Tackling the Energy-Water-Food Nexus

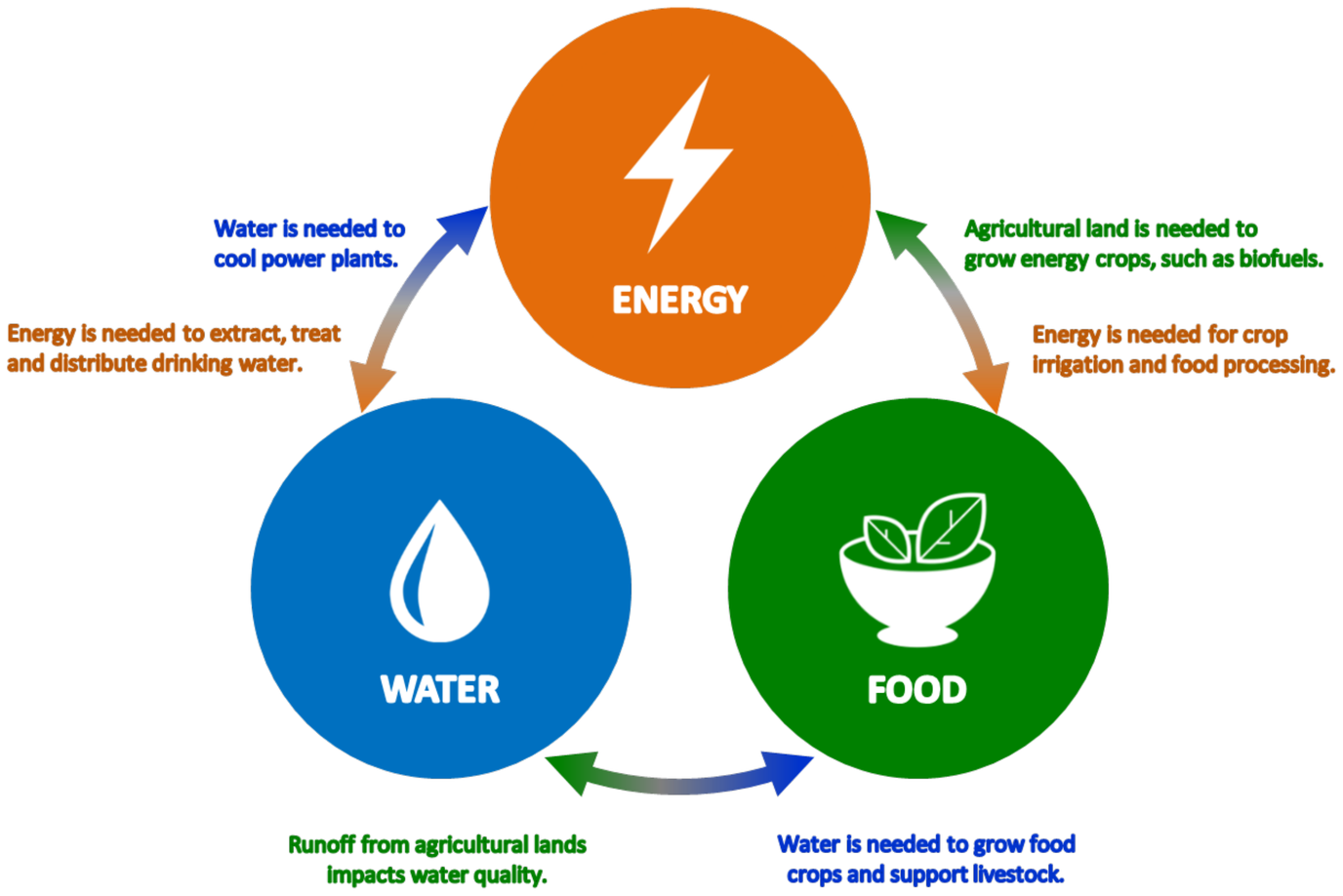
NREL NATIONAL RENEWABLE ENERGY LABORATORY | 40 1977 - 2017

Energy, water, and food are all basic human necessities.

Population growth, urbanization, and a changing climate are intensifying the pressure on these interdependent resources.

There is a critical need for integrated solutions that ensure equitable resource access and support sustainable development.

The Energy-Water-Food Nexus (EWFN) examines the interactions, challenges, and opportunities across these inextricably linked sectors.



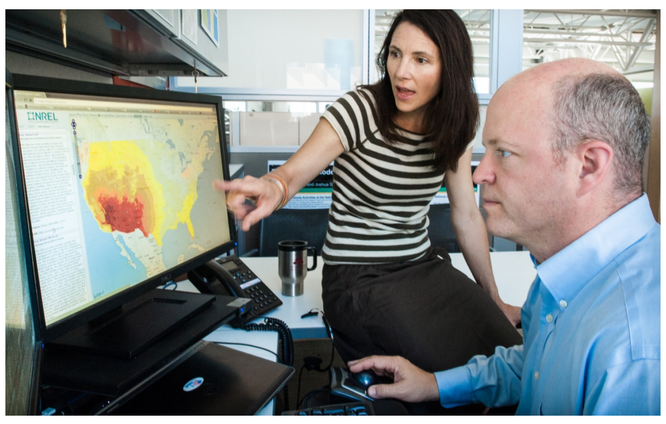
National Renewable Energy Laboratory (NREL)

Providing holistic solutions that address EWFN challenges and opportunities domestically and abroad

POLICY & PLANNING

NREL works with communities, governments, and utilities to develop EWFN policies and programs:

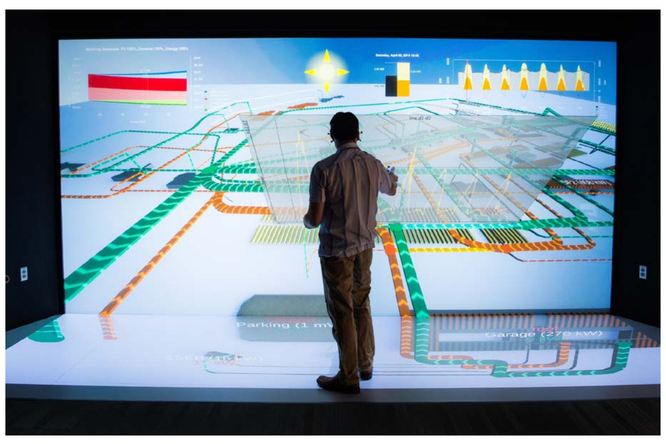
- **Clean Energy Solutions Center** – Provides free technical assistance on EWFN policies and financing strategies
- **Energy-Water-Food Nexus website** – Features the latest in EWFN research
- **Resiliency Planning** – Informs development of infrastructure resilient to natural disasters and climate change
- **Integrated Resource Planning** – Addresses energy, water, food, and climate relationships in long-term planning
- **Energy Access and Gender Equality** – Supports policy development.



MODELING & ANALYSIS

NREL has advanced modeling and analysis capabilities to identify EWFN opportunities:

- **Renewable Energy Integration and Optimization (REopt) model** – Optimizes energy and water systems to identify cost and energy-saving strategies
- **Regional Energy Deployment System (ReEDS) model** – Identifies water resource and climate change impacts on power system operations
- **Other Capabilities** – Modeling energy-water production costs, waste to energy systems, and energy-water tradeoffs for electricity and water distribution systems; evaluating implications of colocating PV and agriculture; conducting EWFN life-cycle assessments; identifying opportunities for energy and grid services in water infrastructure.



ENERGY-WATER SYSTEMS INTEGRATION

NREL uses a system-of-systems approach to evaluate the relationships between energy generation, energy storage, vehicles, water and wastewater systems, hydrogen infrastructure, grid technologies, and communication networks to ensure optimal integration and resiliency:

- Conducts hardware-in-the-loop testing of renewable energy powered water treatment technologies
- Evaluates co-optimization of energy and water treatment systems, providing grid services
- Analyzes energy-water microgrid systems to optimally manage energy and water loads
- Develops strategies for advanced communications and control testing for smart water and energy systems.

TECHNOLOGY DEPLOYMENT & DEMONSTRATION

NREL is working around the world to support the deployment of integrated solutions for the EWFN:

- Conducts water and renewable energy resource studies to inform project development
- Identifies opportunities for energy efficiency, renewable energy, and water conservation
- Evaluates renewable energy powered water treatment technologies
- Optimizes energy and water systems through audits and management strategies
- Evaluates water treatment technologies to optimize cooling tower operations.

FOR MORE INFORMATION:

Clean Energy Solutions Center: www.cleanenergysolutions.org
NREL Energy-Water Work: www.nrel.gov/analysis/energy-water.html
Energy Systems Integration Facility: www.nrel.gov/esif/research.html
REopt Model: https://reopt.nrel.gov/

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