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Buildings Work for Other Agencies and Relevant LDRD Investments

DENNIS STILES

Pacific Northwest National Laboratory

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U.S. DEPARTMENT OF ENERGY

International Building Code Development

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- **China**
  - Adoption of voluntary code for rural buildings
  - U.S.-China energy performance contracting
- **Vietnam**
  - Code development
  - Labeling strategy
  - Prototype building
- **India**
  - International high-profile seminar on building energy efficiency
  - Code implementation in Rajasthan and Prabha Bhawan as a pilot

China: Installing Building Insulation
Source: PNNL

India: Code-Compliant Pilot Building
Source: PNNL

Extending BTO Technology Impacts to the Federal Sector

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- Re-Tuning Training and Assistance
  - GSA: 43 buildings addressed, 9.4% average energy savings
  - U.S. Army: re-tuning included in comprehensive energy/water management training

- Interior Lighting Campaign
  - 14 of 55 participants are Federal facilities (Army, Air Force, Navy, GSA), representing more than 135,000 high efficiency troffer lighting systems.
  - Three federal agencies received recognition for excellence at the ILC Awards event held at the BOMA 2016 International Conference & Expo in Washington, DC
  - Annual energy savings through LED lighting and controls systems ranged from 50% to 82%
  - The ILC maintains a web page and training materials dedicated to the needs of federal landlords

- Federal Energy Management Program
  - Interior and exterior solid state lighting deployment
  - Best practice guides and training materials for metering, building operation & maintenance, and energy auditing

Energy for National Security

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- U.S. Army Office of Energy Initiatives
- U.S. Army Engineering Research & Development Center
- U.S. Army Logistics Innovation Agency
- U.S. Army Reserves Command
- Deputy Assistant Secretary of the Army
- U.S. Air Force Civil Engineering Center

Army Assessments

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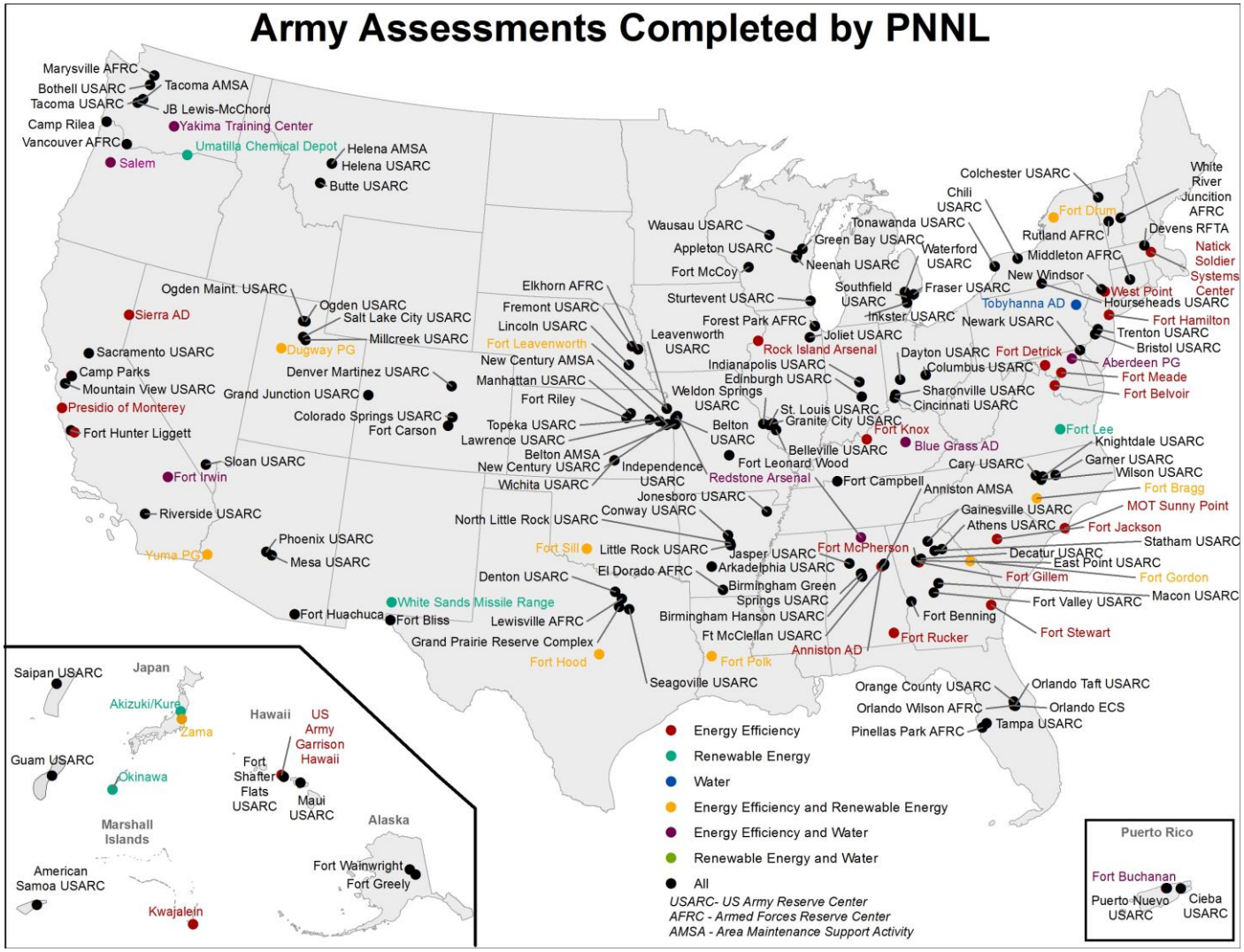

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LDRD

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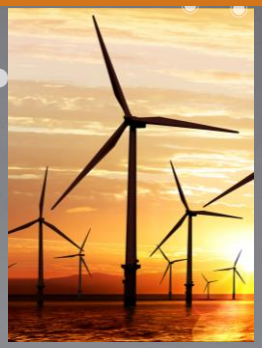
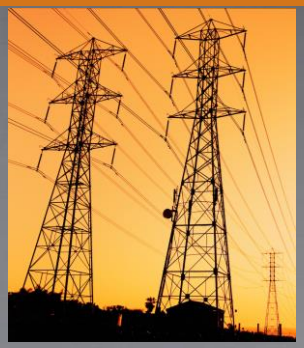
Combining infrastructures, introducing distributed energy resources, and a higher penetration of renewables increases complexity and variability. There is a need for controls that can handle such challenges.



CCSI: An Integrated Approach

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Theory **to underpin system-wide control of large infrastructures**
Tools **to support implementation and deployment of resulting methodologies**
Test bed **to validate the approach**

Theory:

- Divide and conquer approach to ultra-large systems
- Algorithms that are scalable, deployable, robust, resilient, and adoptable

Tools

- Co-simulation
- Visualization
- Validation and verification

Test Bed

- Large-scale simulation
- Hardware-in-the-loop