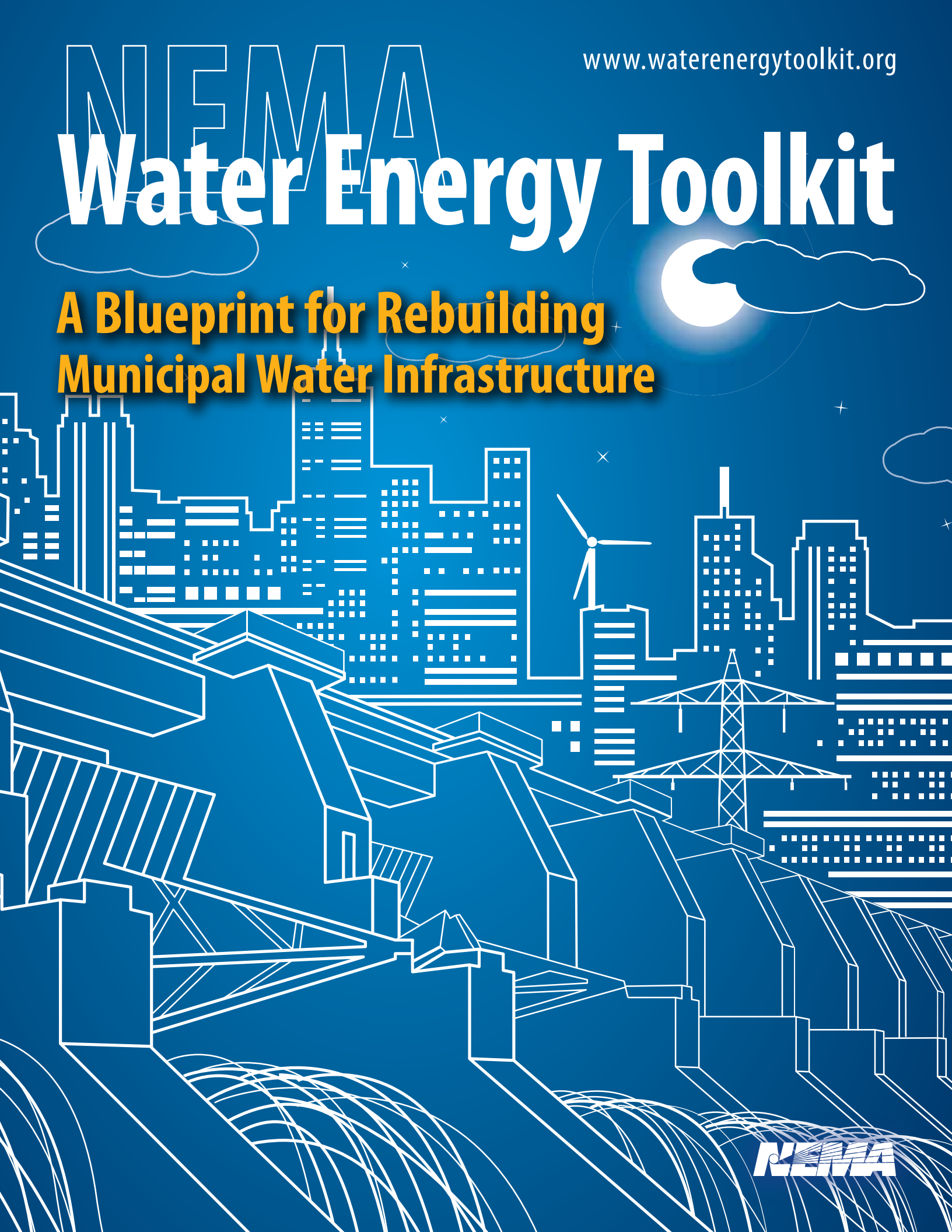
NEMA

www.waterenergytoolkit.org

Water Energy Toolkit

A Blueprint for Rebuilding Municipal Water Infrastructure



Funding Infrastructure and Saving Energy with ESPCs

When most people think about energy, they may first think about using it to power personal devices. After that, they may think about what is required to light, heat, and operate the buildings in which we live and work.

Senator Coons is the senior Democrat on the Senate Judiciary Subcommittee on Oversight, Agency Action, Federal Rights, and Federal Courts.

Senator Gardner is a member of the Senate Energy & Natural Resources Committee and chairs the Energy Subcommittee.

Buildings represent about 40 percent of the primary energy consumption in the United States, and who owns the most buildings and uses the most energy in the U.S.? The federal government. So, as our country continues to make strides to become more energy efficient and secure, there's no better place to start than the energy-sapping constellation of federal real estate.

As a Democrat and a Republican, we believe that the federal government should be a model of energy efficiency, not the exception to it. To make federal buildings more energy efficient, we've introduced legislation to support energy savings performance contracts (ESPCs), public–private partnerships that allow the federal government to work with the private sector to reduce energy costs, cut back on greenhouse gas emissions, and save taxpayer dollars.

This concept started in 1978 when Congress passed the National Energy Conservation Policy Act, giving federal agencies the authority to enter into shared-energy savings contracts with private-sector service companies. These early ESPCs established a means for the federal government to undertake retrofits through energy-efficiency services, reducing energy intensity and saving money over time at no added cost to the taxpayer.

In 1992, ESPCs were authorized as a pilot program. Since then, more than 300 ESPCs have led to billions of dollars in federal cost savings. They have achieved nearly $14 billion in energy savings. Federal agencies have reduced their energy intensity by 49 percent since 1975, and the program has resulted in at least 114,000 private sector jobs.

This technical and important approach to energy efficiency has shown itself to be a common-sense way to support local jobs, help the federal government save energy, and allow us to invest in clean energy, energy efficiency, and water conservation projects that are critical to our economic future. We believe this mechanism should be a key pillar of our efforts to create a cleaner energy future, with the federal government leading by example.

As a Democrat and a Republican, we believe that the federal government should be a model of energy efficiency, not the exception to it.

To ensure that ESPCs continue, we spent several years clarifying the budget scoring rules so that ESPCs are not constrained. With that behind us, we have introduced legislation to enhance ESPC activities throughout the federal agencies.

Our legislation can help, but we also need the White House and federal agencies to do their part. President Bush's efforts improved tracking mechanisms, and President Obama set a goal of achieving more than $4 billion in private sector investment through ESPCs over five years. We believe that the Trump Administration is perfectly positioned to go big with ESPCs by maximizing the cost savings that can be accrued through setting new goals and encouraging new partnerships.

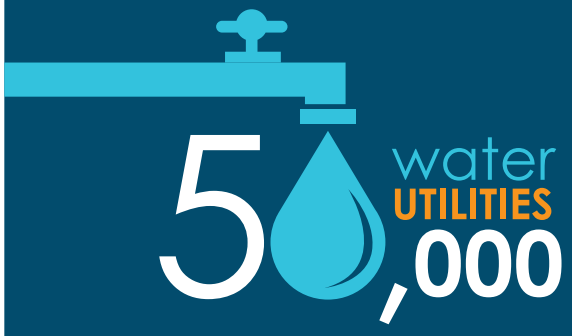
Now is the time for good policy to provide continued incentives to save energy, save money, and create American jobs.

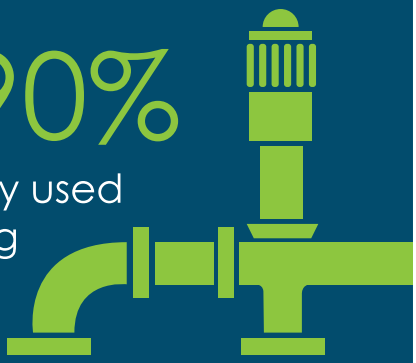
Senator Chris Coons (D-DE) and Senator Cory Gardner (R-CO)

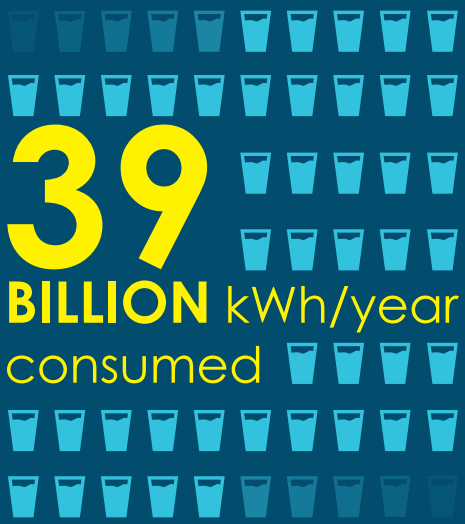
Energy Savings Possible for
URBAN WATER UTILITIES
www.waterenergytoolkit.org

Significant energy and water savings in the water utility sector are possible and financially viable, according to a recent study commissioned by the National Electrical Manufacturers Association (NEMA). *Increasing Energy Efficiency in Urban Water Systems: Summary Report* provides results and analysis conducted by NEMA and GEI Consultants Inc.

NEMA worked with member experts as well as volunteers from the Hydraulic Institute and the International Association of Plumbing and Mechanical Officials, and sourced hundreds of existing reports and studies to analyze energy consumption, water throughput and consumption, and related energy-water metrics.







potential savings through

- Site audits
- Pump evaluations
- System optimization assessments
- Staff training
- Federal grants

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Energy + Water Strengthens Both

Energy use is embedded in the supply, gathering, and treatment of clean and wastewater in U.S. infrastructure, and water is embedded in the generation and application of energy. Where the two converge is a crossing point that is poorly understood outside facilities management. This nexus represents significant strategic opportunities.

The result of a 2016 NEMA Strategic Initiative to study the relationship of electricity and water in urban water systems, the Water Energy Toolkit[1] provides resources to educate water utility owners, managers, and employees about:

- **Improvements and upgrades to water systems**
- **Paying for energy-saving programs**
- **Pump, motor, metering, and control systems training**

This online toolkit compiles information that can be used to identify potential improvements and to explore the use of an energy service company (ESCO)[2] to justify and encourage private improvements.

Out of Sight, Out of Mind

Many people see water infrastructure only when they are stuck in traffic during the trenching operations necessary to lay pipe and culverts. Thus it is easy to lapse into an "out of sight, out of mind" frame of reference. The result is that water facilities fare poorly when it comes to improvements and maintenance. Tight budgets leave facility managers unable to undertake elective maintenance upgrades while privatized utilities can find themselves at the mercy of shortsighted shareholders who do not favor investments in efficiency.

Only in areas where water is increasingly scarce, such as the ongoing California drought, are we beginning to see public campaigns that might begin to incentivize and promote water–energy efficiency efforts.[3] Elsewhere, water management regulations and laws, if any, tend to focus on low-water usage appliances only.

Many NEMA Members function as ESCOs in the energy sector, selling energy savings performance contracts (ESPCs) contracts for energy-efficiency upgrades and services. This contrasts with far fewer ESCO businesses for energy embedded in the water supply or for water savings through efficiency improvements.

1 www.waterenergytoolkit.org
2 energy.gov/eere/femp/energy-savings-performance-contracts
3 www.dgs.ca.gov/dgs/Home/water.aspx

Water + Electricity Mix Well in Toolkit

Making the energy–water nexus a strategic reality begins with these tactical pursuits. Visit the Water Energy Toolkit for information on:

- **Improvements and upgrades to water systems**
- **Paying for energy-saving programs**
- **Pump, motor, metering, and control systems training**
- **Pursuing a foundation for ESPC activity in the water sector**
- **Encouraging private facility upgrades**

It costs money to source, deliver, gather, and treat water, but with these resources facility owners and managers can perform upgrades beyond expansion and leak mitigation.

Case Study: Wastewater Upgrades Save Energy and Taxes

Improvements at the wastewater treatment plant reduced energy use by 30 percent and solid waste by 20 percent.
Photo courtesy of Johnson Controls

Evansville, the third largest city in Indiana, is part of a thriving community that serves as the commercial, medical, educational, and cultural hub for the Indiana/Kentucky/Illinois tristate region. To support the mayor's smart city initiative, the city entered into an energy savings performance contract with Johnson Controls, allowing the city to invest $39 million in much-needed infrastructure without raising taxes.

The improvements started at the wastewater treatment plant and included both traditional and unconventional measures—energy-saving upgrades such as lighting, HVAC, controls, and power factor correction along with valve automation and a solid waste centrifuge—to reduce energy use by 30 percent and solid waste by 20 percent.

By generating power from restaurant commercial kitchen fats, oils, and grease, the process now supplies 40 percent of the energy at the plant. Across the city, a new automated metering system was implemented to increase meter-reading accuracy and efficiency by gathering real-time data from 64,000 meters throughout the city and from 10 wireless towers.

The energy-efficient upgrades will generate an estimated $3.1 million in annual savings over the next 20 years for the city, positioning the Indiana city for future growth.

Adding Value Through ESPCs

As energy efficiency gains increasingly more attention on local, national, and international fronts—often enabled and assisted by NEMA Member products—many companies are opening business arms related to efficiency or founding new efficiency-minded businesses. The prime example of this is the energy service company (ESCO) model where business is generated in servicing, improving, and monitoring a building or facility or municipal power grid.

A favored vehicle to undertake capital improvements such as these is through an energy savings performance contract (ESPC) whereby the business performs retrofitting and improvements for no charge and in turn is awarded a percentage of the operating funds saved by the facility owner post-completion over a designated period of time.

ESPCs are attractive to federal agencies because they increase efficiency and thereby reduce their energy costs using private sector funding and expertise. Using an ESPC eliminates the need for appropriated dollars for equipment replacement and for operations and maintenance of the energy-using equipment.

NEMA Standards

NEMA works closely with regulators and manufacturers to develop more than 500 performance standards related to a variety of equipment used by the water sector. Of particular interest to the water sector are:

- **NEMA EWS 1 Increasing Energy Efficiency in Urban Water Systems: Summary Report**

  This report presents the analysis and conclusions of a NEMA-funded strategic initiative related to the relationship of electricity and water in urban water systems.
  Available at no cost.

- **NEMA EWS 1.1 Market Potential for Electricity Efficiency in Urban Water Systems**

  Companion document to *Increasing Energy Efficiency in Urban Water Systems: Summary Report.*

  $29

- **NEMA EWS 1.2 Use of Performance Contracts for Advancing Efficiency in Water Infrastructure**

  Companion document to *Increasing Energy Efficiency in Urban Water Systems: Summary Report.*

  $78

- **NEMA EWS 1.3 Glossary of Terms Used in the Water Sector**

  Companion document to *Increasing Energy Efficiency in Urban Water Systems: Summary Report.*
  Available at no cost.

- **NEMA EWS 1.4 Literature Review**

  Companion document to *Increasing Energy Efficiency in Urban Water Systems: Summary Report.*

  $64

- **NEMA EWS 1.5 U.S. Water-Related Infrastructure Needs and Potential Funding Opportunities**

  Companion document to *Increasing Energy Efficiency in Urban Water Systems: Summary Report.*

  $59

- **NEMA MG 1 Motors and Generators**

  Assists users in the proper selection and application of motors and generators. Contains practical information concerning performance, safety, testing, and construction and manufacture of ac and dc motors and generators.

  $523

- **NEMA MG 1 Condensed**

  Provides a condensation of NEMA Motors and Generators, MG 1-2011. Some sections are reprinted in their entirety while others have been combined or abbreviated.

  $139

- **NEMA MG 2 Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators**

  Provides recommendations for the selection, installation and use of rotating electric machines so as to provide for the practical safeguarding of persons and property.

  $109

- **NEMA MG 10 Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors**

  Provides practical information concerning proper selection and application of polyphase induction and synchronous motors, including installation, operation and maintenance.

  $91

- **NEMA MG 11 Energy Management Guide for Selection and Use of Single-Phase Motors**

  Provides practical information concerning the proper selection and application of single-phase motors, including installation, operation and maintenance.

  $49

- **NEMA MG SET**

  Provides the most complete and concise reference material available relative to the practical applicability of ac and dc motors and generators. This includes whether they are single phase, polyphase induction, or of the synchronous variety, including performance characteristics such as required levels of efficiency and sound pressure levels, as well as recommendations for their proper selection, installation, operation and maintenance. Set includes: MG 1 , MG 2, MG 3, MG 10, MG 11.

  $609

- **NEMA ICS 1 Industrial Control and Systems: General Requirements**

  Provides practical general information concerning ratings, construction, testing, performance and manufacture of industrial control and systems equipment and terminal blocks. Contains December 2010 editorial change.

  $160

- **NEMA ICS 1.3 Preventive Maintenance of Industrial Control and Systems Equipment**

  Preventive Maintenance of Industrial Control and Systems Equipment Covers fundamental principles, safety precautions and common guidelines for preventive maintenance of most industrial control and systems equipment. Intended to supplement more specific maintenance instructions that may be provided for particular product lines, specific products and other NEMA standards and manufacturer publications.

  $263

- **NEMA ICS 2.3 Instructions for the Handling, Installation, Operation and Maintenance of Motor Control Centers Rated Not More Than 600 V**

  Contains instructions for the handling, installation and maintenance of motor control centers rated 600 V or less.

  $86

- **NEMA ICS 2.4 NEMA and IEC Devices for Motor Service—A Guide for Understanding the Differences**

  Control products compared or contrasted in this guide are those with equivalent electrical ratings; such ratings are expressed via nameplates, catalogues or technical literature.

  $86

- **NEMA ICS 3.1 Guide for the Application, Handling, Storage, Installation and Maintenance of Medium Voltage AC Contactors, Controllers and Control Centers**

  Contains practical information for architects, electrical engineers, contractors and maintenance personnel on the handling, storage and installation of ac general-purpose medium voltage contactors and Class E controllers.

  $167

- **NEMA ICS 7 Adjustable Speed Drives**

  Provides practical information concerning ratings, construction, test, performance and manufacture of industrial control equipment—adjustable speed drives.

  $105

- **NEMA ICS 7.1 Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems**

  Applies to all industrial equipment electrical components and wiring that are part of the electrical drive system, commencing at the point of connection of input power to these components. Applies to open or enclosed electrical equipment for use on circuits that operate from an ac supply voltage of 600 V or less.

  $96

- **NEMA ICS 16 Motion/Position Control Motors, Controls and Feedback Devices**

  Covers rotational electric servo and stepper motors and their power requirements, feedback devices and controls intended for use in a motion/position control system that provides precise positioning, speed control, torque control or any combination thereof.

  $300

- **NEMA ICS 18 Motor Control Centers**

  Applies to three-phase 50 and 60 Hz motor control centers rated not more than 600 V ac.

  $98

- **NEMA ICS 19 Diagrams, Device Designations and Symbols**

  Provides guidelines for representation of devices on diagrams and drawings in a standardized manner.

  $111

- **NEMA ICS 20 Informational Guide to Electrical Industrial Topics**

  Provides information on various topics of interest related to the application and proper usage of electrical equipment in the global marketplace.

  $86

- **NEMA ICS 61131-1 Programmable Controllers (PLC), Part 1: General Information**

  Applies to PLC and their associated peripherals, such as programming and debugging tools and human-machine interfaces, which have as their intended use the control and command of machines and industrial processes.

  $96

- **NEMA ICS 61131-4 Programmable Controllers, Part 4: User Guidelines**

  Assists end users in selection and specification of PLC equipment.

  $205

- **NEMA ICS 61800-1 Adjustable Speed Electrical Power Drive Systems, Part 1: General Requirements—Rating Specifications for Low Voltage Adjustable-Speed DC Power Drive Systems**

  Applies to general purpose adjustable speed dc drive systems that include the power conversion, control equipment and a motor or motors. Excluded are traction and electrical vehicle drives.

  $184

- **NEMA ICS 61800-2 Adjustable Speed Electrical Power Drive Systems, Part 2: General Requirements—Rating Specifications for Low Voltage Adjustable Frequency AC Power Drive Systems**

  Applies to general purpose adjustable speed ac drive systems that include power conversion, control equipment and an ac motor or motors. Excluded are traction and electrical vehicle drives. Applies to systems connected to line voltages up to 1 kV ac, 50 or 60 Hz, and load side frequency up to 600 Hz.

  $175

- **PMC 1Programmable Motion Control Handbook Industrial Products & Systems**

  Provides a complete resource guide to motion control technology, products and applications compiled by leading vendors and developers of motion control technology.

  $42

Water Energy Toolkit

Resources

With more than 50,000 water utilities in the U.S. of varying age, capacity, and material status, significant energy and water savings are possible and financially viable. Utilities want to know more about available energy saving products and workforce development resources. Challenges related to ownership, decision-making processes, and planning-to-execution timelines, however, make detailed energy-savings estimates problematic.

The NEMA Water Energy Toolkit provides training materials for utility engineers and managers who want to improve their systems through

- **Basic motor function**
- **Basic motor components**
- **Basic motor application and performance**

Motor Training

- Fundamentals of Electric Motors
- Advanced Motor Construction
- AC Motor Components – Rotors in Detail
- AC Motor Mounting Types
- Electric Motor Accessories
- Making Electric Motors More Efficient
- Electric Motor Terminology and Electrical Performance Characteristics
- IEEE Standard 841
- NEMA Motor Standards vs. IEC Motor Standards

Pumps and Drives / SCADA

- On Demand Pump Condition Assessment and Optimization v2
- Variable Frequency Drives Benefits
- Variable Frequency Drives and Wastewater
- Pump Systems and Total Ownership Cost

Visit www.waterenergytoolkit.org.

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