

NIST Smart Grid Program

Smart Grid Data Access to Consumers: Green Button Initiative

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Outline

- Introduction
 - Smart Disclosure
 - NIST Framework: Customer Domain
- Smart Grid Data - access to consumers
 - Privacy overview
- Green Button Initiative
 - Energy Usage Information standardization
 - Current status
 - Future Plans



www.nist.gov/smartgrid
www.greenbuttondata.org

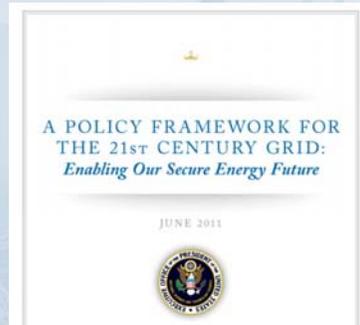


Standards – Key Aspect of US Smart Grid Policy



The Energy Independence and Security Act of 2007 gives NIST “*primary responsibility to coordinate development of a framework that includes ... **standards** ... to achieve **interoperability** of smart grid devices and systems...*”

White House June 2011 Policy Framework includes 4 key Federal policy recommendations:
enable cost-effective smart grid investments, unlock innovation, **empower and inform consumers**, and secure the grid



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Smart Disclosure and Open Government

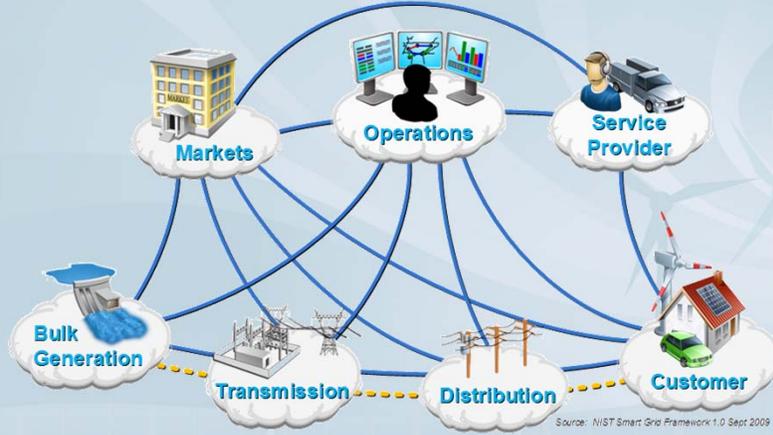
- Smart disclosure refers to the timely release of complex information and data in **standardized, machine readable formats** in ways that **empower and enable consumers** to make informed decisions
 - Product or Service Data, Data on Providers, Individualized Consumer Data
- White House Initiative – Smart Disclosure Task Force
- Open Government Directive
 - Transparency and Open Government – January 21, 2009
 - Data.gov – May 21, 2009 (Energy.data.gov – June 2011)
 - Open Government Partnership National Action Plan Sept 2011
 - Smart Disclosure Summit March 30, 2012
 - Blue Button (Health IT), Green Button (Smart Grid) key examples

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NIST Framework: Smart Grid Domains

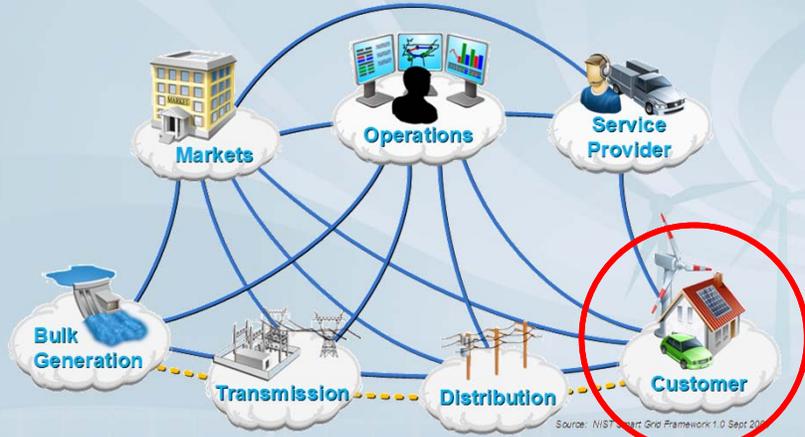


Source: NIST Smart Grid Framework 1.0 Sept 2009

Standardized architectural concepts, data models and protocols are essential to achieve interoperability, reliability, security and evolvability



NIST Framework: Smart Grid Domains

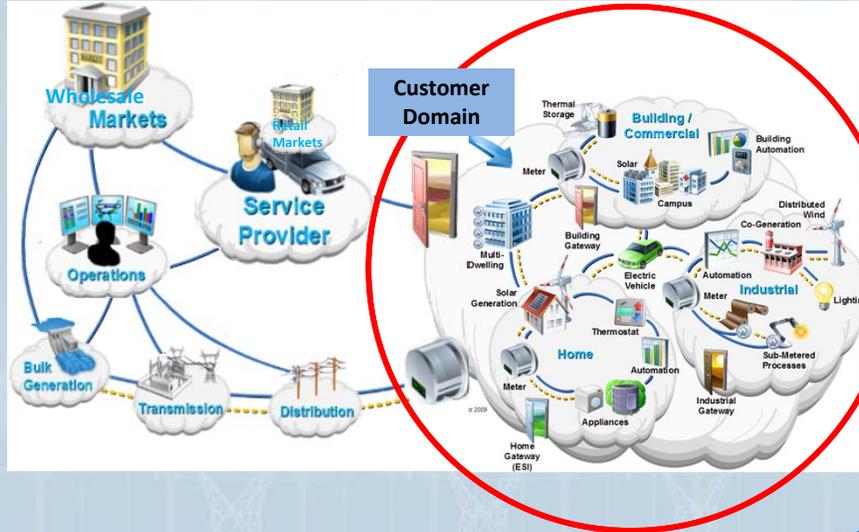


Source: NIST Smart Grid Framework 1.0 Sept 2009

Standardized architectural concepts, data models and protocols are essential to achieve interoperability, reliability, security and evolvability



Customer Domain



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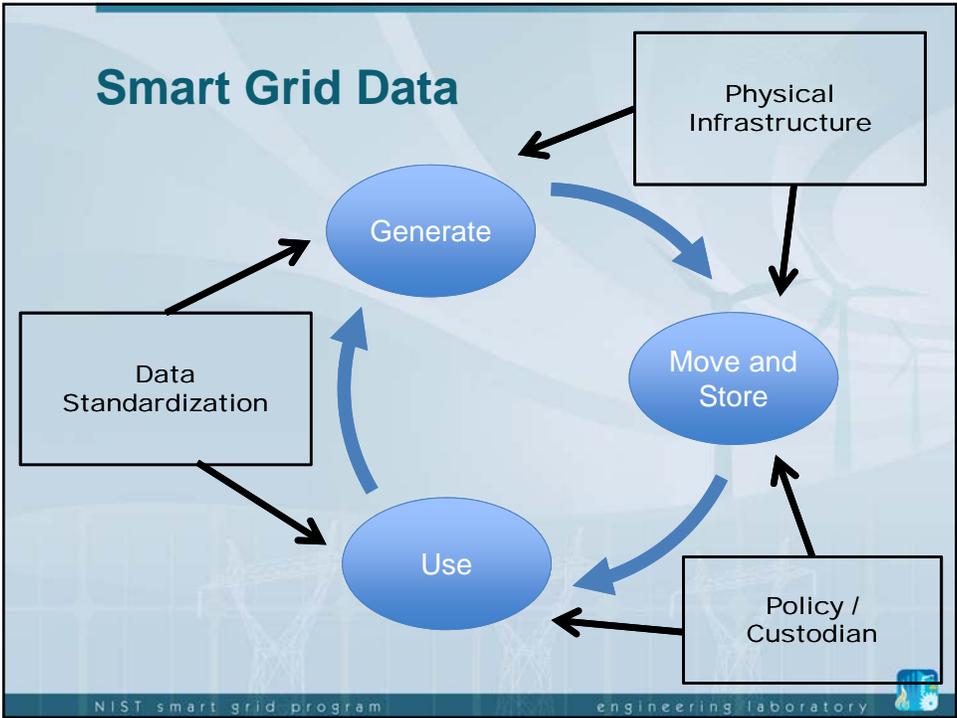
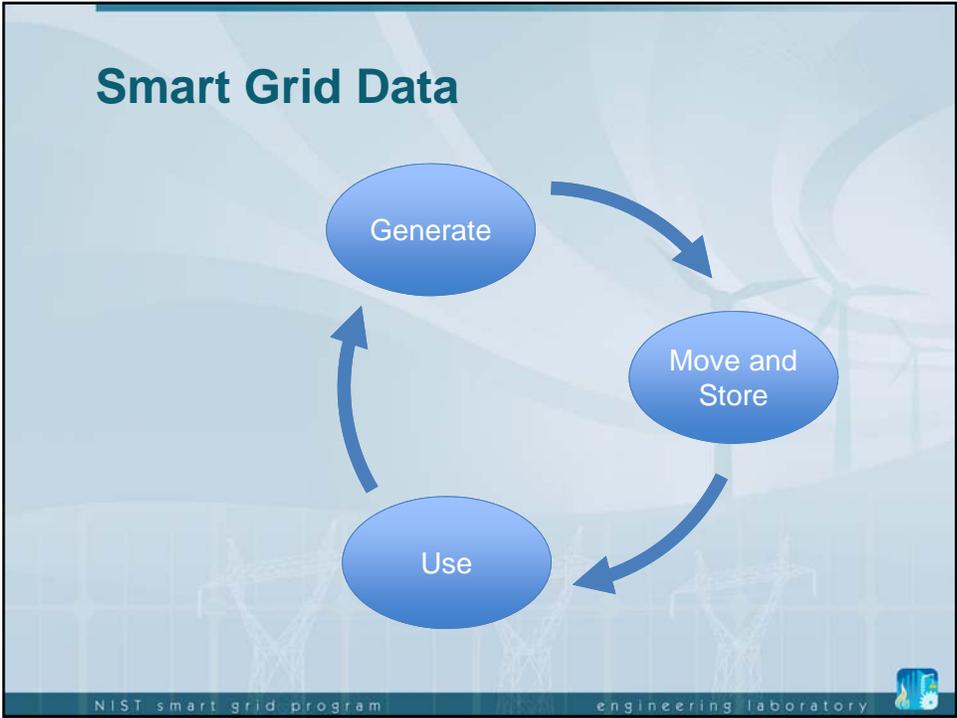
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Energy Usage Information Vision



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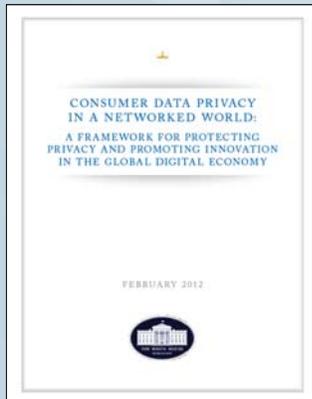
Smart Grid Data – Energy Usage Information

- Physical Infrastructure
 - Smart Meters
 - Meter Communications and Utility Back-end Systems
- Privacy / Custodian
 - US privacy blueprint and privacy efforts
 - US States policies on data access
 - Third Party data access authorization by consumer
- Standardization
 - Energy Usage Information Basics
 - Green Button

Goal: Ecosystem of innovative smart grid products and services based on energy usage information

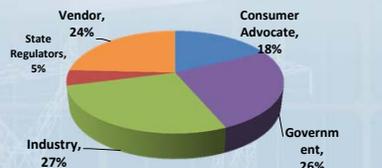


Administration Privacy Blueprint – Feb 2012



- Guides efforts to give users more control over the use of their personal information and help businesses maintain consumer trust.
- Recommends convening stakeholders to develop and implement enforceable privacy policies based on the Consumer Privacy Bill of Rights
- In the energy utility sector, the Federal Smart Grid Task Force (led by Dept. of Energy) is leading privacy efforts.
 - DOE hosted Smart Grid Privacy Workshop on 31 Jan 2012 to convene multiple stakeholders in a collaborative process

Press Release: <http://www.whitehouse.gov/the-press-office/2012/02/23/we-can-t-wait-obama-administration-unveils-blueprint-privacy-bill-rights>



Breakdown of 80 participants by Organization Type



Data Access Policies – US States

- Typical issues include customer consent, uses of data, contract terms, aggregation, and cost recovery
- Variety of US state policies
 - Most states have not acted, typical default is no third party access
 - Several states have adopted specific policies: California, Colorado, Oklahoma, Oregon, Pennsylvania, Texas, Vermont, Washington, and Wisconsin
 - Additional states have open dockets and or legislation pending
- Example: Primary purpose vs. secondary purpose use of data
 - Primary: no consent required for energy efficiency, demand-side management, and energy management programs
 - Secondary: consent required for everything else
- Example: Aggregated data and anonymization of individual use
 - 15/15 rule: aggregated data must contain at least fifteen customers or premises, and no single customer's data may comprise more than 15 percent of the total aggregated data

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Some Emerging Privacy Standards

- Fair Information Practice Principles (FIPPs)
- Consumer Privacy Bill of Rights
- Federal Trade Commission (FTC) Codes of Conduct
- North American Energy Standards Board (NAESB) REQ22 Third Party Access to Smart-Meter-based Information
 - NAESB REQ21 Energy Service Provider Interface ESPI, on which Green Button is based
- U.S. Chamber of Commerce Privacy Seal (and similar)
- TRUSTe program of Electronic Frontier Foundation and CommerceNet Consortium
- Others ...

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Cyber Security Working Group & Privacy Subgroup

- NIST sponsored Cyber Security Working Group (CSWG) established in April 2009, now part of NIST's Smart Grid Interoperability Panel (SGIP)
 - Privacy subgroup started June 2009
- NIST CSWG developed and published the *Guidelines for Smart Grid Cyber Security* (NISTIR 7628) in August 2010
 - Volume 2 of NISTIR 7628 covers privacy
 - Recommendations include: Conduct Privacy Impact Assessments, Document privacy policies and practices, Develop privacy use cases, Educate public, Share solutions, and Collect only necessary energy and personal data

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CSWG Privacy Subgroup Since NISTIR 7628

- Train-the-trainer powerpoint slides to assist organizations in developing materials about smart grid privacy issues
- Recommendations for protecting privacy when dealing with energy usage information for Third Parties receiving the data *without* utility involvement
- Addition of privacy analyses and mitigations to NISTIR 7628 use cases
- Review of NAESB REQ.22 Third Party Access to Smart Meter-based Information compared to NISTIR 7628, Volume 2

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Let's Directly Empower Consumers with Data

A Challenge – Design a “Green Button”

A Challenge to Industry: How can we safely and securely provide customers electronic access to their energy information, thereby supporting the continuing development of innovative new products and services in the energy sector?



Sept 2011 OSTP Blog:
Modeling a Green
Energy Challenge after a
Blue Button

Key Principles

- Use SGIP standards
- Open, Collaborative
- Multi-Stakeholder
- “Lean Startup”
- Easy-to-use



Aneesh Chopra – former U.S. Chief Technology Officer – September 2011

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What is Green Button?

- *Common-sense idea that electricity customers should be able to download their own energy usage information in a consumer- and computer-friendly electronic format from their utility's secure website.*
- *A common experience, from provider to provider, setting clear expectations that consumers' information is theirs to have – and share.*



**Green Button
Download
My Data**

Source:

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Green Button: An overnight success ... leveraging several years of good smart grid standards work!

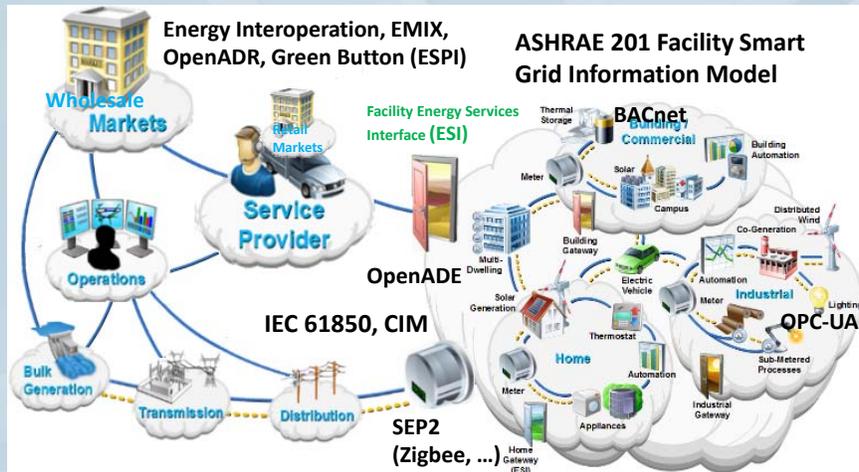
- OpenADE (Open Automated Data Exchange): an early industry standards effort (OpenSG users group) responding to (California) requirements for sharing energy information securely with third parties
- NIST SGIP Priority Action Plan accelerates resolution of issues, and consensus emerges around an industry standard North American Energy Standards Board (NAESB) Energy Usage Information (PAP10) completed Dec2010
- Further industry-led standardization produced NAESB REQ21 Energy Services Provider Interface (ESPI) completed Oct 2011
 - Based on OpenADE and NIST SGIP efforts
 - Privacy: REQ22 Third Party Access to Smart-Meter-based Information
- The new standards define a flexible file format basis for Green Button, with initial implementations using a subset of ESPI and energy usage information.



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Consumer Domain – Standards



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Energy Usage Information



Dimensions

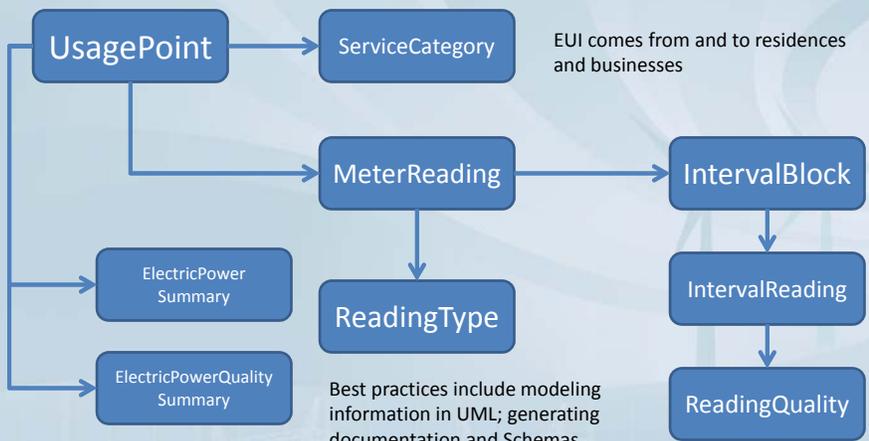
- Measurements of power, energy, gas, water, ...
- Quality: Raw, validated, estimated, ...
- Source: Meter near real-time, utility back end, third party
- Economics: Consumers need to know the cost of their consumed power (but we did not construct a pricing model)
- Identification: by customer, device, location

Kinds of Data

- Readings
- Interval data
- Summary Information
- Power Quality Metrics

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Composition of Energy Usage Information



```

classDiagram
    class UsagePoint
    class ServiceCategory
    class MeterReading
    class IntervalBlock
    class ReadingType
    class IntervalReading
    class ReadingQuality
    class ElectricPowerSummary["ElectricPower Summary"]
    class ElectricPowerQualitySummary["ElectricPowerQuality Summary"]

    UsagePoint --> ServiceCategory
    UsagePoint --> MeterReading
    UsagePoint --> ElectricPowerSummary
    UsagePoint --> ElectricPowerQualitySummary
    MeterReading --> IntervalBlock
    MeterReading --> ReadingType
    IntervalBlock --> IntervalReading
    IntervalReading --> ReadingQuality
    
```

EUI comes from and to residences and businesses

Best practices include modeling information in UML; generating documentation and Schemas directly from the UML for life cycle model and data management

Note: This information is multidimensional. Many different reading types, summaries, and readings possible.

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Web Technologies for Definition and Presentation of Green Button File Format

XML Schema (XSD)

- Describes the rules of file format

XML

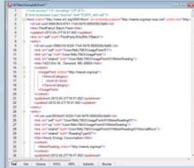
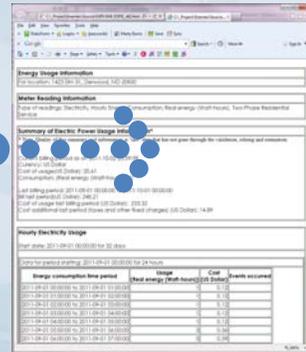
- Contains customer EUI data in standard file format and references to XSD and XSLT

XSLT

- Defines how to transform for humans



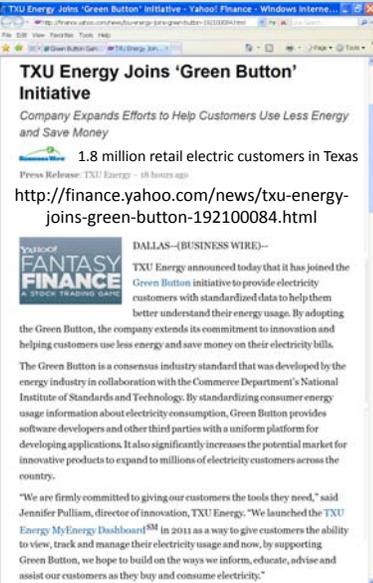
Standard EUI file Format



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Green Button Implementations and Commitments



- After 3 month development, Green Button launched in January 2012 with access for 6 million consumers in California (hourly interval data available one day later)
- Additional Green Button commitments announced 2 May 2012, now totaling 30 million customers in 2012/2013 see www.greenbuttondata.org for list
- White House press release: http://www.whitehouse.gov/sites/default/files/microsites/ostp/green_button_release_2012_05_02.pdf
- Vendor example: Based on year's worth of Green Button data for a commercial building, Retroficiency used its virtual energy assessment and found that the building could reduce consumption by one-third through a variety of retrofits. <http://www.greentechmedia.com/articles/read/green-button-gains-more-believers/>

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The ecosystem of companies and organizations supporting and using Green Button data...

- Utilities
- Utility software vendors
- Apps developers
- Device manufacturers
- Standards organizations

Source: NIST smart grid program engineering laboratory

What people are saying about Green Button...

It may finally give consumers a reason to care about the smart grid.

– SF Chronicle

Solar companies are also eager for consumer data because understanding a homeowner's electricity use is key to the sales process.

– San Jose Mercury News

The project is important because it is a broad-based plan to take energy data and standardize the format of it, open it up (while also providing security) and make it readily available to consumers.

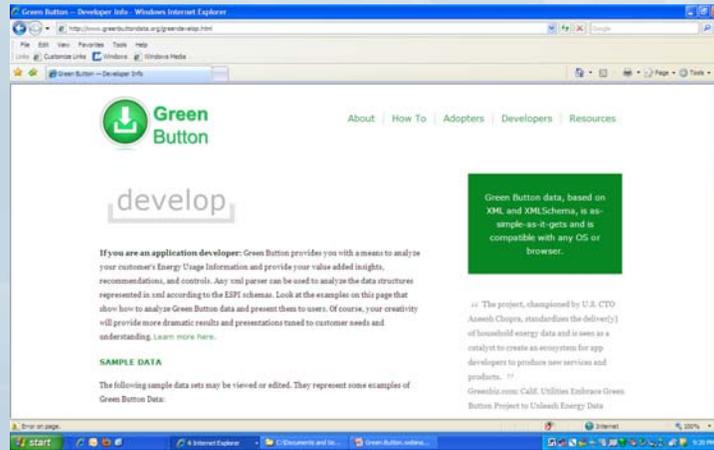
– Gigaom

I'm a big fan of simplicity and open standards to unleash a lot of innovation....I'm going to reach out to ConEd, the utility in NYC, and find out when they are going to add Green Button support to their consumers data. I hope it is soon.

– Fred Wilson (Venture Capitalist)

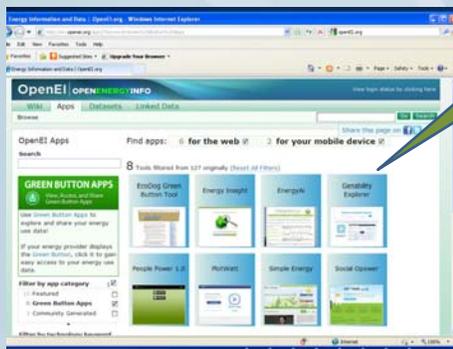
greenbuttondata.org

- Developer's page:
<http://www.greenbuttondata.org/greendevlop.html>



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New Green Button Apps and Competitions



Green Button Apps!

An advertisement for the 'Apps for Energy' challenge. It features the text 'APPS FOR ENERGY' in a large, stylized font. Below it, it asks 'Are you a software developer? Build the best energy app and you could win part of a \$100,000 prize.' A hand cursor icon is shown pointing at a green 'E' logo.

<http://openei.org>

<http://appsforenergy.challenge.gov/>



Consumers challenged to reduce electric use via Smart Meter Texas portal www.smartmetertexas.com

Source: NIST smart grid program engineering laboratory

What might Green Button data be good for?

Empower Consumers and Spur Innovation

Insight: entrepreneur-created web portals analyze energy usage and provide actionable tips;

Heating and Cooling: customized heating and cooling for savings and comfort;

Education: community and student energy efficiency competitions;

Retrofits: improved decision-support tools to facilitate energy efficiency retrofits;

Verification: measurement of energy efficiency investments;

Real Estate: provide energy costs for tenants and/or new home purchasers;

Building Benchmarking: transfer monthly data

Solar: optimize the size and cost-effectiveness of rooftop solar panels.



Source:

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Future Plans

- New SGIP Priority Action Plan 20 for Green Button
 - Additional revisions to NAESB standards, international standardization, development of testing and certification (UCAIug OpenADE – Open Automated Data Exchange)
- Green Button Download My Data
 - Consumers directly download their energy usage information, typically hourly interval data (available one day later) for previous 13 months, then they can choose to share it with third parties to receive value-added services
- Green Button Connect My Data
 - More persistent and automated data exchange from utilities to third parties as authorized by consumers
 - Uses fuller functionality of NAESB ESPI standard, some utilities are ready and interested in implementing

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Questions?

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