NARUC Winter Policy Summit

Staff Electricity Subcommittee

NARUC Winter Policy Summit

Advancing Electrification: How to Ensure it is Efficient and Beneficial

NARUC Winter Policy Summit

Moderator: *Michael Marchand, Arkansas Staff*

Panelists: *Arshad Mansoor, EPRI*
and
Ken Colburn, RAP

EPRI ELECTRIC POWER RESEARCH INSTITUTE

Efficient Electrification

What is the Opportunity?

2018 NARUC Winter Policy Summit
February 11–14, 2018

Dr. Arshad Mansoor
Senior Vice President
EPRI

The Integrated Energy Network – Efficient Electrification

Efficient Electrification is a Key Enabler for the Integrated Energy Network

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Paper Mill – Infrared Drying

Clean Air… Less Water… Clear Choice

Indoor Agriculture

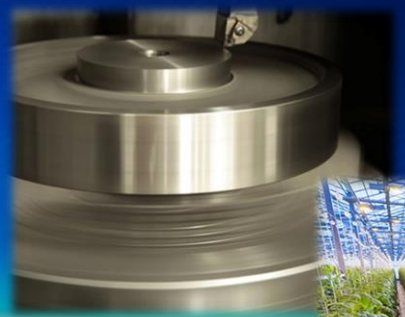
Clean Air… Less Water…
Less Land… Less Pesticide…
More Yield… Clear Choice

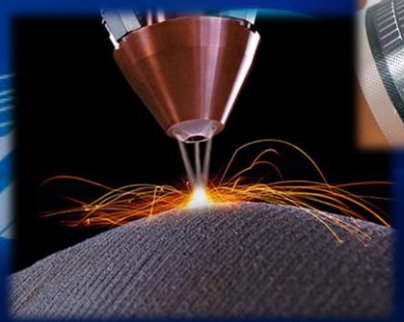
Efficient Electrification

Mobility

Heating and Cooling

New Applications





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Efficient Electrification – Win…Win…Win

METRIC OPTIONS	BENEFIT		
	CUSTOMER	UTILITY	SOCIETY
Economic Efficiency • It costs less	✓	✓	✓
Energy Efficiency • Uses fewer Btu overall	✓	✓	✓
Economic Development • Jobs creation and retention • Development of community assets	✓	✓	✓
Environment • Emissions reduction, CO_2 savings, water savings	✓	✓	✓
Grid Flexibility	✓	✓	✓
Productivity Improvements • Plant output increases • Reduction in energy intensity • Improved product quality	✓		✓
Worker Safety Improvements • Reduced lost time and accidents	✓		✓

Electric Process Heating

Heat Pumps

Electric Lift Trucks

EPRI National Electrification Assessment

EPRI MODEL INPUTS

SCENARIO	VARIABLES		
	TECHNOLOGY	FUEL COST	POLICY
CONSERVATIVE	Slower Technology Change	Flat Fuel Prices	No Additional CO_2 Policy
REFERENCE	Rapid Technology Change	Rising Fuel Prices	No Additional CO_2 Policy
PROGRESSIVE	Rapid Technology Change	Rising Fuel Prices	40% Economy-Wide CO_2 Emissions Reductions by 2050
TRANSFORMATION	Rapid Technology Change	Rising Fuel Prices	80% Economy-Wide CO_2 Emissions Reductions by 2050

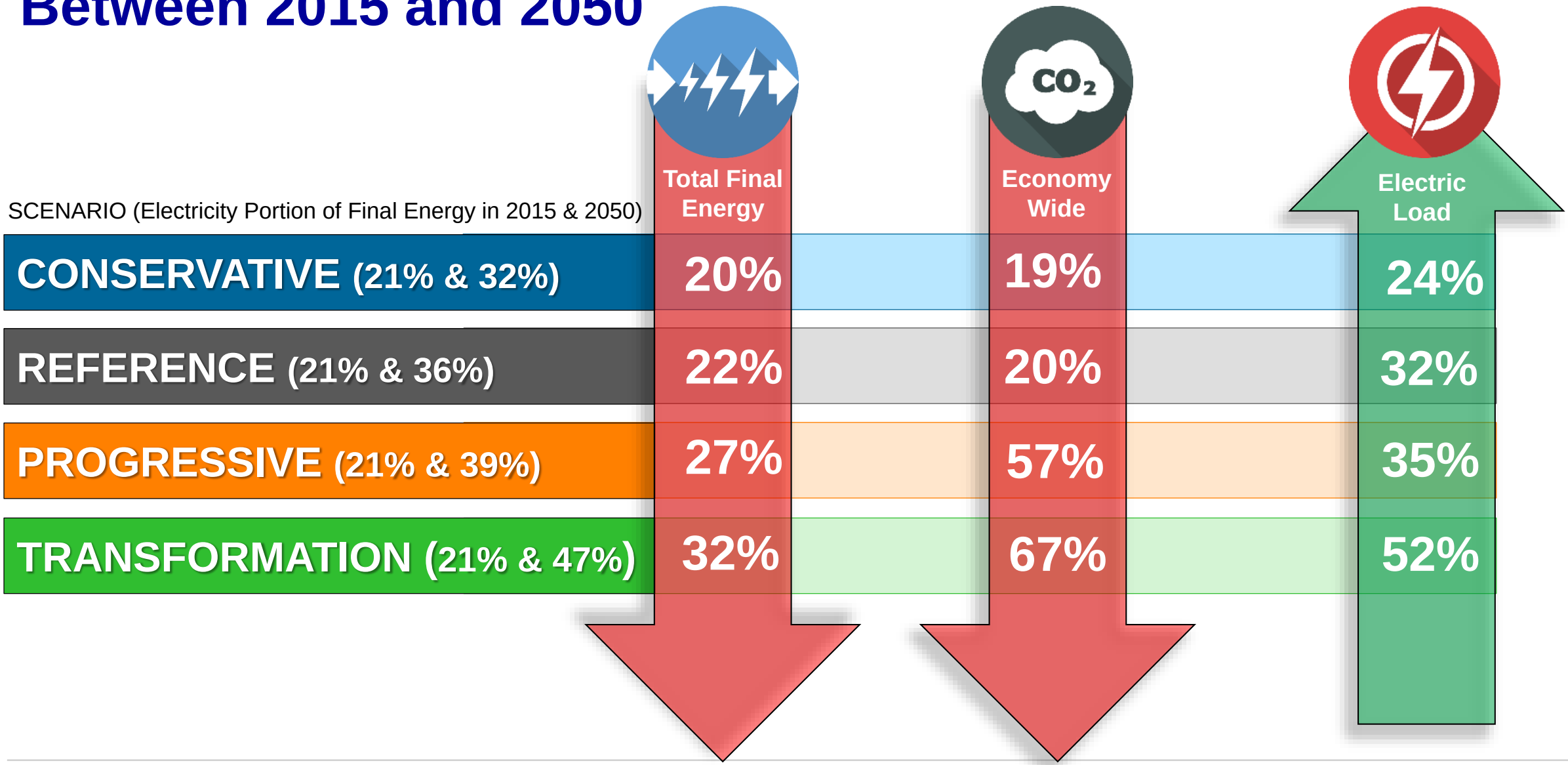
MODEL OUTPUTS

Electric Generation Mix

Economy-Wide CO_2 Emissions

Electric and Non-Electric End-Use Energy Demands

Scenario Impacts on Final Energy, CO_2, and Electric Load: Between 2015 and 2050



US Electrification Assessment…Key Insights and Actions

Customers Increase Reliance on Electric End-Uses	Driven by economic technology adoption and consumer choice; accelerated by policy and regulatory constructs
Final Energy Consumption Decreases	Efficient electrification, coupled with continued efficiency gains, leads to a decline in total energy consumption
Natural Gas Use Increases	Both for end-use applications across the economy and for electric generation
Air Emissions Decrease	GHG emissions reduced as generation continues to be clean and electrification growth increases

Accelerate Grid Modernization	Increasing electrification will require a more reliable, resilient and flexible electricity grid
Optimize Grid Operations and Planning	Planning and operation of the grid must evolve with connected efficient electric technologies as grid resource
Pursue Market Transformation	Fuel neutral energy efficiency policy, innovative rate structure, public charging infrastructure and customer awareness and education
Prioritize Technology Innovation	Innovation in energy storage, power electronics, and materials key to advance efficient electrification and helping to manage affordability

Coming in 2018…..State/Utility Efficient Electrification Assessments

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OBJECTIVES & SCOPE

Integrated analysis of customer energy demand and the electric power system combined with detailed technology assessments to support utility decision making.

VALUE

- Actionable research on renewable targets, air quality attainment, energy market reforms, and CO_2 mitigation
- Technology assessment on renewables integration, flexible operations, and distributed energy resources
- Analytics to inform your understanding of how increased electrification will impact your evolving power system
- Unbiased information to inform industry stakeholders on the benefits/costs of electrification for society and customers

Task 1: Energy System Assessment (2020 to 2050)	Task 2: Environmental Assessment (2020 to 2050)	Task 3: Transmission Assessment (selected years)	Task 4: Utility-level Assessment and Implementation Plan (selected years)
State-Level Assessment			Utility-Level Assessment

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Coming in 2018…Efficient Electrification Benefit/Cost Assessment Methodology

Environmental Impacts

- GHG Emissions
- Air Quality
- Water
- Land
- Other Resources

Economic Impacts

- Productivity
- Product Quality
- Worker Health and Safety
- Occupant Comfort
- Cost of Service

Integrated Energy Network Infrastructure

- Avoided Costs
- Grid Flexibility
- Reliability

Leverage Framework of Standard Tests for Energy Efficiency Cost-Effectiveness

Develop Efficient Electrification Equivalent of "**National Standard Practice Manual for Energy Efficiency Cost-Effectiveness**"

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ELECTRIFICATION 2018

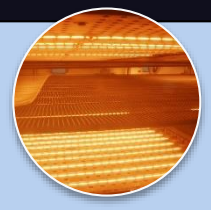
INTERNATIONAL CONFERENCE & EXPOSITION

www.electrification2018.com

SAVE THE DATE

AUGUST 20–23, 2018 LONG BEACH, CALIFORNIA

Electric Transportation (20%)



Industrial Electrification (20%)

Residential and Commercial Electric Technologies (20%)

Understanding the Costs and Benefits of Electrification (17%)

Grid Modernization for and Electrified Economy (9%)

The Policy and Regulatory Landscape for Electrification (14%)

Breakthrough Technologies (9%)

ELECTRIFICATION 2018 CONFERENCE TRACKS

Scan here for the latest EPRI Efficient Electrification newsletter

Together…Shaping the Future of Electricity

07 February 2018

Advancing Electrification: Ensuring It's Beneficial

NARUC Staff Subcommittee on Electricity

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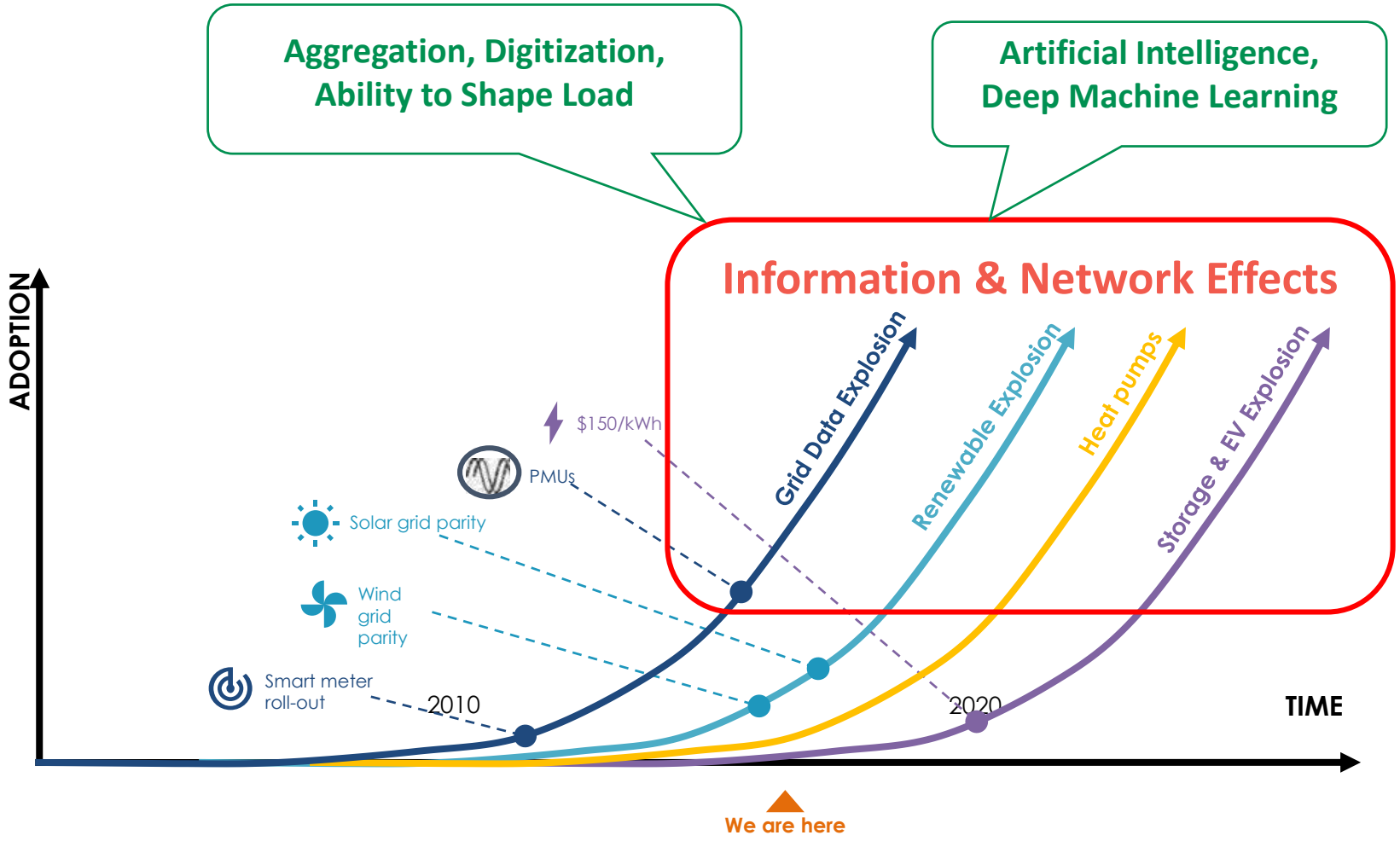
Disruptive Forces Transforming Electricity



Source: Chandu Visweswariah, Utopus Insights Inc.

Electrification is Well Underway

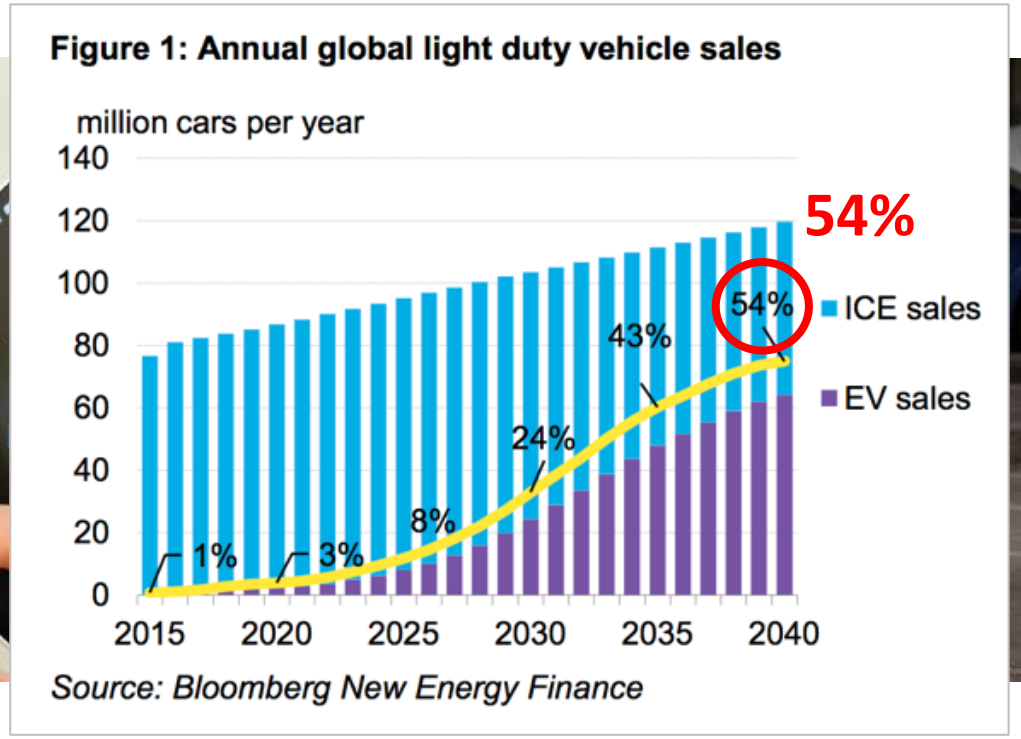
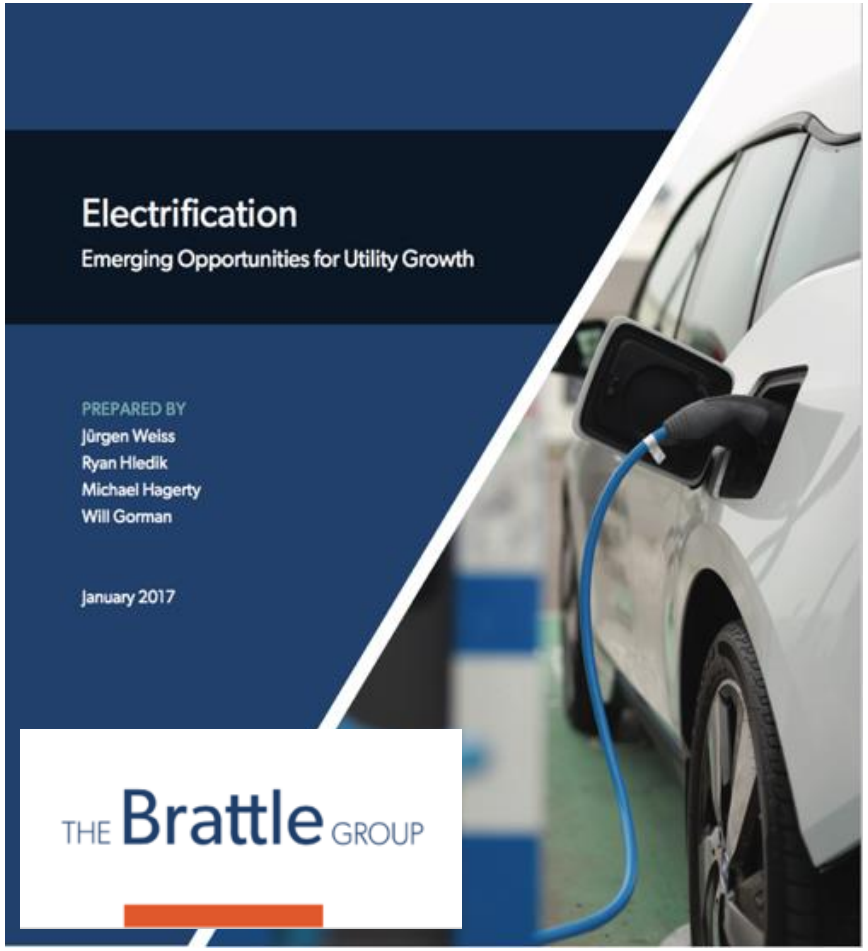


Photo credits: Nest and Dennis Schroder, NREL

But, Not All Electrification is Created Equal

- *It's all about **load growth**, right?*
- *Brattle: "Utility sales could nearly double by 2050"!*



What Makes for ***Beneficial*** Electrification (BE)?

Three explicit criteria:

1. Saves Customers Money Long-Term; New Services

2. Reduces Environmental Impacts

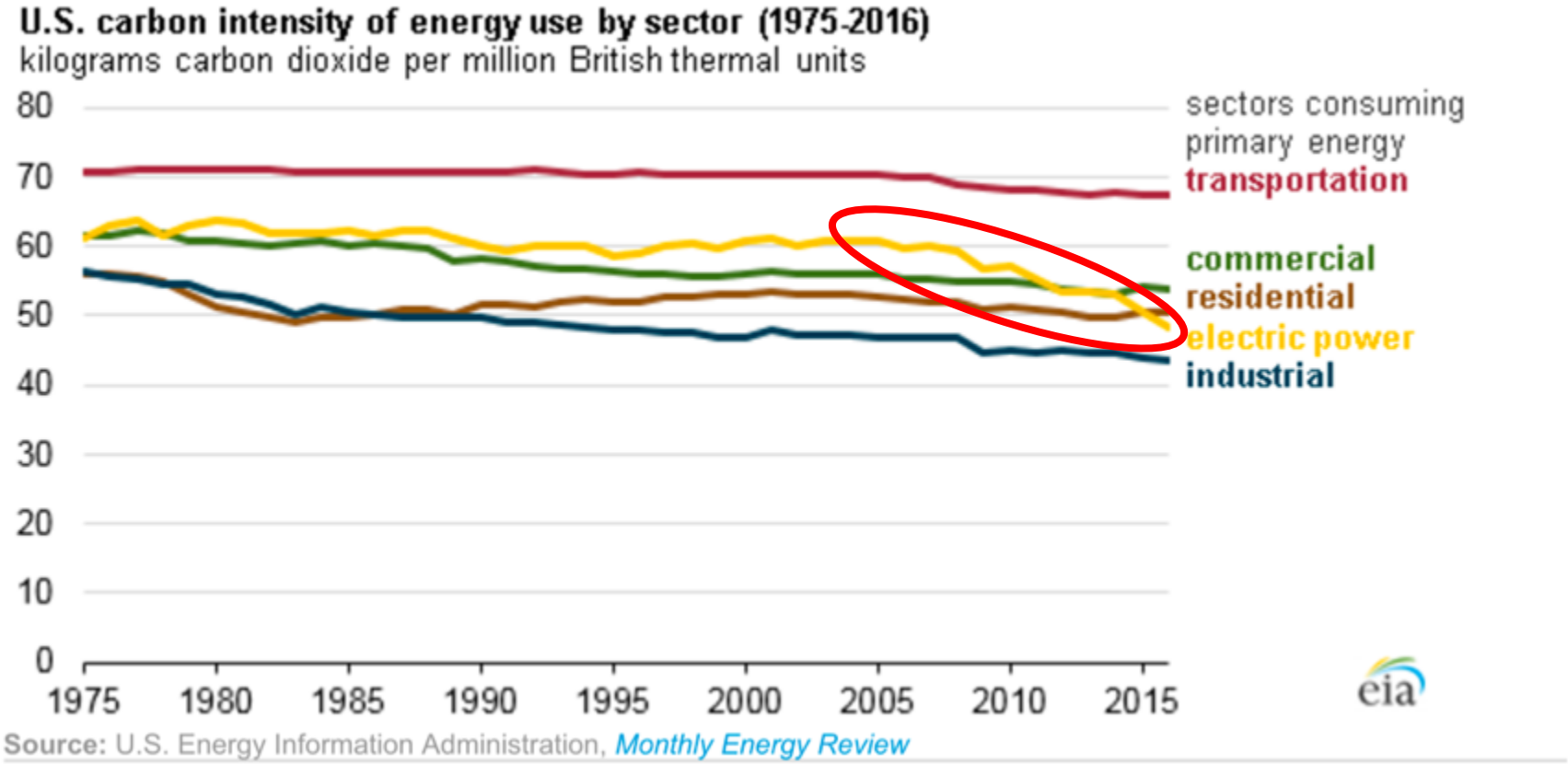
3. Enables Better Grid Management

Metrics Matter…

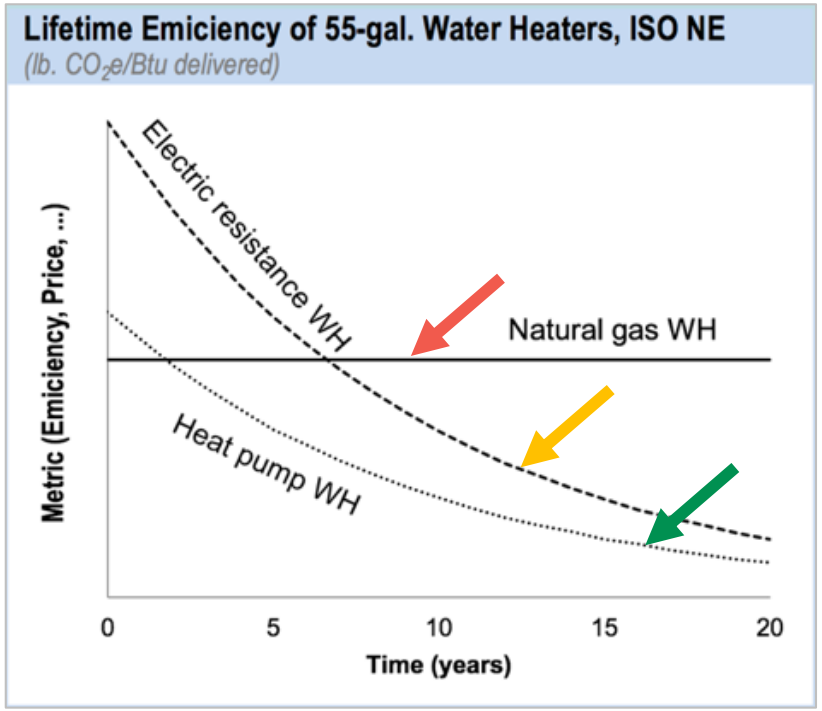
Emissions Efficiency	Existing Fuel #CO_2/ MMBTU	Marginal Resource on System to Serve Load: 100% Coal	50% Coal 50% CCCT Gas	100% CCCT Gas	50% CCCT Gas / 50% Non-Carbon	100% Non-Carbon
Utility System #CO_2/MWh		2,000	1,200	800	400	0
Space Heating - Oil to Heat Pump	202					
Warm Climate 3,000 - 6,000 HDD		209	143	78	39	0
Cold Climate >7,000 HDD		314	215	117	58	0
Space Heating - Natural Gas to Heat Pump	130					
Warm Climate		209	143	78	39	0
Cold Climate		314	215	117	58	0
Water Heating - Gas to Electric Resistance	167	628	430	233	117	0
Water Heating - Gas to Heat Pump	167					
Warm Climate		209	143	78	39	0
Cold Climate		314	215	117	58	0
Clothes Drying - Gas to Ultrasonic	167	157	108	58	29	0
	#CO_2/Mile					
Automobile - Gasoline to EV	0.65	0.54	0.37	0.20	0.10	0

- Green = BE
- Yellow ~ OK
- Red = Don't electrify, yet

Think Ahead: Electric Power is Getting Much Cleaner...

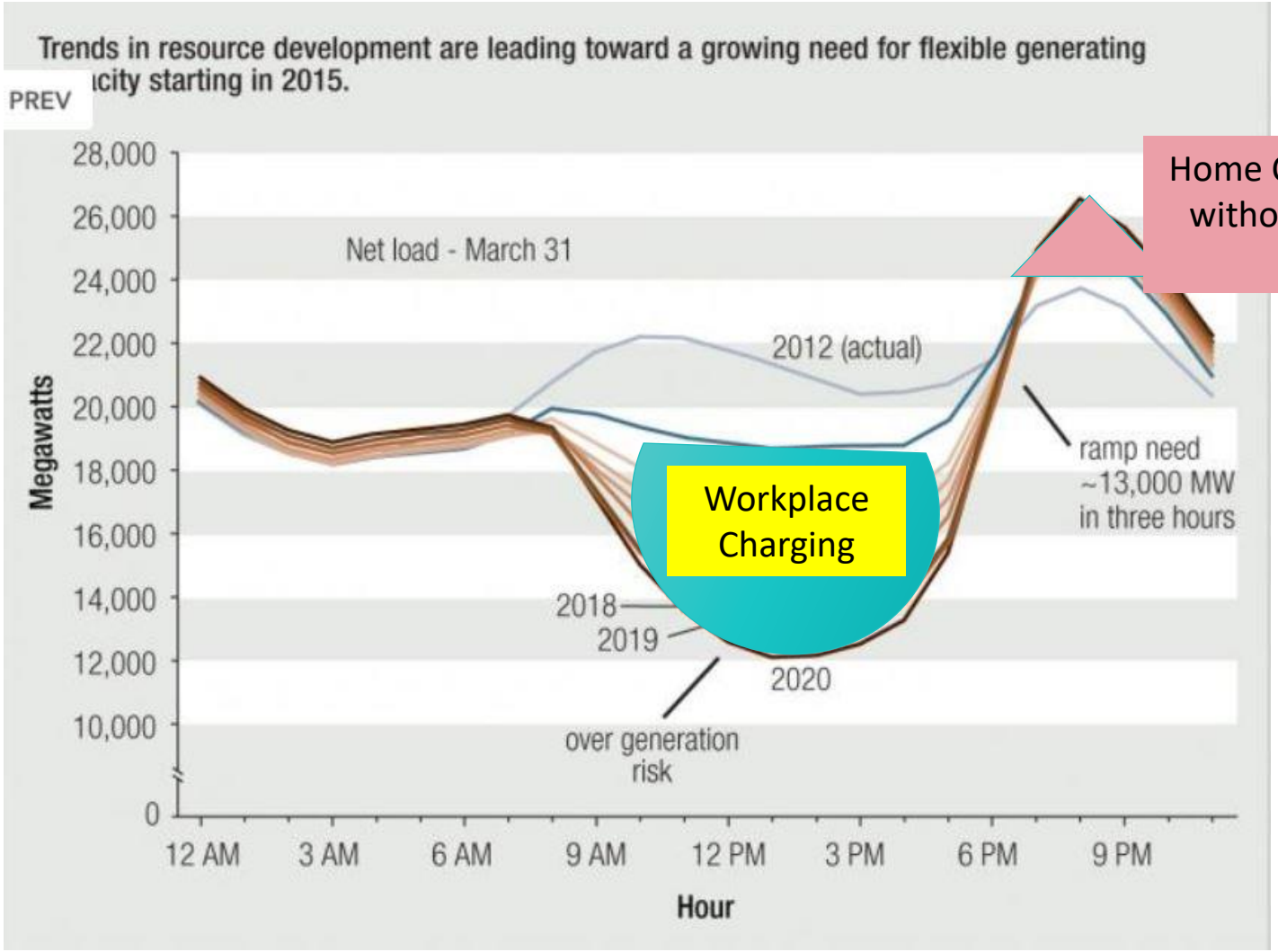


So Benefits Will Increase Over Time as Devices Improve Along With the Grid



xergyconsulting

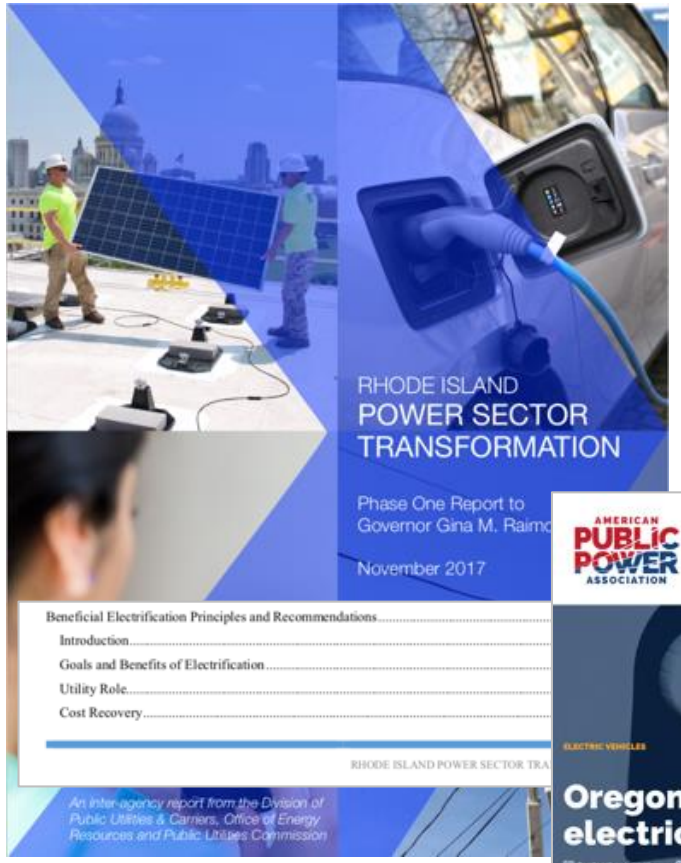
Grid Management: Workplace EV Charging



Source: Jim Lazar, RAP

Where Will Electrification Initiatives Originate?

- Customers
- Policymakers
- Commission Initiatives
- Utility Proposals



How Best to “Manage” and “Influence”? (1)

- **Commission Initiatives**:
  - Structure Explicit Processes
  - Establish Principles and Goals
    - Include the *Three Criteria*
  - Define Utility Role and Cost Recovery
  - Get Stakeholder Feedback
  - Design, Plan, and Implement
  - Learn and Revise

How Best to “Manage” and “Influence”? (2)

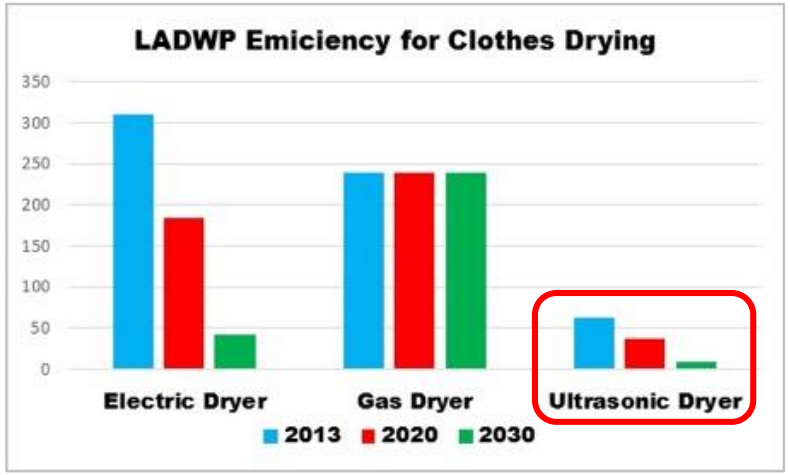
- **Utility Proposals**:
  - Meet the *Three Criteria*
  - How: Rate Design = Cornerstone
  - Where: Distribution System Planning done?
  - Aligns with Power Sector Transformation initiatives?
  - Aligns with state RE and EE policies?
    - Modify RPS to avoid discouraging BE?
    - Modify EERS to avoid discouraging BE?
  - Equity Impacts?
  - Resiliency Impacts?
  - Cybersecure?

How Best to “Manage” and “Influence”? (3)

- **Alignment with Other Policy Goals?**
  - Jobs
  - Economic Development
  - Policy Leadership
- **Alignment with the Future?**
  - *Three Criteria* benefits over time
  - Technology development continues…
  - Storage, Transactive Energy, Blockchain, etc.

Technology Development Continues: Ultrasonic Clothes Dryer

- Uses sound waves to “shake” moisture out
- 80% reduction in electricity consumption compared to electric resistance dryer



Risks Also Loom…

- Perpetuation of kWh-throughput business model and existing rate designs
- Hitching to the electrification bandwagon
- Transactive energy and storage become economic first => bypass
- Regulatory awareness, issues, delays

There's Not a Lot of Time…

5th Avenue, NYC, Easter **1900**
See any automobiles?

Park Avenue, NYC, Easter **1913**
See any horses?

RAP papers on operationalizing beneficial electrification coming soon.

Source: Tony Seba

About RAP

The Regulatory Assistance Project (RAP)® is an independent, non-partisan, non-advocacy, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at *raponline.org*

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