NEMA
The Association of Electrical Equipment
and Medical Imaging Manufacturers
www.nema.org
National Electrical Manufacturers Association

April 15, 2013

Honorable Max Baucus, Chairman
Honorable Orrin G. Hatch, Ranking Member
Committee on Finance
United States Senate
Washington, DC 20510

Re: Proposal to Ways & Means Energy Tax Reform Working Group

Dear Chairman Baucus and Ranking Member Hatch:

Attached, for your information, please find a proposal for a technology-neutral energy efficiency tax incentive developed by and on behalf of the more than 400 member companies of NEMA for consideration by the Ways & Means Committee's Energy Tax Reform Working Group.

On November 9, 2012 the NEMA Board of Governors adopted a policy supporting corporate tax reform and a system that is "predictable, efficient and has rates that are comparable to those of other advanced economies" – achieving this by broadening the tax base and lowering the corporate income tax rate.

If Congress deems it appropriate to broaden the tax base and retain a limited number of simplified, high priority incentives, we offer for consideration the attached technology-neutral energy efficiency tax incentive for America.

The U.S. currently wastes more energy than it consumes. Greater energy efficiency will boost economic productivity and competitiveness, enhance U.S. energy security, mitigate outages and reduce emissions.

The 400-plus member companies of NEMA, with domestic production and exports of more than $120 billion, are leading the way on high tech solutions to achieve greater efficiency.

Our member companies and NEMA's staff of experienced engineers spanning more than 50 industry sectors, stand ready to assist your Committee in the important task of achieving sensible tax reform that grows the economy and improves America's competitiveness. If you have questions about our tax reform submission, please contact Chuck Konigsberg, Vice President, Strategy and Policy, 1300 North 17th St. STE 1752, Rosslyn VA 22209, (703) 841-3200.

Respectfully,

Evan R. Gaddis
President and CEO

cc:
House Committees on Ways & Means, Energy & Commerce
Senate Committee on Energy and Natural Resources

Introduction: NEMA supports broadening the base and reducing corporate tax rates

On November 9, 2012 the NEMA Board of Governors adopted a policy supporting corporate tax reform and a system that is "predictable, efficient and has rates that are comparable to those of other advanced economies" – achieving this by broadening the tax base and lowering the corporate income tax rate.

If Congress deems it appropriate to broaden the tax base and retain a limited number of simplified, high priority incentives, we offer for your consideration a technology-neutral energy efficiency tax incentive for America.

Greater energy efficiency is a national priority that will boost economic productivity and competitiveness, enhance U.S. energy security, mitigate outages and reduce emissions.

Overview: Technology-neutral energy efficiency tax incentives for America

The proposed tax incentives apply to buildings, industrial applications and the electric grid.

1. **Incentives for Energy Efficient Commercial Buildings:**

   - Establish a technology-neutral tax deduction to encourage installation of equipment and systems to maximize or improve energy efficiency in new and existing buildings.

   - Eligibility would be determined using ASHRAE's[1] Building Energy Quotient (bEQ) building rating and labeling system.

   - For *new buildings*, the tax incentive would be based on the bEQ level achieved after the first 12 to 18 months of actual operation of the building. For *retrofits of existing buildings*, the incentive would be based on: (i) the post-retrofit bEQ level achieved; and (ii) the extent of the energy savings, indicated by the improvement in pre- and post-retrofit bEQ levels.

2. **Incentives for Energy Efficient Industrial technologies:**

   - Accelerated (five-year) depreciation for investment in equipment or software that is specifically identified by the Secretary of Energy as "energy efficient" or is projected to improve industrial energy efficiency (using tools or industry standards recognized by the Department).

3. **Incentives for Smart Grid technologies:**

   - Accelerated (five-year) depreciation for electric grid technologies that isolate problems and repair them remotely, enable quick recovery from extreme weather outages, and maximize the efficiency, reliability and resilience of electricity.

---

[1] ASHRAE is a building technology society with more than 50,000 members worldwide focusing on issues including building systems and energy efficiency. www.ashrae.org

1. Incentives for Energy Efficient Commercial Buildings

Buildings consume 40% of the primary energy and 70% of the electricity in the U.S. annually. Recent advances in building equipment, lighting, sensors, controls, and integrated systems make it possible to achieve a significant reduction in a building's energy use, transforming older inefficient buildings into high performance buildings (HPBs) and enabling highly efficient new buildings. In addition, through automation, individual buildings and groups of buildings can interact with the power grid to manage peak demand. HPB products make buildings smarter, safer and more efficient, while contributing to productivity, energy security and reduced emissions.

The proposed technology-neutral tax deduction is designed to encourage installation of equipment and systems to maximize or improve energy efficiency in both new and existing buildings.

The proposed deduction uses a sliding scale that demonstrates a reduction in actual energy use; this would be measured using ASHRAE's Building Energy Quotient (bEQ) rating and labeling system.[2] The BEQ rating system analyzes and compares a commercial building's energy use with similar buildings, providing a simple numerical and letter rating. [See the Appendix for further background on bEQ and examples of its application.]

The tax incentive would apply to both new and existing buildings. For **new buildings**, the tax incentive would be based on the bEQ level achieved after the first 12 to 18 months of actual operation of the building. For **retrofits of existing buildings**, the incentive would be based on: (i) the post-retrofit bEQ level achieved; and (ii) the extent of the energy savings, indicated by the improvement in pre- and post-retrofit bEQ levels.

The deduction would be calculated on a dollars-per-square foot basis. For new buildings that are energy efficient, the deduction would range from $2.50/ft.^{2} for buildings using half the energy of a typical building within its category to $4.00/ft.^{2} for buildings at or close to zero net energy.

For retrofits to existing buildings, the deduction would range from $0.25/ft.^{2} to $7.00/ft.^{2} – with the deduction capped at 50% of the cost of the energy efficiency improvements.

To encourage broad efforts toward commercial building energy efficiency, the deduction for buildings owned by public and other tax-exempt entities could be passed through to the developer, contractor or "person principally responsible for the design of the energy efficiency systems" (as in current law).

Rationale for the proposed bEQ-based tax incentive:

- The incentive is technology-neutral and consistent with a simplified tax code.

[2] The bEQ would be used for tax purposes only, not as a requirement for building labeling.

- Reflects actual energy use and for retrofits also includes the amount of improvement.
- Encourages a broad range of energy efficiency technologies (lighting, HVAC, management systems, on-site generation of renewable energy, building envelope etc.).
- Compares buildings with others in the same class.
- The bEQ-based approach uses EPA's Energy Star Portfolio Manager benchmarking tool, which "normalizes" a building's energy use information for climate, occupancy, and building function.
- Requires an on-site energy audit that includes recommended upgrades.

2. Incentives for Energy Efficient Industrial Technologies

According to the Department of Energy, in 2010 the industrial sector used 21% of the nation's total energy consumption, and 23% of the nation's electrical energy.

When high-efficiency drives and premium motors are combined with sensors, intelligent process controls and monitoring systems, it is estimated that 15-30% energy savings are attainable in most industrial environments.

However, only one out of five U.S. companies have invested in industrial energy efficiency in the past 3 years, with many citing inadequate funds or financing as a barrier.

The proposed technology-neutral tax incentive would provide **accelerated (five-year) depreciation** treatment for investment in "**energy efficient industrial technology**" defined as equipment or software capable of:

(1) managing or directly reducing energy consumption during an industrial process;
(2) sensing, controlling and monitoring energy use from an industrial process; **or**
(3) providing continuous analysis of energy consumed during such process;

provided such components: (i) are identified by the Secretary of Energy in regulation as "energy efficient industrial property"; **or** (ii) are projected, using tools or industry standards recognized by the Department of Energy, to improve energy efficiency in the specified industrial process.

Rationale for the proposed incentive for energy efficient industrial technologies:

- **Electric motors** account for about 70 percent of all electricity that industry uses. However, more than 90 percent of industrial motors cannot adjust their power consumption (which is like driving a car continuously with the gas pedal all the way down).

- **Drives:** Installation of high efficiency drives, where motor speed and direction control is needed, can reduce motor energy consumption by 20 to 50 percent.

- **High Efficiency Motors:** It is estimated that utilization of NEMA Premium® motors could save 5,800 gigawatts of electricity – eliminating nearly 80 million metric tons of carbon dioxide emissions into the atmosphere over the next 10 years, equivalent to keeping 16 million cars off the road.

- **Automation Systems:** Intelligent operation of the integrated components of an industrial system through automation, sensors, and controls can achieve significant efficiencies. Savings of over 20% have been realized though process automation.

3. Incentives for Smart Grid Technologies

America's Smart Grid is a 21st century electric grid that uses two-way communications and two-way power flows to maximize the efficiency, reliability and resilience of electricity. These technologies help to isolate problems, repair them remotely, and recover more quickly from extreme weather outages; in addition, two-way power flow accommodates the integration of renewables, distributed generation and energy storage into the grid.

The **proposed technology-neutral tax incentive** would <u>accelerate depreciation to five (5) years</u> for investment in "smart grid technologies," the **primary purpose** of which is to manage or reduce energy consumption by:

(1) sensing, collecting, monitoring or controlling energy or data on an electric distribution grid;
(2) providing real-time, two-way communications to monitor or manage such grid;
(3) providing real-time analysis of data that can be used to improve electric distribution system reliability, quality and performance;*
(4) enabling grid-connected renewable generation sources, distributed generation and energy storage capacity;
(5) improving the safety, efficiency, quality and reliability of electrical transmission through enhanced control of voltage and power flow; <u>**or**</u>
(6) reducing peak demand through demand-response systems (see appendix) that remotely adjust power consumption thereby reducing the need for additional power generation capacity.

*Items 1 – 3 in the definition are derived from current law.

Rationale for the proposed incentives for Smart Grid technologies:

- A **smarter grid** will mitigate future power outages by re-routing electricity to minimize the scope of outages and enabling faster restoration of services.
- **Smart meters** empower consumers to make energy efficient decisions.
- **New transmission technologies** can safely integrate remote renewable energy sources into the grid and regulate power flow to increase transmission and distribution line capacity by 5 to 10 percent. (See the Appendix for additional background.)
- Investing in the **power-flow control capabilities of high voltage direct current** allow electrical power to be transmitted over longer distances using fewer transmission lines. In addition to significantly lowering electrical losses over long distances, power-flow controls provide the electrical stability to enable black starts and interconnection of otherwise incompatible AC power networks.

- The use of **grid-connected storage** improves reliability; increases power quality through voltage, reactive power, and frequency support; relieves transmission congestion; extends the life of distribution equipment; increases utilization of renewables; and mitigates outages.
- Broader deployment of Smart Grid technologies will enable utilities to protect the electric grid from the **growing risk of cyber-attack**.

About NEMA

NEMA is the association of electrical equipment and medical imaging manufacturers, founded in 1926 and headquartered in Arlington, Virginia. Its member companies manufacture a diverse set of products including power transmission and distribution equipment, lighting systems, factory automation and control systems, and medical diagnostic imaging systems. Worldwide annual sales of NEMA-scope products exceed $120 billion. **www.nema.org**

APPENDIX

BACKGROUND: ASHRAE's Building Energy Quotient (bEQ) Rating System

- The bEQ "in Operation" rating system is a building energy labeling program developed by ASHRAE that utilizes a very detailed analysis to closely examine and compare a commercial building's use with similar buildings, providing a numerical and letter rating on a scale that is readily understood.

- bEQ requires an on-site energy audit by a certified building energy assessment professional. The audit includes a complete building analysis, an examination and presentation of key building energy performance indicators to precisely detail when and how energy is being consumed in the building, and recommendations for investments in equipment upgrades and other measures to reduce the building's energy use.

Technologically-neutral and Performance-based

- The new bEQ-based incentive in the form of a new tax deduction provides a **technologically-neutral performance metric** to incentivize commercial building energy efficiency.

- The approach of the new incentive encompasses all of the elements of the **"overall building"**:
  - Efficiency gains in lighting, windows, insulation, HVAC;
  - Building management systems and Smart Grid technologies;
  - Other technologies and building systems that reduce building plug loads and other energy uses; and
  - On-site renewable power generation and distributed generation.

- bEQ is a building **operational energy rating** system. Demonstration of compliance relies on **actual energy use**; no modeling is required for establishing compliance.

- bEQ incorporates **on-site production of renewable energy.**

- bEQ uses a scale that strives towards achieving zero net energy buildings. The bEQ scale awards a score of 100 for buildings that are at the median of their building type category in energy use intensity (EUI) and 0 for buildings that achieve net zero energy or better.

Applicable to Both New Buildings and Retrofits of Existing Buildings

- For **new buildings**, the tax incentive would be based on the bEQ level achieved after the first 12 to 18 months of actual operation of the building.

- For **retrofits of existing buildings**, the incentive would be based on: (i) the post-retrofit bEQ level achieved; and (ii) the extent of the energy savings, indicated by the improvement in pre- and post-retrofit bEQ levels.

- The deduction would be calculated on a dollars-per-square foot basis, subject to a cap of 50 percent of the cost of the energy efficiency improvements in the case of retrofits.

Measuring bEQ Level

- In general, the bEQ-based approach uses EPA's Energy Star Portfolio Manager benchmarking tool, which "normalizes" a building's energy use information for climate, occupancy, and building function.

Comparison of bEQ-Based Approach to Existing Approaches Predicated on Percentage Reduction in Energy Use

- There are two general goals for developing an effective incentive for commercial building energy efficiency improvements:
  - the incentive levels should be commensurate with the amount of energy saved; and
  - the incentive levels should be sufficient to motivate building owners to undertake energy improvements.

Unfortunately, these two goals can sometimes work against each other.

- One way to structure an incentive is simply to base it on percentage EUI reduction. However, basing an incentive on a percentage improvement in EUI will result in the same reward for a wide range of different levels of actual energy savings achieved in absolute terms (kBtu/ft^2 per year), depending on a building's baseline and use or function.

  Comparing two buildings of identical size and shape, a 30% EUI reduction in a highly efficient building or a building with an inherently low energy function, such as a warehouse, will save much less energy than the same percentage EUI reduction in a building that is relatively inefficient or is in a high energy use category such as grocery stores. In other words, 30% of a low energy use baseline (i.e., a smaller EUI to begin with) will result in a smaller actual energy savings, as compared to 30% of a high energy use baseline (i.e., a larger EUI to begin with).

- At the same time, for buildings within the same use category, *achieving the same percentage reduction in energy use for a building that is already highly efficient may be more difficult and more costly,* even though the actual energy savings would be smaller than a similar percentage reduction would produce for the inefficient building.

  This trade-off could be justified on the ground that it awards the incentive not just on the amount of actual energy saved, but also takes into account the level of effort and cost required to achieve such additional energy savings. This view assumes that the cost of achieving the same percentage improvement for a relatively efficient building may be higher than it would be for a relatively inefficient building because the less expensive energy efficiency measures already will have been implemented and more costly retrofit measures will be necessary to achieve further improvement.

- To address these issues, the bEQ-based approach outlined below for retrofits of existing buildings uses a combination of:

    1. level of bEQ achieved; and
    2. reductions in EUI as measured by increments of improvement in the building's bEQ score.

Under this approach, the bEQ score achieved serves as the proxy for the level of effort required and assumes that energy efficiency improvements will be more difficult and costly to achieve as the bEQ score improves.

In addition, unlike the percentage reduction approach under which the BTU savings resulting from a particular percentage reduction varies widely depending on the baseline against which the percentage reduction is being applied, a specified increment of bEQ improvement will result in the same amount of energy saved regardless of the building's starting baseline on the bEQ scale before the energy efficiency improvement measures are undertaken.

<u>bEQ-Based Deduction for New Buildings</u>

1. Deduction based on the bEQ level achieved after the first 12 to 18 months of actual operation of the building.
2. Deduction calculated on a dollars-per-square foot basis.

Deduction Based on bEQ Score	
bEQ Score	**Deduction** (per ft^2)
0-15 (A+, A)	$4.00
16-25 (A)	$3.50
26-40 (A-)	$3.00
41-55 (A-)	$2.50

bEQ Scale 100 = Median		
Rating scale	**Rating**	**Description**
0	A+	Net-Zero Energy
1-25	A	High Performance
26-55	A-	Very Efficient
56-85	B	Efficient
86-115	C	Average
116-145	D	Inefficient
>145	F	Unsatisfactory

bEQ-Based Deduction for Retrofit Improvements to Existing Buildings

1. Sliding scale deduction based on bEQ numerical rating achieved and size of improvement in energy use measured in bEQ incremental improvement (not as a percentage improvement).
2. Deduction based on the bEQ "In Operation" rating/score achieved and bEQ improvement.
3. Minimum reduction in bEQ of 20 points required.
4. Minimum bEQ rating of 100 or better required upon implementation of energy efficiency improvement measures.
5. Deduction calculated on a dollars-per-square foot basis, subject to a cap of 50% of the eligible costs of energy efficiency improvements.
6. Building owner allowed to make repeated improvements over multiple years and to receive deductions for each incremental step or instead to implement all of the retrofits in single year.

Retrofits to Existing Buildings			
Deduction Based on bEQ Improvement		***Additional*** Deduction Based on bEQ Score	
Units of bEQ Score Improvement	Deduction (per ft^2)	bEQ Score Achieved	Deduction (per ft^2)
50 +	$2.50	0-9	$4.50
45-49	$2.00	10-19	$4.00
40-44	$1.50	20-29	$3.50
35-39	$1.00	30-39	$3.00
30-34	$0.75	40-49	$2.50
25-29	$0.50	50-59	$2.00
20-24	$0.25	60-69	$1.50
		70-79	$1.00
		80-89	$0.50
		90-99	$0.25

bEQ Scale 100 = Median		
Rating Scale	**Rating**	**Description**
0	A+	Net-Zero Energy
1-25	A	High Performance
26-55	A-	Very Efficient
56-85	B	Efficient
86-115	C	Average
116-145	D	Inefficient
>145	F	Unsatisfactory

For illustrative purposes only, following is a comparison of the current law deduction under section 179D and the bEQ approach:

<table>
<tr><th>Subject</th><th>Current 179D</th><th>bEQ Proposal</th></tr>
<tr>
<td>Deduction Levels & Energy Reduction Requirements

New Buildings</td>
<td>$1.80/ft² for 50% whole building energy reduction.

$0.60/ft² for 15% energy reduction from HVAC/hot water system.

$0.60/ft² for 10% energy reduction from envelope system.

$0.60/ft² for 40% reduction in lighting power density, $0.30/ft² for a 25% reduction, and a pro-rated amount for reductions between 25% and 40%.</td>
<td>
<table>
<tr><td colspan="2">New Buildings: Deduction Based on bEQ Score</td></tr>
<tr><td>bEQ Score</td><td>Deduction (per ft²)</td></tr>
<tr><td>0-15 (A+, A)</td><td>$4.00</td></tr>
<tr><td>16-25 (A)</td><td>$3.50</td></tr>
<tr><td>26-40 (A-)</td><td>$3.00</td></tr>
<tr><td>41-55 (A-)</td><td>$2.50</td></tr>
</table>
</td>
</tr>
<tr>
<td>Deduction Levels & Energy Reduction Requirements

Existing Buildings</td>
<td>Same as above</td>
<td>
<table>
<tr><td colspan="4">Retrofits to Existing Buildings</td></tr>
<tr><td colspan="2">Deduction Based on bEQ Improvement</td><td colspan="2">Additional Deduction Based on bEQ Score</td></tr>
<tr><td>Units of bEQ Score Improvement</td><td>Deduction (per ft²)</td><td>bEQ Score Achieved</td><td>Deduction (per ft²)</td></tr>
<tr><td>50 +</td><td>$2.50</td><td>0-9</td><td>$4.50</td></tr>
<tr><td>45-49</td><td>$2.00</td><td>10-19</td><td>$4.00</td></tr>
<tr><td>40-44</td><td>$1.50</td><td>20-29</td><td>$3.50</td></tr>
<tr><td>35-39</td><td>$1.00</td><td>30-39</td><td>$3.00</td></tr>
<tr><td>30-34</td><td>$0.75</td><td>40-49</td><td>$2.50</td></tr>
<tr><td>25-29</td><td>$0.50</td><td>50-59</td><td>$2.00</td></tr>
<tr><td>20-24</td><td>$0.25</td><td>60-69</td><td>$1.50</td></tr>
<tr><td></td><td></td><td>70-79</td><td>$1.00</td></tr>
<tr><td></td><td></td><td>80-89</td><td>$0.50</td></tr>
<tr><td></td><td></td><td>90-99</td><td>$0.25</td></tr>
</table>
</td>
</tr>
</table>

Illustrative Comparison of Current section 179D and Proposed bEQ-Based Tax Incentive (continued)		
Subject	**Current 179D**	**bEQ Proposal**
Metric	Percentage reduction in energy use.	bEQ score ***plus*** bEQ improvement.
Correlation of Metric to Actual Energy Savings (i.e., kBtu/ft^2)	Limited	Strong
Baseline	ASHRAE Standard 90.1-2001 (with addenda in effect on April 2, 2003).	New Buildings: no benchmark, but must achieve minimum bEQ score. Existing Buildings: prior year's energy use.
Compliance Demonstration	Whole building energy simulation modeling. Lighting power density calculation for lighting improvements (no modeling required).	New Buildings: bEQ "In Operation" rating for a 12 month period following placed in service date. Existing Buildings: bEQ "In Operation" rating for a 12 month period before retrofits and rating for a 12 month period following the retrofits.
Minimum Performance Requirements	Described above.	New Buildings: bEQ score of 55 or better. Existing Buildings: 1) minimum reduction in bEQ of 20, and 2) minimum bEQ score of 100 (which is the median EUI for the relevant building category).
Consideration of Renewable Energy	N/A	bEQ metric incorporates on-site energy generation from renewable sources.

bEQ Example 1 (retrofit):

For example, a 200,000 ft. ^{2}, older vintage 4 story office building undergoes a deep retrofit and improves its bEQ score from **<u>100</u>** (i.e., the median for its category) to **<u>50</u>** (very efficient). For this 50% improvement in actual energy use, the building owner would earn a total \$4.50/ft.^{2} deduction (\$900,000 deduction). The total \$4.50 deduction would consist of 2 pieces: \$2.50 based on the 50 increment improvement in bEQ score, plus \$2.00 based on achieving a final bEQ score of 50 which is a Very Efficient Building under bEQ. For an energy efficiency improvement of this magnitude, the estimated total cost of the improvement could be in the range of \$8.00/ft.^{2} to \$12.00/ft.^{2}. If this cost ends up at the low end of the estimated improvement cost range, \$8.00/ft.^{2}, then the deduction would be limited by the cap of 50% percent of the cost of the energy improvement to \$4.00/ft.^{2} instead of \$4.50/ft.^{2}.

bEQ Example 2 (new building):

In the case of a newly constructed 80,000 ft.^{2} office building, based on actual energy use over a one-year period, the building achieves a bEQ rating of 43, which is a 57% improvement in performance as compared to the median building within the same use category. The bEQ rating of 43 is designated as Very Efficient by bEQ. This would result in a \$2.50/ft.^{2} deduction, or \$200,000. For comparison purposes, the 2012 cost of constructing a new 80,000 ft.^{2} building is estimated by RS Means to be in the range of \$134 to \$233/ft.^{2}. So, under this example, the deduction would represent 1% to 2% of the building's overall construction costs.

<u>BACKGROUND: Incentivizing Industrial Energy Efficiency</u>

A manufacturing process is complex and dynamic and a challenging environment to achieve persistent and sustained energy savings. A portion of efficiency can be achieved by focusing on specific technologies or processes such as motors, drives, boilers, heaters and the like. However sustained and persistent savings can be best achieved through the use of business management systems that target energy usage.

Working with industry partners the Department of Energy (DOE) has been instrumental in the development of the ISO 50001 energy management standard and ANSI accredited Superior Energy Performance (SEP) certification process. These are both voluntary, transparent systems for verifying energy performance improvements and management practices.

NEMA recommends that DOE continue its support for development of both of these industry standards through: (1) Support and expansion of industry partnerships such as the U.S. Council for Energy Efficient Manufacturing; (2) Development and evolution of tools and training to support implementation of ISO50001 and SEP; (3) Implementation of regional pilots for SEP certification across a wide range of manufacturing sectors; and (4) Continued evolution of SEP to support enterprise level implementation. This could include, through the Federal Energy Management Program, developing a roadmap of targeted federal manufacturing facilities with a 100% SEP implementation goal by a date certain.

BACKGROUND: Smart Grid Technologies

Demand-Response: The Federal Energy Regulatory Commission definition of Demand Response is the following: "Demand response means a reduction in the consumption of electric energy by customers from their expected consumption in response to an increase in the price of electric energy or to incentive payments designed to induce lower consumption of electric energy." (Docket No. RM05-5-020, dated Feb 21, 2013)

Example: On hot summer days in mid-afternoon, many utility companies reach or exceed electrical power generation supply capacity due to high load demand from air conditioners. Demand Response / Load Control (DR/LC) programs can prevent black-outs or expensive start-up of accessory generators to meet the temporary high demand by shutting off certain loads during this peak demand. DR/LC programs traditionally adjust remotely programmable thermostats to turn off these air conditioner loads. Now, DR/LC can be extended to pool pumps, water heaters, lighting, and plug-loads through remote / computer controllable switches and receptacles, without impacting occupant comfort. DR/LC programs can delay or eliminate the need for more electrical generator assets at a much lower overall program cost.

Transmission Technologies and Integrating Renewable Energy into the Grid: While current smart grid preferences address distribution-level demand response, building a stronger, more resilient and energy efficient electric grid requires both transmission and distribution upgrades. Integrating renewable energy like wind and solar that have variable power generation output into the electric grid can expose the grid to increased line loading and destabilizing voltage fluctuations and frequency deviations. These instabilities can result in power quality deterioration, including possible brown or black-outs. To manage grid disruptions and variable renewable energy, grid operators maintain a margin of reserve power capacity. This reserve power, called spinning generation reserves, impacts grid efficiency and increases the grid's carbon footprint.

However, smart transmission technologies can be used to manage and even improve grid stability to increase transmission capacity over existing lines. These systems use sensors, hardware and sophisticated control software to help operators manage the grid. Variable power sources such as wind and solar can then be safely integrated into the grid without the need for building new lines.

Similarly, the lower losses and power-flow control capabilities of high voltage direct current (HVDC) allow electrical power to be transmitted over longer distances using fewer transmission lines. In addition to significantly lowering electrical losses over long distances, power-flow controls provide the ability to allow black starts and the interconnection of otherwise incompatible AC power networks. HVDC can also be used with long-distance underground or subsea cables without the limitations associated with AC cables. These transmission superhighways allow remote generation sources, including off-shore wind, to be safely and cost-effectively connected to urban use centers.

Examples –

The CREZ (Competitive Renewable Energy Zones) initiative is a Texas Public Utility Commission project to establish wind generation facilities in the Texas panhandle for the ultimate transmission of more than 18,000 MW of power to various parts of the state. Its purpose is to deliver renewable power to end-use consumers in the most cost-effective manner. Utilities responsible for tying this powerful but intermittent renewable resource into the grid are relying on Flexible Alternating Current Transmission Systems to increase transmission capacity, improve grid reliability and successfully facilitate the integration of wind power in areas throughout north Texas and the Dallas-Ft. Worth metropolitan area. FACTS solutions help power companies increase transmission capacity over existing AC power lines, providing fast voltage regulation, active power control and load flow control in meshed power systems. The main purpose is to minimize bottlenecks in existing transmission systems, and improve the availability, reliability, stability and quality of the power supply.

The Snohomish County PUD installed a Conservation Voltage Reduction system to improve system throughput and improve power quality. Their investment of under $5 million has resulted in energy savings of 53,856 MWh/yr, including reduced distribution system losses by 11, 226 MWh/yr while providing better voltage quality (less voltage swing) to end-use customers.

The Clinton Utilities Board is using state-of-the-art voltage regulation technologies to power 3,000 homes solely through energy savings. Utilizing Dispatchable Voltage Regulation to safely and automatically adjust end-use voltages to meet peak demand needs, Clinton has harnessed a virtual power plant by capturing otherwise lost energy to meet service needs.

About NEMA

NEMA is the association of electrical equipment and medical imaging manufacturers, founded in 1926 and headquartered in Arlington, Virginia. Its member companies manufacture a diverse set of products including power transmission and distribution equipment, lighting systems, factory automation and control systems, and medical diagnostic imaging systems. Worldwide annual sales of NEMA-scope products exceed $120 billion. **www.nema.org**