International Institute for Energy Systems Integration

Outputs from Copenhagen Workshop

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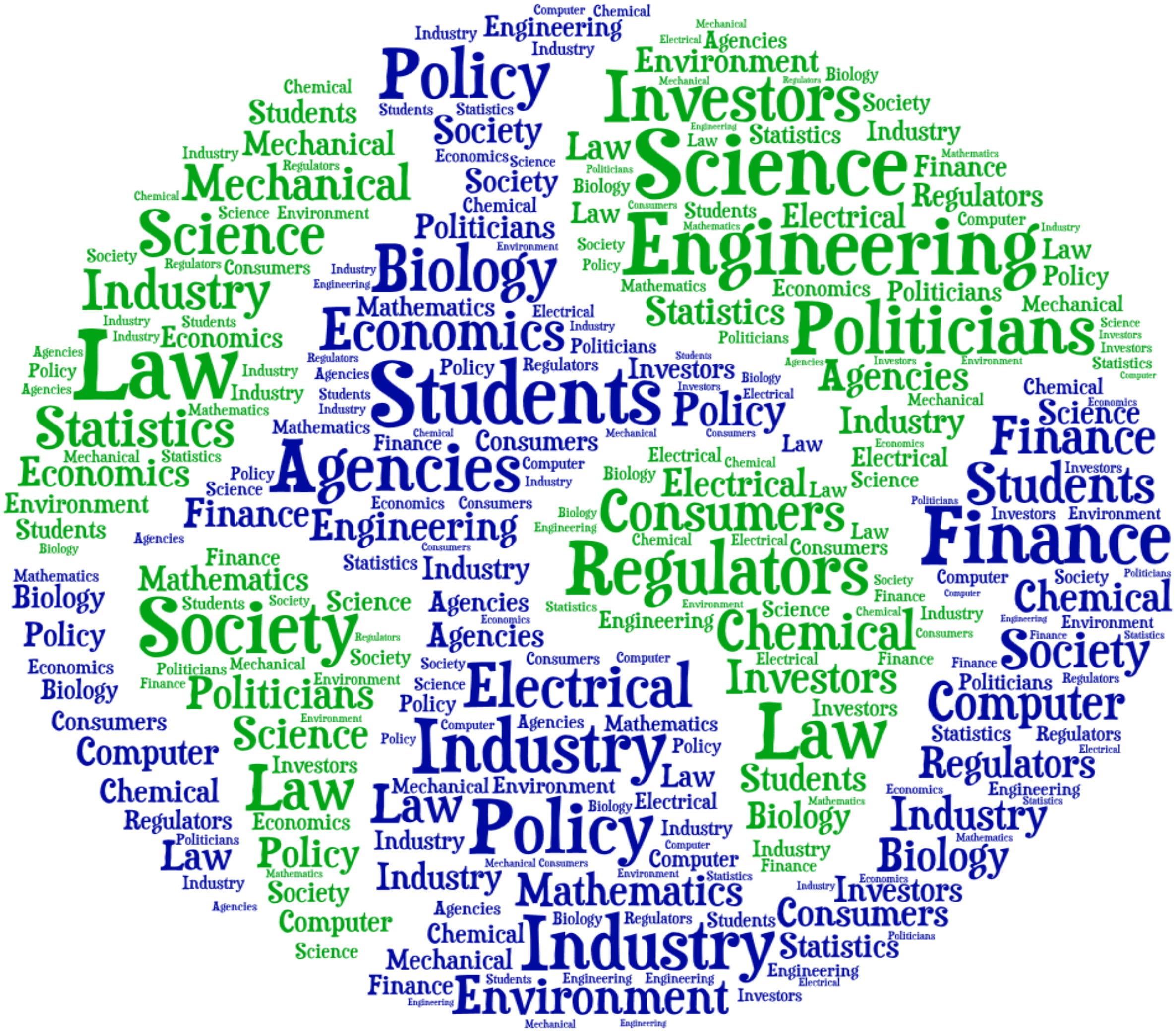
Multiple Stakeholders



Desired outcomes

- Identify knowledge generation opportunities
  - "White space"
  - Lessons learnt
    - From the past
    - From one another
- Communication of knowledge generation
  - Academic – journals, magazines, reports
  - Thought leadership – actions in particular with industry

iiESI International Institute™ for Energy Systems Integration

Self Assessment: Desired outcomes

	Regulation	Gas/Electricity	Decentralised	Energy water
Knowledge White Space	• Regulation needs to be in the models • Policy models need to have the physics	• JOINT contingency analysis, planning & flexibility • Untapped synergies	• Enable aggregation • Interactions of DR/DER impact grid • DATA handling	• Understand where energy is used in water and water used in energy
Knowledge Lessons Learnt	• Avoid mistakes with systems thinking. • LMPS in Europe.	• Coordination of gas/electricity markets	• Many positive examples • The value proposition	• Large use of energy • Broader aspects, food • Localised issue
Communication Academic	• iiESI Website, slides, summary of event • Journals, reports, etc.			
Communication Thought leadership	• Remove uncertainty by objectively identify the “best” options for the energy system • Education of society in particular the policy makers			

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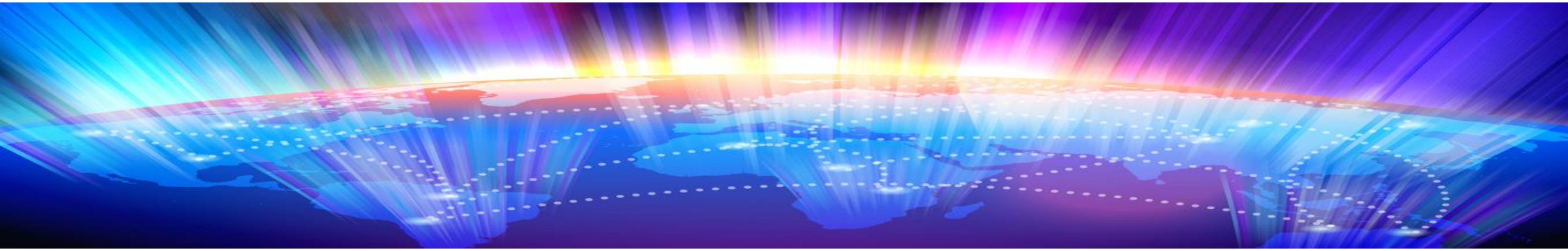
Integration



Addressing Energy Challenges Through Global Collaboration

Our Mission:

To ensure investments in energy systems integration are coordinated and optimized to yield the greatest value possible to the global community.

Our Vision:

Engage people in efforts to enable highly integrated, flexible, clean, and efficient energy systems.

Our Near-Term Objectives:

- Hold 2-3 meetings each year to foster the exchange of ideas, results, lessons learned, and best practices from energy systems integration activities
- Create a framework for knowledge capture, management, and transfer from energy systems experience and experiments conducted to date and in the future
- Coordinate investments in future energy systems integration R&D and education

Contacts and Further Information to be found at:

www.iiesi.org

Closing Comments

- Slides and summaries will be on website www.iiesi.org

- Next meeting announced soon
  - September at NREL in colloboration with IEA RIAB
  - November in Kyoto, Japan ?
  - Energy Systems Integration 101 – July 2014

International Institute™ for Energy Systems Integration

Energy Systems Integration 101

National Renewable Energy Laboratory
Golden Colorado, July 21-25, 2014

Curriculum

- Introduction
- Energy systems domains and interactions
- Methods, tools and applications
- Regulatory, policy and business models
- Project work

Instructors

- Prof. Mark O'Malley, ERC, University College Dublin
- Dr. Ben Kroposki, Dr. Jaqulein Cochran, Mark Ruth & Patrick Sullivan, NREL
- Prof. Henrik Madsen, CITIES, Danish Technical University
- Prof. Jim McCalley, Iowa State University
- Rob Pratt, PNNL
- EPRI, TBA

To register please go to https://www.surveymonkey.com/s/BKFZLLC
For further information and to reserve your place please contact judy.will@nrel.gov

Gas Electric Integration

Notes

- Questions to Raise
  - Need to look at joint contingency analysis
  - Earth systems coupling not addressed yet
- Key points to reflect in summary
  - Role of storage as degree of freedom for strategic response in the future (William d'H)
    - Interplay of elec flexibility planning w storage and DR needs to be linked to gas storage and perhaps thermal storage
  - Common US-Eur view of using gas to balance growing renewable aspirations
  - Back-up capacity, if decreasing gas network use decays gas supply condition or make it increasingly expensive to maintain. Oil and coal back-up could remain necessary and economically efficient
  - Clear differences between Eur and US in terms of DR forecasting as overall element of forecasting challenges
  - Conflict short-term flexibility and long-term reliability. Real-time diagnosis tools
  - Need to harmonize timing of gas elec market arrangements. Gate closer limitation for gas due to slow dynamics
  - Delayed response of gas network must be reflected in elec inc/dec decisions to avoid gas imbalance risks (need for fast intermediary resources such as storage or DR)
  - Virtual "linepack" vs virtual "inertia" ???
  - Improved coordination between planning/operation for gas and electric sector
  - ENEL focusing on improved CCGT designs and operational optimization to meet renewable system needs (diagnostics, optimized O&M)
  - Regulatory uncertainty large barrier to investment in flexibility resources (ENEL) e.g. thermal power plant requirement differ depending on RE support schemes (e.g. priority grid access)
  - France looking for co-optimization between gas and elect; shift from electricity to gas can deliver long-term DR (10hrs) has stronger impact on electric grid expansion cost
  - See gas quality and use transitioning for gas …. → renewable gas …. Trying to frame possibilities and identifify what knowledge remains to be developed.
  - Synergy between biomass digestion (CO2 release, heat release) and 'power2gas' (CO2 capture, heat consumption).

Regulation, Policy & Market Design Session

Summary Points

Version 1

Regulation, Policy & Market Design Session

- US and EU policies consist of multiple schemes
  - Governments mandate renewables
  - Negative pricing results
  - Thermal units retired due to low margin
  - Capacity markets required
  - Coal generation maintained
  - Carbon price increased
  - Grid services markets created, etc...

- Could we have avoided with systems thinking?

Regulation, Policy & Market Design Session

- US and EU taking quite different approaches
  - Federal/State relationships (EU strong Fed, US strong State)
  - zonal pricing in EU vs. nodal LMPs in US
  - competitive markets (PJM, EU) vs. hybrid regulation (cost of service in Wisconsin + MISO) vs. full regulation (other US)

- Difficult to compare US and EU systems
  - Size, diversity of power pools is comparable
  - Different political targets and objectives
  - Many lessons to be learned and shared
  - Single optimal framework may not be possible or desirable

Regulation, Policy & Market Design Session

- Comments of Note
  - Prof. Perez-Arriaga: Why is it not thinkable to have nodal pricing in Europe? Would it be worth the effort?
  - Andy Ott: In the EU, the market design has been done backwards; first design of forward market, but ignoring the physical flows
  - Anne Hoskins: Active markets for demand response in PJM area show remarkable success in reducing peak. Markets do work.
  - Eric Callisto: Electricity rates in regulated markets tend to be lower than in competitive markets
  - William D’haeseleer: Regulators apply the rules set by policy makers! So often policy makers are to be blamed for bad market function

Regulation, Policy & Market Design Session

- Closing Thoughts
  - It is essential to think about the time frame of the energy supply: from long term (investment) and security of supply up to real time operations, balancing actions.
  - They each focus on separate issues, but they are linked and influenced by policy.
  - It was clear that all systems aspects need to be taken into account when designing regulation, and
  - to take regulation into account when modeling system aspects...

Decentralised DSM

“Decentralisation & DSM” Identified Needs

- enabling aggregation of loads
  - regulatory freedom to operate (current rules usually made for incumbent generators and large interruptible loads)
  - compatible (and inexpensive) IT for large-scale roll-out
- value proposition
  - make understandable to customer that provides load (e.g. $50 Walmart card in PJM)
  - markets for different services open to aggregators
- better understand and control localised grid interactions (+/-) upon activation of DER and DR
- challenge of handling large quantities of data
- learn from many successful examples in different countries