



Unique Perspectives On a Transforming Energy Economy

2014 Annual Meeting

March 12, 2014

Doug Arent



Logistics and Safety

RSF Building Evacuation Routes

- 1** WING A evacuates north and gathers on road in front of S&TF
- 2** WING B AND C evacuates east and gathers at the RSF Visitor Parking Lot



★ Restrooms

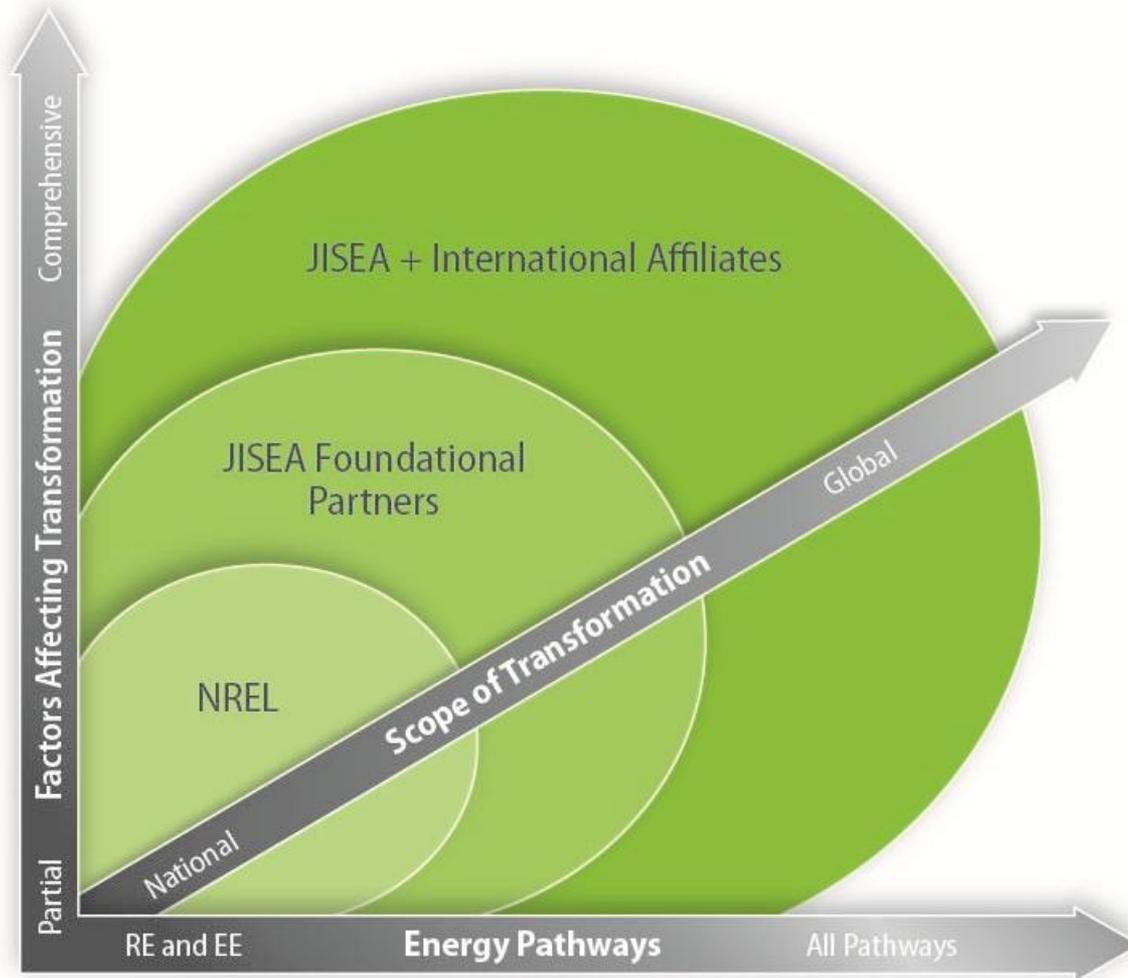
Recycling / Composting / Trash

Blue Bin – Recycling	Green Bin – Composting	Gray/Tan Bin - Trash
<ul style="list-style-type: none"> • Plastics 1-7 • Glass • Cans • Paper 	<ul style="list-style-type: none"> • Any food product • Paper Plates • Napkins ,Paper towels, Kleenex • Compostable cups, plates utensils • Tea bags 	<ul style="list-style-type: none"> • Foil and cellophane wrappers • Plastic bags • Styrofoam

Informing Energy System Transformations

JISEA research focuses on the intersections of energy, finance, and society. With thought-provoking analysis of energy technologies and energy systems, JISEA materially impacts the national energy agenda and energy systems transformation.

JISEA's Mission Space



Making All This Possible: Teamwork

Program Committee

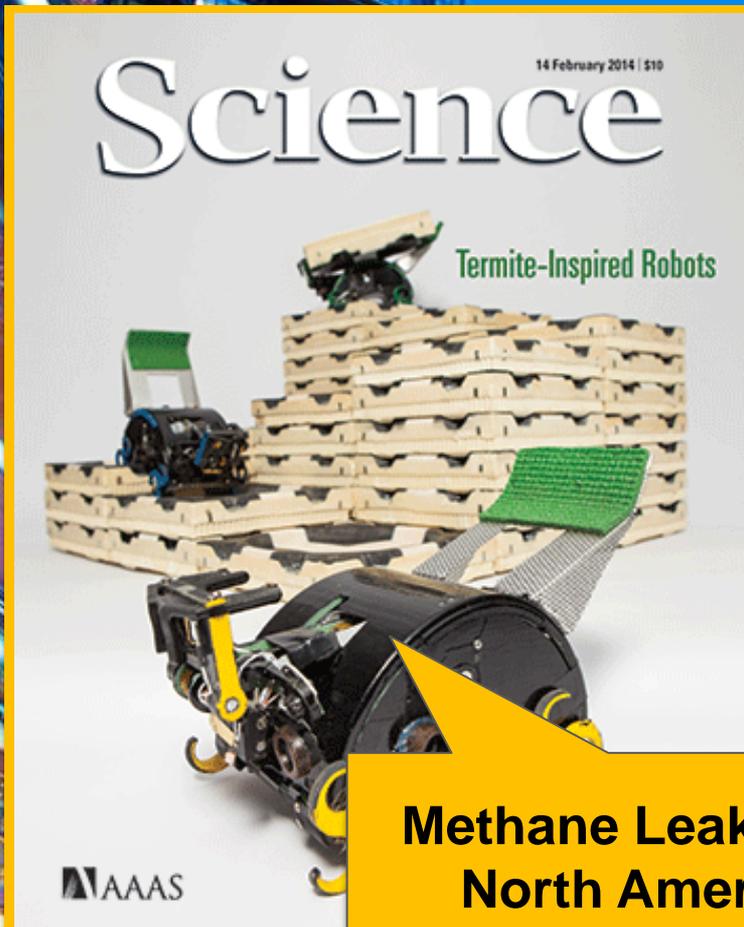
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- Masdar Institute for Science and Technology
- Renewable and Appropriate Energy Laboratory, U. C. Berkeley

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Building a Foundation for Sound Decisions



Methane Leaks from North American Natural Gas Systems

JISEA Joint Institute for Strategic Energy Analysis



Exploring the Potential Business Case for Synergies Between Natural Gas and Renewable Energy

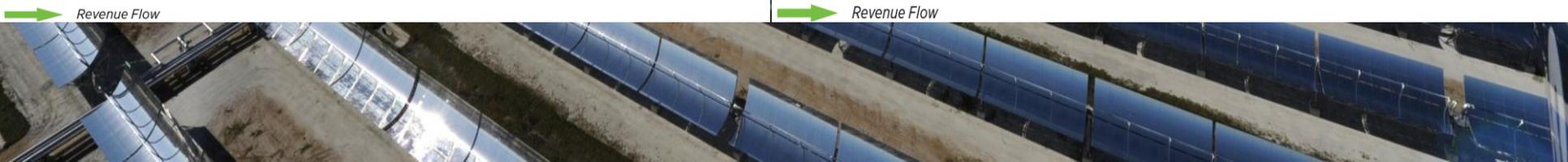
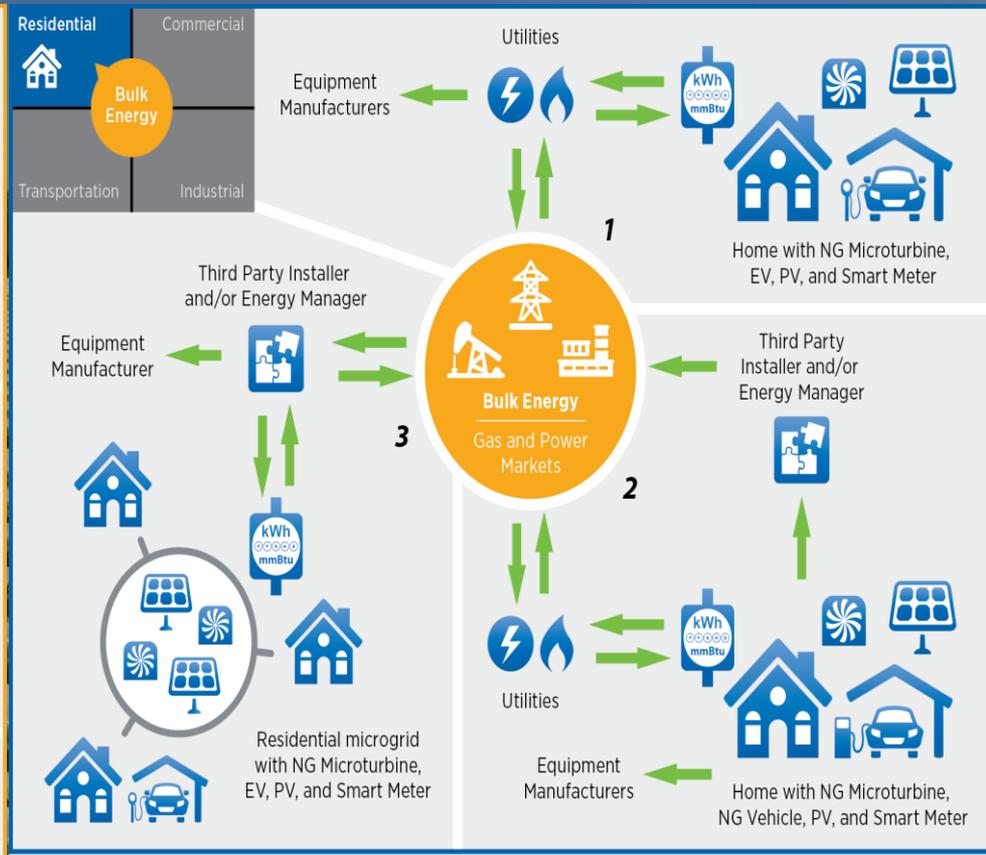
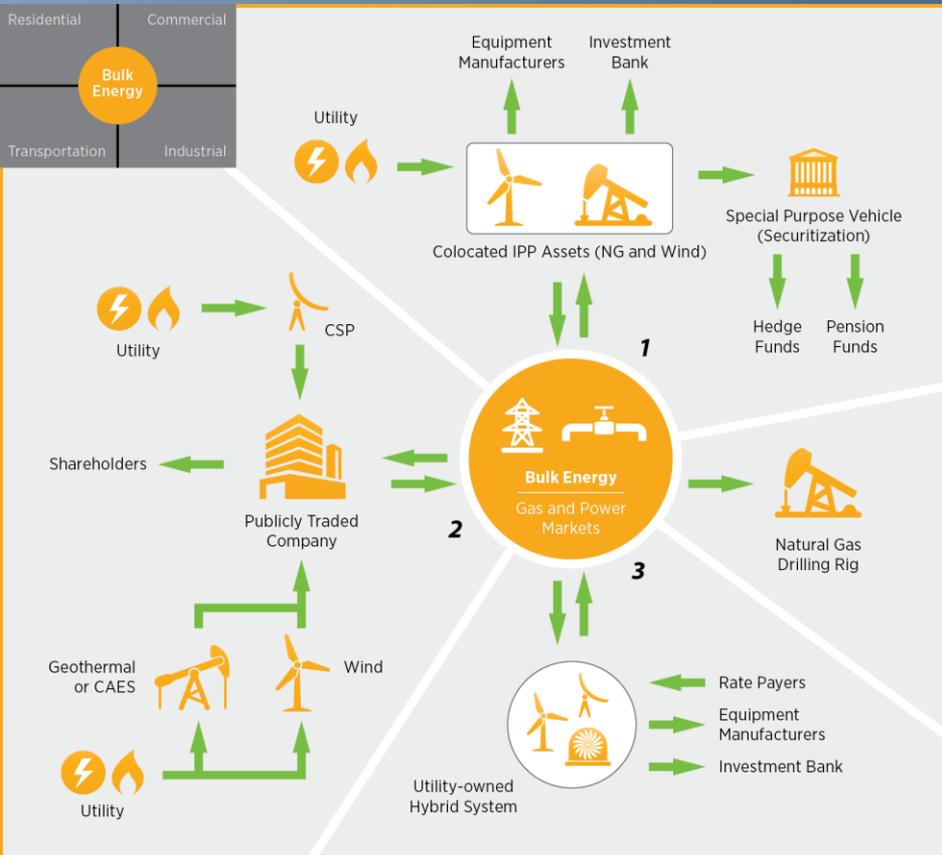
Jaquelin Cochran, Owen Zinaman, Jeffrey Logan, and Doug Arent
National Renewable Energy Laboratory (NREL)

The Joint Institute for Strategic Energy Analysis is operated by the Alliance for Sustainable Energy, LLC, on behalf of the U.S. Department of Energy's National Renewable Energy Laboratory, the University of Colorado-Boulder, the Colorado School of Mines, the Colorado State University, the Massachusetts Institute of Technology, and Stanford University.

Technical Report
NREL/TP-6A50-60052
February 2014
Contract No. DE-AC36-08G028308

Efficient, Economically Attractive Options



Leading Nationally and Internationally



JISEA Joint Institute for Strategic Energy Analysis

Natural Gas and the Transformation of the U.S. Energy Sector: Electricity

Jeffrey Logan, Garvin Heath, and Jordan Macknick
National Renewable Energy Laboratory

Elizabeth Paranhos and William Boyd
University of Colorado Law School

Ken Carlson
Colorado State University



Opportunities for Synergy Between Natural Gas and Renewable Energy in the Electric Power and Transportation Sectors

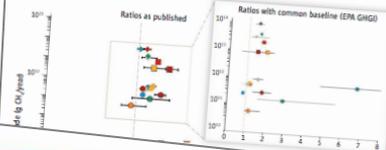
April Lee, Owen Zinaman, and Jeffrey...

ENERGY AND ENVIRONMENT

Methane Leaks from North American Natural Gas Systems

Underestimation—Device to Continent

Studies that estimate emissions after atmospheric mixing occurs ("atmospheric" studies) typically compare measurements to emissions inventories, such as the U.S. Environ...



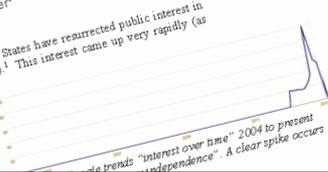
International Association for Energy Economics

Linking Energy Independence to Energy Security

By Morgan Bazilian, Benjamin Sovacool, and Mackay Miller*

Introduction

Dramatic changes in oil and gas production in the United States have reawakened public interest in "energy independence" (see e.g., Houser and Mohan, 2012).¹ This interest came up very rapidly (as Figure 1 depicts)—the rhetoric only 5-7 years ago was dramatically different (see e.g., CFR, 2006). This attraction likely stems in part from a connotation that "independence" equals resiliency and stability of energy services without risk of domestic energy issues and, probably more interestingly, in addition, the vocabulary used to briefly explore aspects of energy security, although politically such can detract from sound energy sector.



operated by the Alliance Department of Energy's University of Colorado-Boulder, University, the of University.



Variance Analysis of Wind and Natural Gas Generation under Different Market Structures: Some Observations

Brian Bush, Thomas Jenkin, David Lipowicz, and Douglas J. A... National Renewable Resources for the F...

Roger Cooke

Life Cycle GHG Emissions from Conventional Natural Gas Power Generation: Systematic Review and Harmonization

INLCA XII

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Journal of Unconventional Oil and Gas Resources

journal homepage: www.elsevier.com/locate/juogr

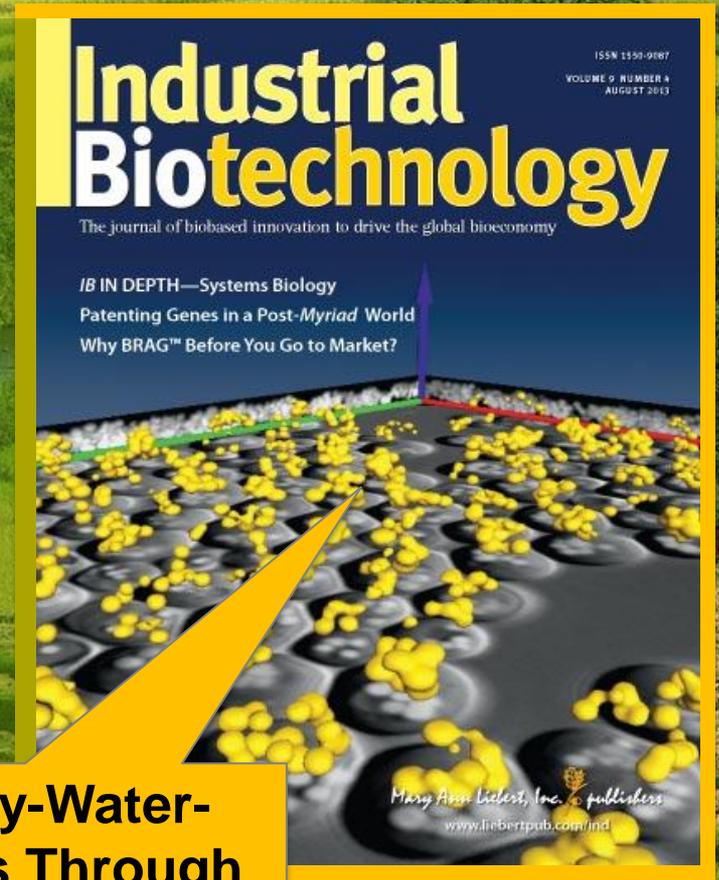
Ensuring benefits from North American shale gas development: Towards a research agenda

M. Bazilian^{a,*}, A.R. Brandt^a, L. Billman^b, G. Heath^b, J. Logan^b, M. Mann^b, M. Melaina^b, P. Statwick^c, D. Arent^c, S.M. Benson^{a,d}

JOURNAL OF INDUSTRIAL ECOLOGY

Advancing Our Understanding of Human-Earth System Interactions

Energy systems integration is a critical research and development area that will underpin the energy system of the future.



The Energy-Water-Food Nexus Through the Lens of Algal Systems

Supporting Global Initiatives



21st Century POWER PARTNERSHIP



21st Century POWER PARTNERSHIP
Accelerating the transformation of power systems

Flexible Coal

Evolution from Baseload to Peaking Plant

The experience cited in this paper is from a generating station with multiple units located in North America referred to here as the CGS plant. For commercial reasons, the station has not been identified.

Jaquelin Cochran,^a Debra Lew,^a Nikhil Kumar^b

^a National Renewable Energy Laboratory, ^b Intertek

Summary for Policymakers:
Key Findings from a North American Coal Generating Station (CGS)

Twenty-first century power systems, with higher penetration levels of low-carbon energy, smart grids, and other emerging technologies, will favor resources that have low marginal costs and provide system flexibility (e.g., the ability to cycle on and off to follow changes in variable renewable energy plant output). Questions remain about both the fate of coal plants in this scenario and whether they can cost-effectively continue to operate if they cycle routinely.




21st Century POWER PARTNERSHIP
Accelerating the transformation of power systems

Market Evolution: Wholesale Electricity Market Design for 21st Century Power Systems

Jaquelin Cochran, Mackay Miller, Michael Milligan, Erik Ela, Douglas Arent, and Aaron Bloom
National Renewable Energy Laboratory
Matthew Futch
IBM

Juha Kiviluoma and Hannele Holttinen
VTT Technical Research Centre of Finland
Antje Orths
Energinet.dk

Emilio Gómez-Lázaro and Sergio Martín-Martínez
Universidad de Castilla-La Mancha

Steven Kukoda and Glycon Garcia
International Copper Association

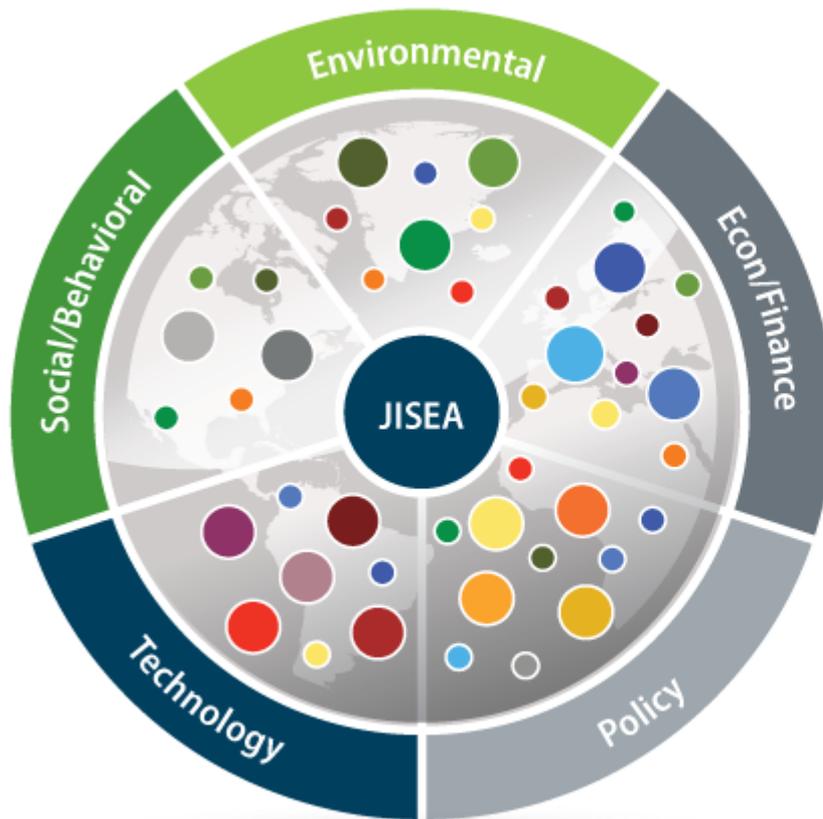
Kim Møller Mikkelsen
Global Green Growth Institute (GGGI)

Zhao Yongqiang and Kaars Sandholt
China National Renewable Energy Center

21stCenturyPower.org

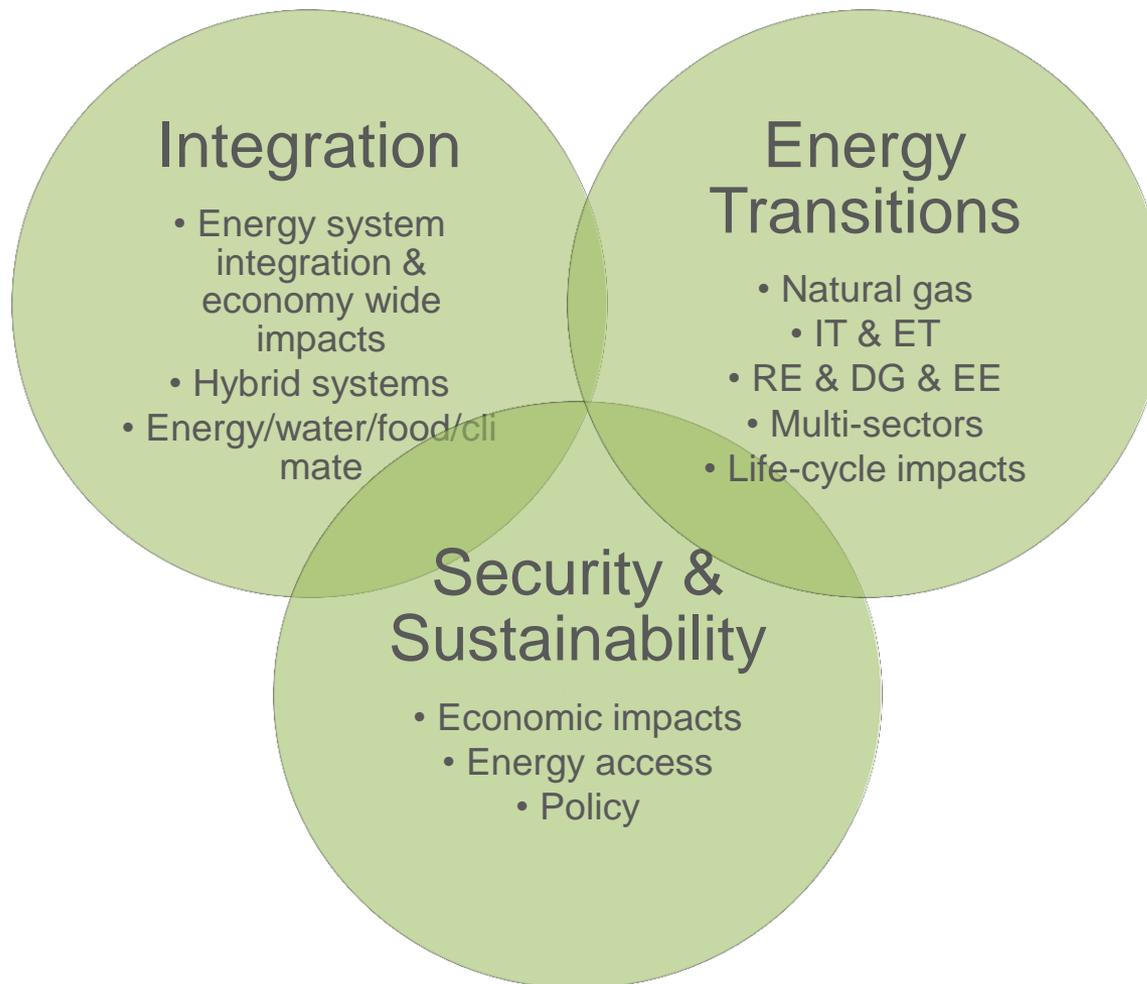
Technical Report
NREL/TP-6A20-57477
October 2013
Contract No. DE-AC36-08-O228308

Funding Innovative Research



- Energy H₂O Nexus
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Looking Ahead



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