Electrification:
Options for Consumers and the Environment

March 5, 2019

Materials will be available at:  www.eesi.org/030519beneficial

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Efficient Electrification

Barbara Tyran
Executive Director, Government & External Relations

EESI Briefing
March 2019
Efficient Electrification

Mobility

Heating and Cooling

New Applications
Meeting Future Customer Energy Expectation

Integration can Improve Reliability, Increase Efficiency, Create New Opportunities, and Expand Customer Choice

Integrated Energy Network (IEN)

IEN leads to an increasing societal reliance on electrification and resiliency will be key – cyber and physical resiliency against man-made and natural disaster
US EV sales exceed 782k through end of February 2018

US EV sales exceed 782k through end of February 2018
Customer choice increasing with ~90 EVs by 2022
Range of battery electric vehicles (BEVs) is also increasing
Looking Ahead – Today and Tomorrow

- New transportation models
- 200+ mile mass-market battery electric vehicles
- High power charging
- Autonomous driving
Winter Olympics 2018

Clean Air... Clear Choice
Indoor Agriculture

Clean Air... Less Water...
Less Land... Less Pesticide...
More Yield... Clear Choice
Emerging and Enabling Technologies

Sharing Economy

Cryptocurrencies

Augmented Reality

Blockchain Transactions

"Wattcoin is Bringing Blockchain Technology to the Energy Industry"
US National Electrification Assessment

April 4, 2018

EPRI Study Finds that a Consumer-Driven Increase in Electrification Provides Lower Cost, Less Energy Use, and Fewer Emissions
Customer Choices for End-Use Energy:

- Economy-wide assessment - Residential, commercial, industrial and transport
- Customers have broad technology choices and control
- Customer decisions integrated with detailed electricity supply model
Critical Trends: “Shared” Integrated Grid

Customer Engagement  Connected Devices = Shared Economy  Community Resiliency
Together...Shaping the Future of Electricity
Beneficial Electrification: The Future Is Electric!
Beneficial Electrification League (BEL)

Introduction!
Electrification Futures Study (EFS) Overview

Goal: explore potential & impact of electrification of U.S. economy; power sector focus

www.nrel.gov/efs

Multi-year research effort with development of a series of publications, tools, and data, to be released and finalized as the project continues.
<table>
<thead>
<tr>
<th>EFS Scenario Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reference</strong></td>
</tr>
<tr>
<td>• No dramatic technological, societal, or policy changes</td>
</tr>
<tr>
<td>• Electro-technology adoption follow current trends</td>
</tr>
<tr>
<td>• (EIA AEO Reference Case)</td>
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<tr>
<td><strong>Medium Electrification</strong></td>
</tr>
<tr>
<td>• Plausible but not transformational changes</td>
</tr>
<tr>
<td>• “Low-hanging fruit” end-uses see accelerated adoption</td>
</tr>
<tr>
<td>• Limited, niche market adoption elsewhere</td>
</tr>
<tr>
<td>• Technical, economic, and consumer preference barriers remain</td>
</tr>
<tr>
<td><strong>High Electrification</strong></td>
</tr>
<tr>
<td>• More favorable set of conditions for electrification</td>
</tr>
<tr>
<td>• Aggressive adoption where many barriers are overcome</td>
</tr>
<tr>
<td>• Not a “technical potential”</td>
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Beneficial Electrification (BE)

The application of electricity to end-uses that would otherwise use fossil fuels and where doing so satisfies at least one of the following conditions, without adversely affecting the others:

- *Saves consumers money over time*
- *Benefits the environment and reduces greenhouse gas emissions*
- *Improves product quality or consumer quality of life*
- *Fosters a more robust and resilient grid*
Beneficial Electrification League (BEL)

Beneficial Electrification!

- Environmentally Beneficial Electrification – Nov. 2015, July 2016
- ‘Beneficial Electrification’ RAP Whitepapers & Webinars
- PLMA ‘Beneficial Electrification’ Webinars & Workshops
- EPRI ‘Electrification 2018’ Conference
- 2018 Beneficial Electrification Leadership Forum
- Website & Resources – www.beneficialelectrification.com
- Beneficial Electrification League – BEL
- Beneficial Electrification Ambassador (BE-A) Program
Beneficial Electrification League (BEL)

It Started With ......
Electric Water Heating!
Beneficial Electrification League (BEL)

Electric Water Heating Market Share

Hawaii: 60%
West: 26%
Midwest: 30%
Northeast: 22%
South: 60%
### Beneficial Electrification League (BEL)

<table>
<thead>
<tr>
<th>45 Million Water Heaters</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>4.5kW/ea.</td>
</tr>
<tr>
<td>Energy Storage Capacity</td>
<td>12kWh</td>
</tr>
<tr>
<td>Annual Energy</td>
<td>3800kWh/ea.</td>
</tr>
</tbody>
</table>

**Image Description:**
- The pie chart shows the distribution of energy consumption across different categories:
  - **Mobile Homes**
  - **Multi-Family**
  - **Single-Family**
Beneficial Electrification League (BEL)

Table:

<table>
<thead>
<tr>
<th>Regulation</th>
<th>Zone</th>
<th>Jan</th>
<th>Feb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locations</td>
<td>RTO</td>
<td>414</td>
<td>428</td>
</tr>
<tr>
<td>MWs</td>
<td>RTO</td>
<td>64</td>
<td>65</td>
</tr>
</tbody>
</table>

Average Number of Unique Participating Locations per Month: 421
Average MWs per Month: 65

Capability represents total amount that may be offered. Actual offered and cleared volume may be significantly lower and is represented in subsequent figures/tables in report.

Figure 10: 2017 PJM Demand Response Confirmed Regulation Registrations Load Reduction Methods
Beneficial Electrification League (BEL)

Recognizes:

• Electricity is getting cleaner, less carbon intensive
• Electricity production is becoming more intermittent and variable
• The electric grid is more sophisticated, more efficient, and more resilient
• Consumers are more sophisticated and expect more
• End-use technologies are more advanced, more efficient, and more wide-spread
• Climate change goals are not going away
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Background:

- BE is the most effective and inclusive GHG reduction strategy
- To be successful, BE requires a collaborative effort
  - Utilities
  - Environmental and consumer advocates
  - Manufacturers and technology providers
  - Policymakers
- Immediate opportunities include:
  - Electric vehicles
  - Electric space and water heating
  - Commercial/industrial, and agricultural applications
Beneficial Electrification League (BEL)

Key Objectives:

- Create a broad stakeholder coalition
- Establish definitions and goals for stakeholders
- Build strategic partnerships
- Provide stakeholder engagement opportunities
- Identify policies that support / hinder BE
- Support BE market development
- Seek additional sponsorship and grant opportunities
Beneficial Electrification League

Current Activities:

• Hosting state/regional “Intro to BE” meetings
• Engaging in speaking opportunities
• Creating state/regional BE Leagues
• Promoting the BE Ambassador Program
• Providing input on policy requests
• Establishing a national BEL presence
Beneficial Electrification League (BEL)

Public Awareness & Market Development!
“In this age, in this country, public sentiment is everything. With it, nothing can fail; against it, nothing can succeed.
Come gather 'round people wherever you roam,
And admit that the waters around you have grown,
And accept it that soon you'll be drenched to the bone
If your time to you is worth savin'
Then you better start swimmin'
Or you'll sink like a stone
For the times they are a-changin'!
Thank You!
The Win-Win-Win of Beneficial Electrification!
Beneficial Electrification: Changing the Way We Think About Electricity

Keith Dennis
Senior Director
National Rural Electric Cooperatives Association (NRECA)
Many stakeholders believe that Beneficial Electrification (BE) is key to meeting US and global GHG reduction goals – and it’s compatible with a pro-growth strategy!

- Emissions of generation are declining
- Efficiency of devices is increasing
- More flexible loads are desirable

BE may lead to scenarios where more electricity is used, but fewer overall GHG emissions are produced.

An opportunity for electric utilities and environmental groups to identify solutions that work well for the consumer, local communities and the environment
Introduction: What is “Beneficial Electrification?”

The Beneficial Electrification League asserts that BE includes:

The application of electricity to end-uses that would otherwise consume fossil fuels (e.g., fuel oil, diesel, natural gas, propane, gasoline) where doing so satisfies at least one of following conditions, without adversely affecting the others:

- save consumers money over time;
- benefit the environment and reduce greenhouse gas emissions;
- improve product quality or consumer quality of life; or
- foster a more robust and resilient grid.

Beneficial Electrification programs are a valuable opportunity to engage both electric utilities and environmental groups in the effort to identify solutions that work well for the end-use consumer, local communities and the environment.
By virtue of being plugged into the grid, the environmental performance of electric devices improves over time.
Great opportunity to incentivize electric agricultural pumps and heat pumps for space heating in rural areas!
Beneficial Electrification – Improves Product Quality

Image: Electric rock crushing using electricity in Illinois (Coles-Moultrie) increases co-op load, improves operation, and reduces air pollution
John Deere unveils latest all-electric tractor prototype for zero-emission agriculture

Fred Lambert - Dec. 5th 2016 5:30 am ET  @FredericLambert
Example: Steele-Waseca Water Heaters and Solar

Buy a 410 watt panel in the SUNNA project and get a free electric thermal storage water heater

- $170 panel cost to consumer
- No sighting issues
- No maintenance issues
- Hedge against future energy hikes
America’s schools spend roughly $2 billion on fuel each year for transportation.

Transitioning to electric-powered school buses could cut these costs in half, down to $1 billion.
What is the Future of Smart Homes?

Who will survive?

Image source: Tesla Motors
What is Next?
Welcome the “Beneficial Electrification League”!

• A new non-profit dedicated to promoting the benefits of beneficial electrification

• [www.beneficialelectrification.com](http://www.beneficialelectrification.com)

• Supporters include: Natural Resources Defense Council (NRDC), National Rural Cooperative Association (NRECA), Environment and Energy Institute (EESI), WECC, Great River Energy, Oglethorpe Power, Jackson EMC, and more.
Further Contact Information

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Board Member
Beneficial Electrification League
Beneficial Electrification:
A Key to Carbon Reduction
U.S. Carbon Dioxide Emissions Scenarios

The DDPP/NRDC Reference Case is based on AEO 2013. E3 used a reduction goal of 80 percent by 2050 based on 1990 levels. MCS stands for Mid-Century Strategy, which was decarbonization modeling completed by the Obama administration following the Paris accord; MCS used a goal of 80 percent by 2050 based on 2005 levels.
Currently assessing how to close the gap to net-zero
Transportation Electrification
Building Decarbonization

- **Energy Efficiency**: Use least energy
- **Electrification**: From cleanest fuel
- **Demand Flexibility**: At the right time
Climate & Clean Energy Policy Cycle

**Standards & Markets:** State & federal clean energy, efficiency, vehicle and carbon standards lock-in wide-spread adoption and deployment.

(The cycle keeps going to allow for continuous improvement and the next set of stronger standards).

**Innovation:** DOE funds basic science and early stage product development.

**Deployment:** Federal & state programs provide tax incentives, grants and financing to get products out into the market and drive down costs.
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Electrification: Options for Consumers and the Environment

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