
- Laboratory performance evaluations
- Finding limits, vulnerabilities

O&M, Best Practices
- Lessons learned, sharing and documenting approaches
- Field data gathering, working with manufacturers
Standards and Interoperability
**161F Focus Area 1: Standards and Interoperability**

**Issue**
- AMI systems are proprietary and utilities are locked-in to single sources of supply
- Lack of competition may result in higher prices and discourage innovation
- Vendors are not inclined to change

**Approach**
- Direct participation in SDOs, accelerating work
- Provide members with hardware and software tools to enable assessment
- Vendor engagement, hands-on interoperability workshops

**Better performing, more cost-effective, more manageable advanced metering systems**
Reference Implementations

Hardware and Software Evaluation Tools

- **Meter Interfaces**
  - DLMS C12.19
  - COSEM C12.18,22

- **Collectors / Access Points**
  - Networking
    - 6LowPAN
    - G3-PLC 802.15.4g

- **Backhaul Interfaces**
  - Networking
    - 3G/4G LTE
    - Fiber

- **HeadEnds**
  - Physical Layers
  - Network Layers
  - Application Layers
  - Data Models

- **Enterprise Interfaces**
  - Physical Layers
  - Network Layer
  - Application Layer
  - Data Models

- **Reference Platforms**
  - Firmware
  - Apps

- **Apps**
  - Enterprise Interfaces

- **Reference Implementations**
  - Hardware and Software Evaluation Tools

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Utility Applications

• Evaluate vendor products – neutral/unbiased tools for use at points throughout the system
  – find gaps in the “openness” of vendor offerings
  – standards are making such evaluations possible for the first time

• Discover gaps in integration of multiple technologies

• Make open source components available to the marketplace
  – lowering the hurdle for market entry, improving out of the box interoperability

• Unbiased performance assessments, help guide business decisions

• Enable certification agencies
Recommended Project Focus for 2015
Reference Meter Communication Platform for 802.15.4g

- Use a powerful and flexible development platform
- High performance and large memory, useful for many years of reference development
- Widely available, inexpensive platform

- Retain flexibility of these components – manufacturer neutrality
- No code / minimal code in these parts

User Interface for Monitoring and Testing
- Initiate, receive, route network messages
- Monitor & log activity
- Simulate various node types

Physical Interface Modules

Compliance Testing and Certification of the Platform
Recommended Project Focus for 2015
Open AMI Backhaul

- Lower layers are already standardized here (fiber, cellular, etc.), IP based
- Project recommendation is to develop a standard set of application-layer messages for backhaul
- This is applicable to existing systems
- Benefits would include:
  - Straight forward build-out of hybrid networks (multi-NAN)
  - Enabling software-only companies, better competition
  - Direct evaluation of vendor products against reference tools
Recommended Project Focus for 2015

Open AMI Backhaul

• Create a working group of utility and vendor stakeholders

• Meet to develop & document:
  – the interactions between access points and head-ends
  – Standard messages to support each (based on data model)

• Develop a reference implementation software and test harness

• Conduct an interoperability workshop with willing vendors

• Transfer work to standards group (e.g. IEC)
Optimizing the Value of AMI Investments
161F Focus Area 2: Optimizing Advanced Metering System Value and Utilization

Issue

• AMI systems have the potential to be utilized in many ways and their data to be processed for many purposes.

• Need to identify and prove-out potential additional uses of AMI systems and data. System impacts and benefits need to be quantified in order to aid utilities in business case development and in optimizing the value of AMI assets.

Approach

• Establish industry databases, analyze results
• Develop algorithms for data analytics
• Conduct trials, share experiences
• Work with AMI providers directly

Maximizing the Return on AMI System Investments
Recommended Project Focus for 2015:
Web-Based Database of Industry AMI Status and Uses

- Finalize and launch web database
- Provide incentives for initial population by utilities
- Analyze data
- Develop report and provide results to members
AMI Operation and Management

O&M, Best Practices
161F Focus Area 3: Advanced Metering Systems Operations and Management

Issue

• Management and operation of AMI fixed networks is a new endeavor for utilities.
• The systems are recent inventions, and best practices are just being discovered for their deployment, operation, health monitoring, management, and replacement.

Approach

• Identify best practices, track industry experiences
• Utility focus groups developing common approaches
• Engaging subject-matter experts. Assess together, refine

Reduce total cost of ownership. Extend system life and reduce risk of unexpected rise in system failures.
161F Focus Area 3:
Advanced Metering Systems Operations and Management

- AMI system prognostics process
- Radio network management, maintenance and recovery practices
- Planning and migration strategies for AMI system replacement
- Organizational for managing overall AMI operations
- Lessons learned, best practices, and content repository for customer relations and communication regarding meters, functionality, deployments

Reduce total cost of ownership. Extend system life and reduce risk of unexpected rise in system failures.
Recommended Project Focus for 2015:
AMI Prognostics Guidebook, Version 2
AMI PHM Process

Shift is Proportional to Used Service Life
Meters and Devices
161F Focus Area 4: Performance Evaluations of Electricity Meters

Issue

- Solid state electricity meters are still new by utility timelines. There are many questions regarding their capabilities, accuracy, environmental sensitivities and tamper resistance.
- Utilities are still in their first generation of solid state residential meters and have questions regarding their characteristics.

Approach

- Perform laboratory evaluations
- Collect field data
- Coordinate through the AMI/Metering Interest Group

Ensuring the Dependability and Accuracy of the Electricity Meter
Example Projects

- 2-150KHz sensitivity (joint project with P1)
- Anti-theft measures (detection of bypass and load)
- Meter sensitivity to Intentional EMI (IEMI)/EMP
- Enabling consistent power quality measurements
- Standard sub-meter socket (joint with P174, P94, P18)
- Measurement method for up/down regulation services

Prior Year Projects

- Meter tolerance of high voltage (sustained and surge)
- Sensitivity to DC current and magnetic fields
- Accelerated life testing
- Hot socket detection
Recommended Project Focus for 2015: Meter Registration Errors Due to 2-150KHz Noise

- Characterize actual field levels at member sites
- Perform laboratory testing with a range of meters
- Identify filtering/mitigation methods
- Coordinate findings with ANSI and IEC standards groups
EPRI Metering and AMI Interest Group

An Open Forum of Metering and AMI Experts

Identifying Issues, Sharing Ongoing Actions and Discoveries:

- Meter accuracy
- Theft / tamper
- Life cycle management
- Failure mechanisms
- Best practices
- Standards gaps

This expert group serves to help guide and inform the 161F research portfolio
Technology Innovation
2015-2017 Enabling Smart Meter Open App Platforms

Problem Statement
• Semiconductor technology advancement has made open platform capability practical
• Vendors are creating platform capability anyway, but not “open”, they need help

Project Goal
• Engage utilities and AMI vendors to develop, implement, and demonstrate an open app smart meter capability enabling:
  – Consistent behavior across brands
  – Systems more accessible and flexible for utility uses
  – Reduced lock-in and dependencies
Concept Report Available

Transforming Smart Grid Devices into Open Application Platforms

EPRI Report

3002002859
Focus Group Activity

- Meeting weekly to develop the open platform specification for smart meters
- Other utilities and meter/AMI vendors encouraged to join the discussion
- Working towards a demonstration
Same App

Downloaded to two Independent Meter Platforms

Identical Result & Behavior
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Discussion
Together…Shaping the Future of Electricity