Smart Grid Enabled Distributed Energy Resources: Right-Sized Energy Resources

Westchester Climate Change Summit

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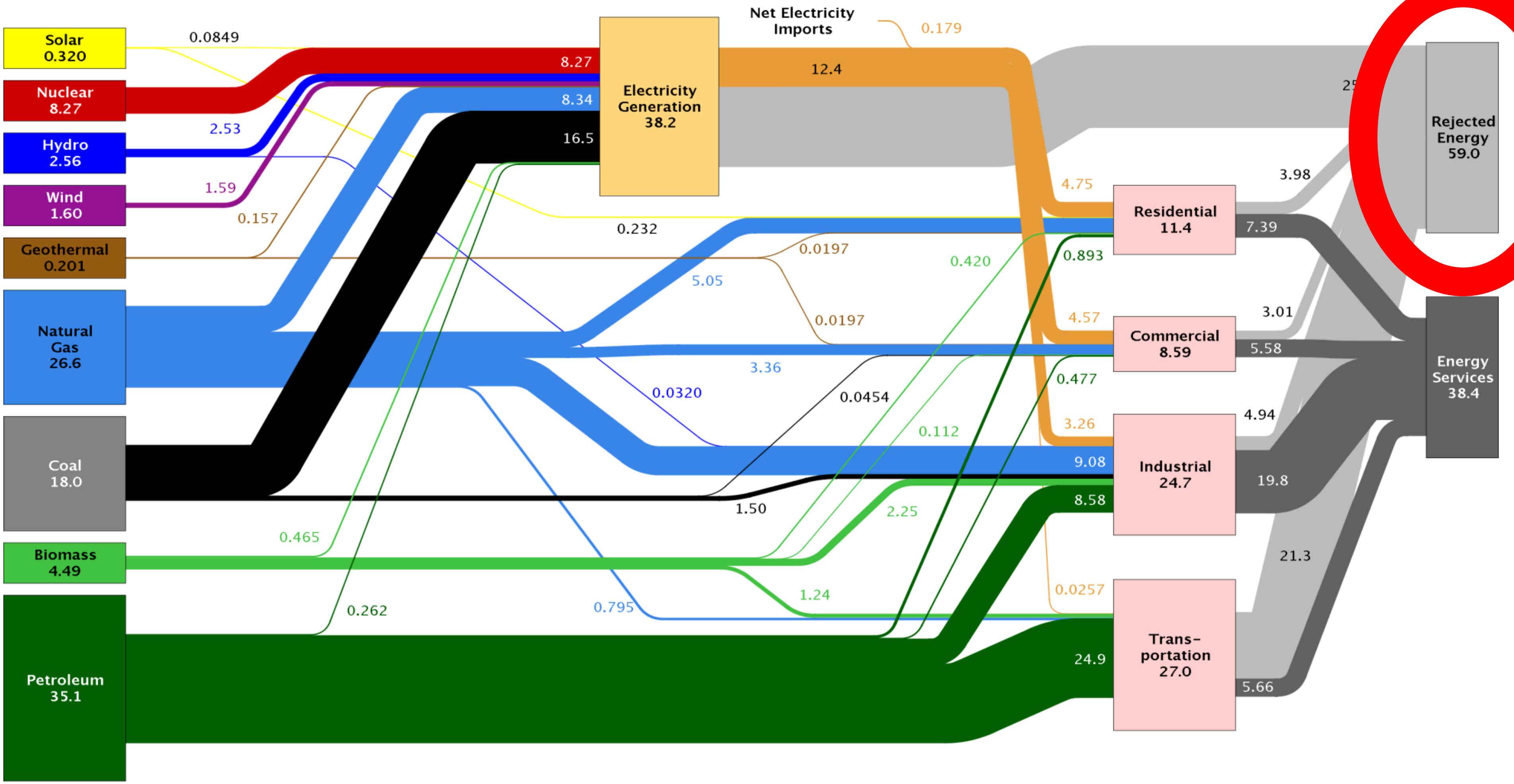
Clean energy for all communities, today and tomorrow!

Estimated U.S. Energy Use in 2013: ~97.4 Quads

Lawrence Livermore National Laboratory



Source: LLNL 2014. Data is based on DOE/EIA-0035(2014-03), March, 2014. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports consumption of renewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential and commercial sectors 80% for the industrial sector, and 21% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

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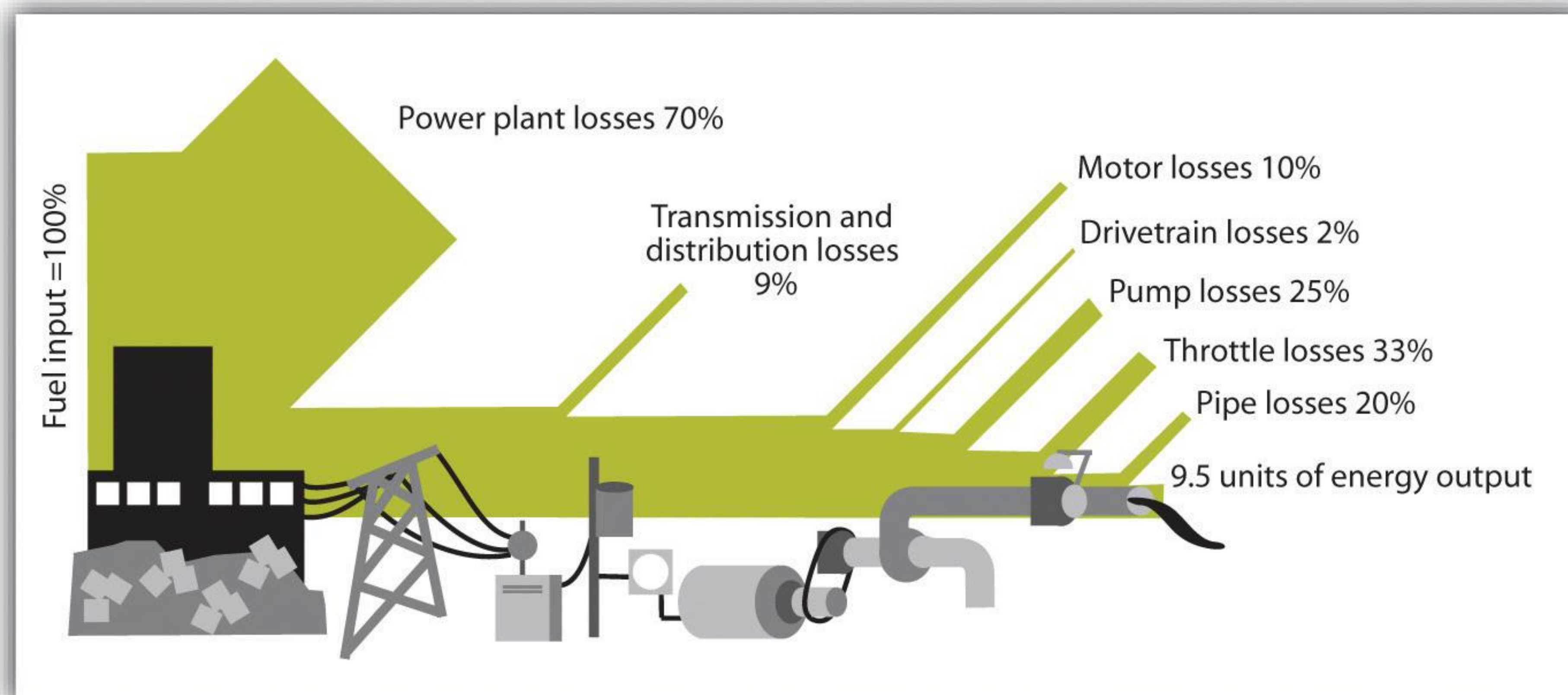
Electricity Use Today is Wasteful – An Opportunity!



ach unit of savings generates 10X in avoided fuel and emissions
50X for incandescent lighting!

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1. Introduction - Context

- Prolonged recession and divided politics have dampened enthusiasm for energy efficiency and climate change policies
- However, the long term drivers for change are still here
  - Energy security and reliance on imported oil
  - The environment and climate change
  - The growing affordability of carbon-free supply-side options
- Local communities are even more important now – distributed energy resources and customer-level energy management is the future, especially with a Smart Grid

1. Introduction – More Regional Resources

- Northeast is the epicenter of activity for critical infrastructure resiliency - in 2014, CT, MA, NJ and NY, up to $150 Million for development
  - NY Gov. Cuomo announced $40 Mil NY “Microgrid Prize” competition
  - CT authorized $30 Mil for Phase II and III MGrid Pilot
  - MA Gov. Patrick announced $40 million for community microgrid development
  - NJ established a "resiliency bank”

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1. Introduction - Outline of Talk

- The smart(er) grid (SG) is a means to provide services and support technology deployment; it is not an end in itself
- The potential economic value of SG-enabled DER is very substantial
- However, there are important challenges ahead
- Local communities have an important role to play, especially now in the US, to overcome some of these problems
- Integration of interested parties is a key theme and local government can help, as a leader and convener - Austin Texas provides a good example

2. Vision – The Old and New (Smarter) Electricity Paradigm

	Old Paradigm	Smart Grid Paradigm
Balancing the system	Generation ramped up and down	Generation and demand both contribute actively
Generation	Large scale and distant from markets	Smaller scale, renewable and decentralized
Transmission	Smart	Smarter
Metering/retail	Dumb and one way	Smart and two way
Consumer	No response to system needs or real time prices	Active in managing system via response to price

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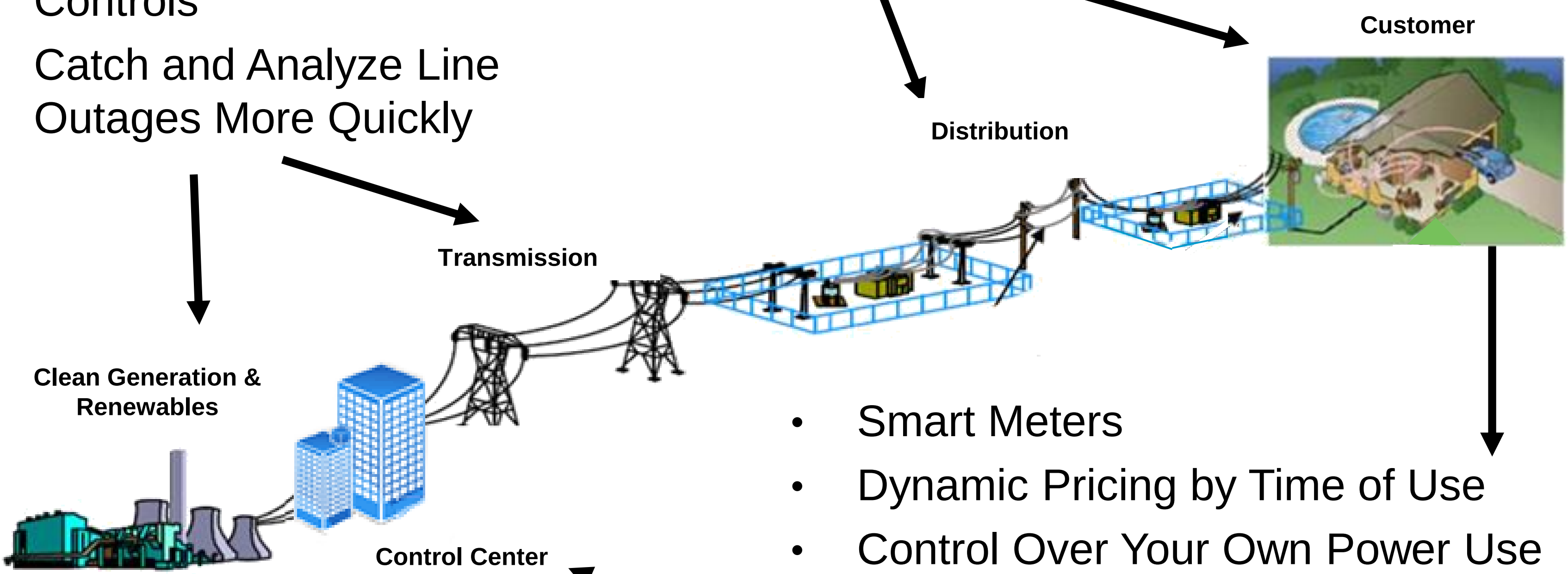
How Does the Smart Grid enable DER?

- Sensors and Other IT Controls Diagnose and Manage Substations
- Locate/Fix Line Outages

- Fast Sensors and Controls
- Catch and Analyze Line Outages More Quickly



- Smart Meters
- Dynamic Pricing by Time of Use
- Control Over Your Own Power Use
- Integrate Local Power Sources
- Sell Power Back to the Grid

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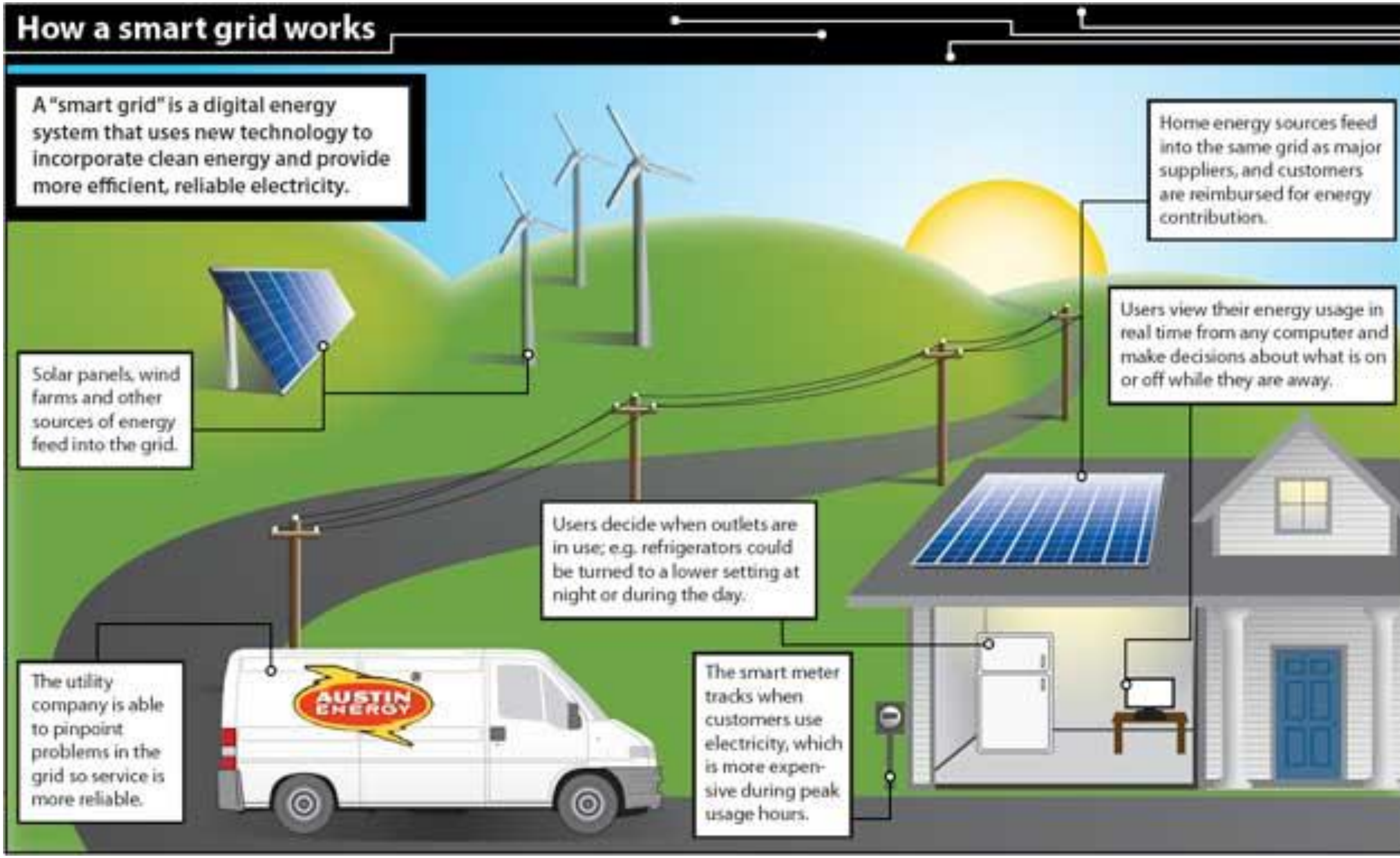

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2. The Smart Grid – Change Everything

- Improve the benefits of EVs
- Integrate distributed generation and storage
- Improve grid reliability
- Raise large new cyber security and privacy issues
- Above all: Change the business model and regulation (NY REV)

Photo Source: EVB Energy Ltd. Smart meter used by EVB Energie AG. 12 August 2008. Wikimedia Commons.

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2. Smart Grid - Change Everything

At a cost of …
$ 250 Billion Dollars

Photo Source: EVB Energy Ltd. Smart meter used by EVB Energie AG. 12 August 2008. Wikimedia Commons.

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3. The Potential Benefits of SG-Enabled DER

- The SG can benefit customers by generating value for customers in the form of avoided costs.
- Major value elements
  - Automated meter interface (AMI)
  - Demand response (DR)
  - Energy efficiency (EE)
  - Distributed generation (DG)
  - Plug-in electric vehicles (PHEV or EV)

3. Potential US Benefits to 2050: $227–568 Billion

National Smart Grid Valuation Summary, 2010 - 2050

Present Value of Avoided Costs, Millions of $

	Meter O&M	Generating Capacity	Energy from Electricity*	Energy from Gasoline	Carbon	Reliability	Total
AMI	$51,367	$0	$0	$0	$0	$0	**$51,367**
DR (Dynamic Pricing)	$0	$32,510	$10,367	$0	$2,230	$0	**$45,107**
DR (Enabling Technology)	$0	$12,195	$3,646	$0	$784	$0	**$16,625**
EE (IHDs)	$0	$3,125	$16,089	$0	$3,461	$0	**$22,675**
EE (Building Commissioning)	$0	$4,204	$15,719	$0	$3,381	$0	**$23,304**
DERs	$0	$12,432	$29,237	$0	$3,225	$22,966	**$67,860**
Total without PHEVs	**$51,367**	**$64,466**	**$75,058**	**$0**	**$13,081**	**$22,966**	**$226,938**
PHEVs	$0	-$10,811	-$211,151	$560,123	$3,061	$0	**$341,222**
Grand Total	**$51,367**	**$53,655**	**-$136,093**	**$560,123**	**$16,142**	**$22,966**	**$568,160**

** Also includes value of ancillary services for DERs*

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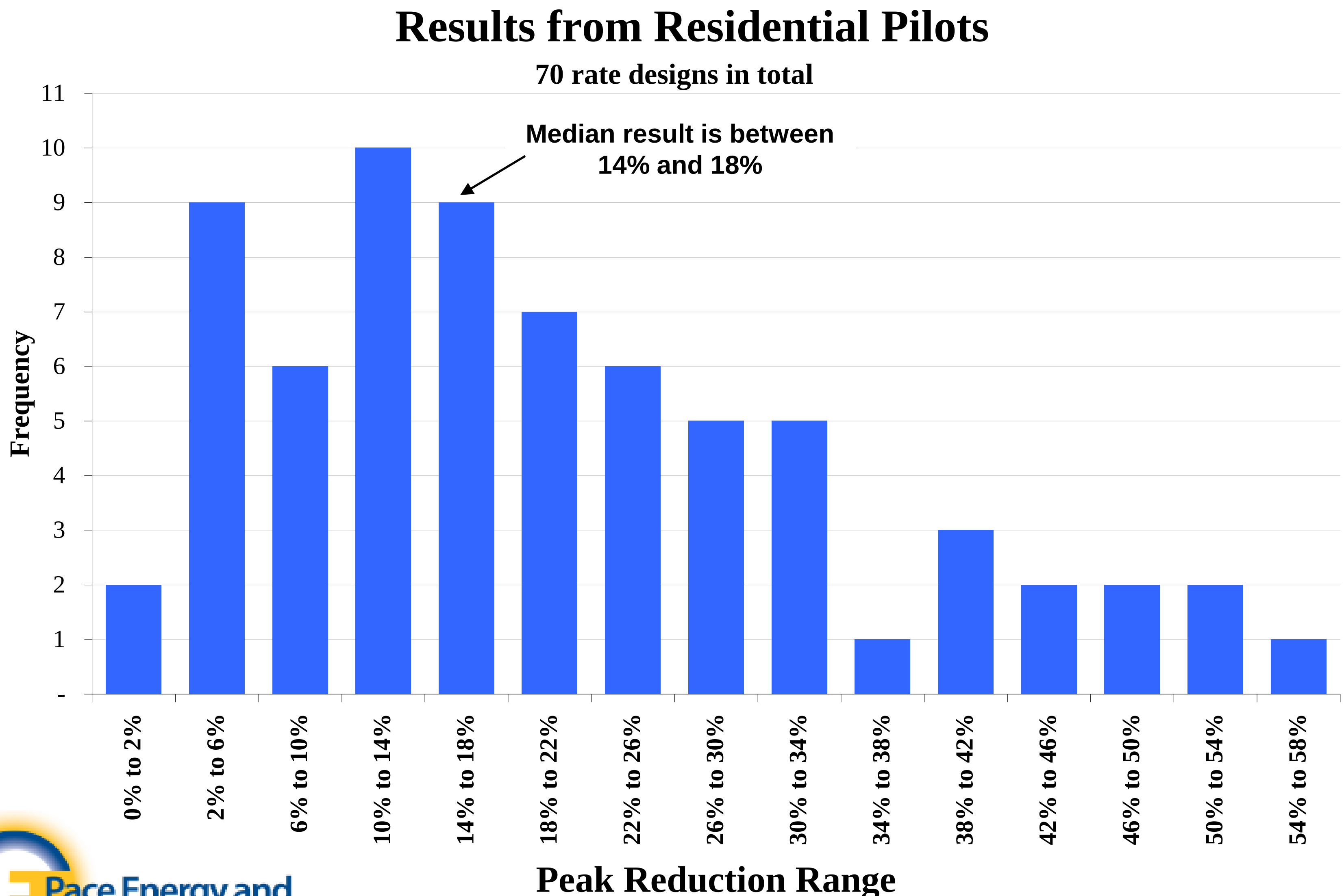
3. Potential Benefits of Dynamic Pricing



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4. Barriers to Realizing the benefits

- Health concerns – wireless communications and radiation
- Privacy concerns – does the utility know when I am bathing?
- Security – will SG facilitate computer hacking
- Above all, there are economic and financial concerns
  - Will the benefits outweigh the costs for the system?
  - How to finance the change – massive investment now, benefit later?
  - Regulated companies may have incentives to sell more energy, not less
  - Customers are concerned they may pay more with smart meters
- A central challenge is to address these concerns

5. Role of Local Communities

Local governments can help overcome these problems

- Integrate SG into energy and climate change strategy (Vision)
- Coordinate organizations and institutions to achieve Vision
- Prepare citizens for SG, DER, and new services
- Carry out pilots to understand implications and address concerns
- Support SG roll out by utility and competition (where allowed)

Those with facilities and operations

- Invest directly in renewable energy facilities, EE, and SG
- Put profits back into the business of advancing sustainability

Microgrids, CHP, Community Solar, Demand Response, etc.

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5. Case Study: Pecan Street Research, Inc.

- Not-for-profit corporation
- Founders include
  - University of Texas
  - City of Austin
  - Austin Energy
  - Austin Technology Incubator
  - Austin Chamber of Commerce
  - Environmental Defense Fund
- Community-wide collaboration to advance smart grid and utility of the future – as a model for the US and the world
- Recipient of $10 million in federal funds
- pecanstreet.org

5. Role of Local Communities - Microgrids

- Microgrids usually incorporate some local distributed generation and may allow for Smart Grid/DER benefits.
- Where microgrids are connected to macrogrids, they may
  - Reduce the costs of relying on the macro-grid (depending on relative cost)
  - Sell services to the macro-grid (using demand response and local generation)
  - Create greater security of supply (relying less on macrogrid)

6. The Way Forward for Local Communities

- Concentrate on realizing the benefits of SG-enabled DER
  - Financial, economic, operational, engineering
  - “Small Is Profitable,” Rocky Mountain Institute (2002)
- Define a Vision: SG-enabled DER is a tool to provide services to customers and give them the flexibility to buy the mix of services that fits
- Promote integration of public and private, civil society, and consumers to pursue the common goal of energy and environmental sustainability

Through integration of a full range of distributed energy resources, communities can make the Smarter Grid a success and a powerful strategy to address climate change

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How Pace Energy & Climate Center Can Help

- Technology, project development, and regulatory training and education
- Best practices and case study analysis
- Regulatory and policy support, especially in the NY REV, rate cases, and other regulatory proceedings
- Technical, economic, financial, regulatory, and operational feasibility analysis
- In-house expert advice and support for project teams
- Stakeholder engagement process support

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Thanks!

Come see us in the E-House!

(big yellow building with the solar panels on top)

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