JISEA
Joint Institute for Strategic Energy Analysis

Welcome to the 2021 JISEA Annual Meeting!

Energy, Climate and Air Pollution

13 April 2021

Introduction: Jill Engel-Cox, JISEA Director

Moderator: Garvin Heath NREL/JISEA

@JISEA1

www.jisea.org

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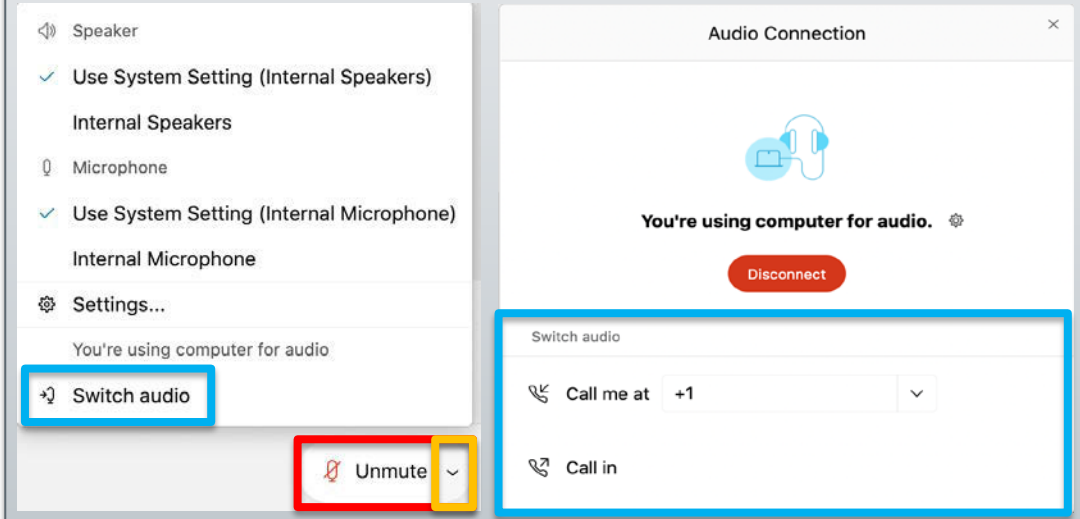
Housekeeping and WebEx Tips

To find or switch audio options:

1. Select carrot next to Mute/Unmute button
2. Select Switch Audio
3. WebEx will display your current audio option at the top
4. Other audio options displayed under “Switch audio”



To change view options:

1. Select layout button

2. Change to:

   Grid – All videos shown

   Stage – Speaker highlighted, other videos below

   Focus – Only speaker video shown

Message Isabel McCan if any technical problems.

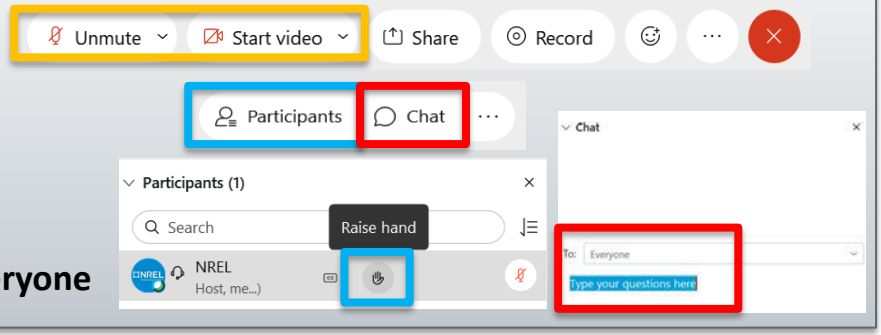
Housekeeping and WebEx Tips

Engage!

- Answer polls
- Comment in the chat
- Ask questions

During the presentation(s):

- Stay muted
- Camera off
- If you have a question:
  - **Raise your hand, or,**
  - **Type it in the chat box to Everyone**



Asking questions:

- Unmute
- Camera on

Overall Agenda: All Sessions 8:30-9:45 am MT

Monday, April 12:	**Industrial Clean Energy**
	At 1:00 pm MT: Interactive virtual campus tour
Tuesday, April 13:	**Energy, Climate, and Air Pollution**
Wednesday, April 14:	**Keynote Discussion: Energy Equity**
Thursday, April 15:	**Sustainable Communities**
Friday, April 16:	**Topic "Tables" Discussion with Experts**

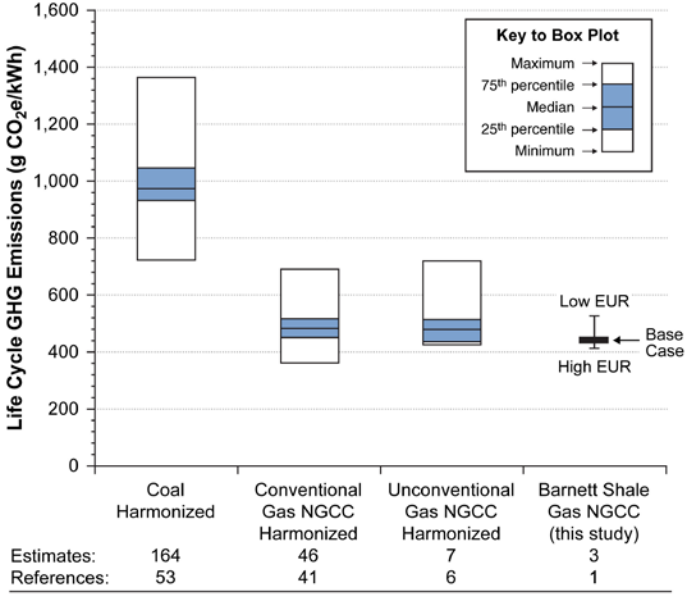
All sessions include ~45-minute presentations and ~30-minute open questions & discussion.

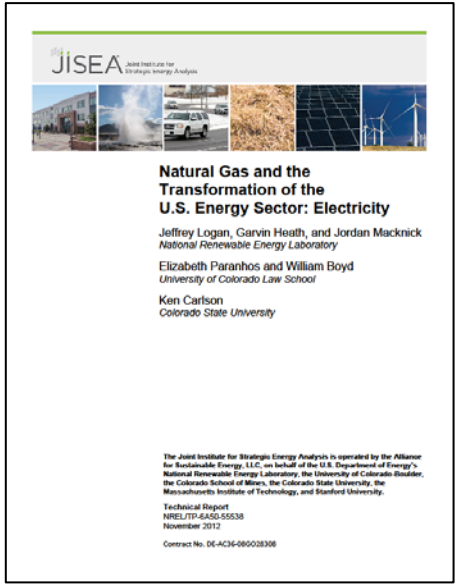
Agenda

- Examples of NREL research related to energy, climate and air pollution
- JISEA Catalyzer on Energy and Atmospheric Systems
- Speakers
- Discussion

JISEA's First Study Included Energy-Climate

- Developed novel estimate of life cycle GHG emissions from Barnett Shale based on air pollutant emissions inventory
- Harmonized published life cycle GHG emissions estimates of conventional and unconventional NG





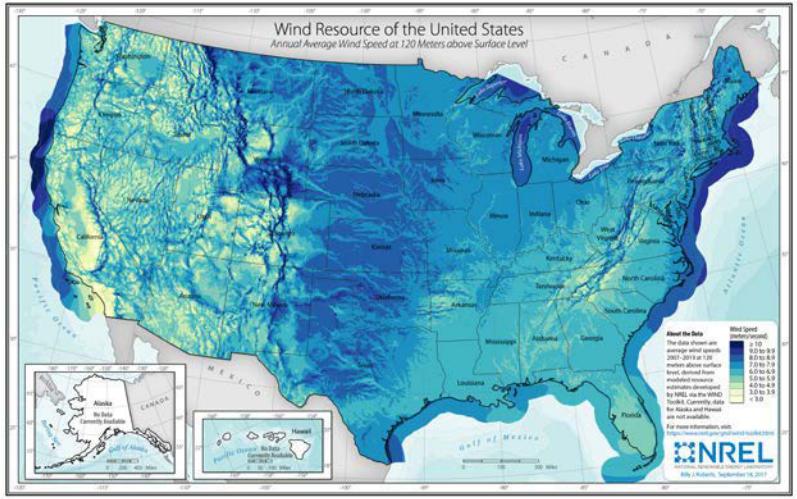
EUR = estimated ultimate recovery
NGCC = natural gas combined cycle

Sources: Conventional – O'Donoughue, P.; Heath, G.; Dolan, S. Vorum M.; (2012). "Life Cycle Greenhouse Gas Emissions from Natural Gas–Fired Electricity Generation: Systematic Review and Harmonization." *Journal of Industrial Ecology*;
Unconventional – Heath, Garvin, Patrick O'Donoughue, Doug Arent, and Morgan Bazilian. 2014. "Harmonization of Initial Estimates of Shale Gas Life Cycle Greenhouse Gas Emissions for Electric Power Generation." *Proceedings of the National Academy of Sciences.*

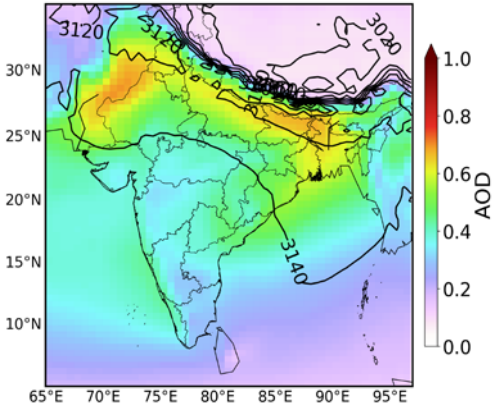
Renewable Energy and Atmospheric Systems

17% of NREL's HPC used for atmos. science

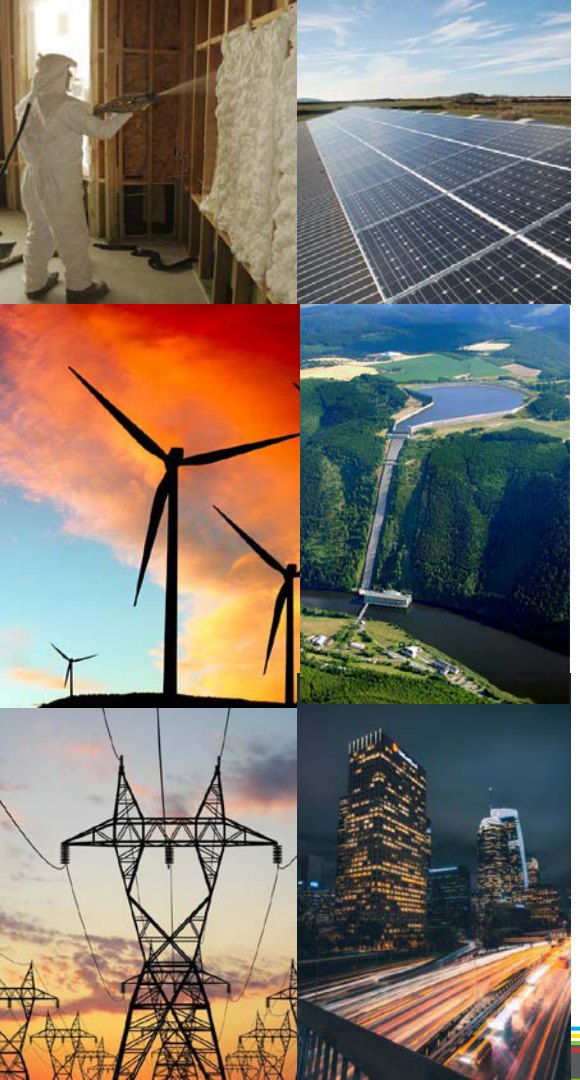
- Solar and wind resource assessments have been a core capability of NREL used globally for decades
- Solar: particles emitted as part of air pollution attenuate solar radiation as much as 20-25% in most polluted cities
  - Now developing workflows such that future solar resource assessments could better capture km-scale spatial variation in aerosols (particles)
  - This will enable more accurate financial modeling of solar power output, more refined siting, and with further development, improved forecasting
- Have also examined effect of climate change on solar and wind resources
  - I Losada Carreño, *et al.,* "Potential impacts of climate change on wind and solar electricity generation in Texas," *Climatic Change* **163** 745, 2020



USA wind resource at 120 m (now up to 200 m)



Indian air pollution



LA100

The Los Angeles 100% Renewable Energy Study

- What are the **pathways and costs to achieve a 100% renewable electricity supply** while electrifying key end uses and maintaining the current high degree of reliability?
- What are the potential benefits to **the environment** (ozone and PM2.5 concentration changes) and **health**?
- How might **local jobs** and the **economy** change?
- How can communities shape these changes to prioritize **environmental justice?**

https://www.nrel.gov/analysis/los-angeles-100-percent-renewable-study.html

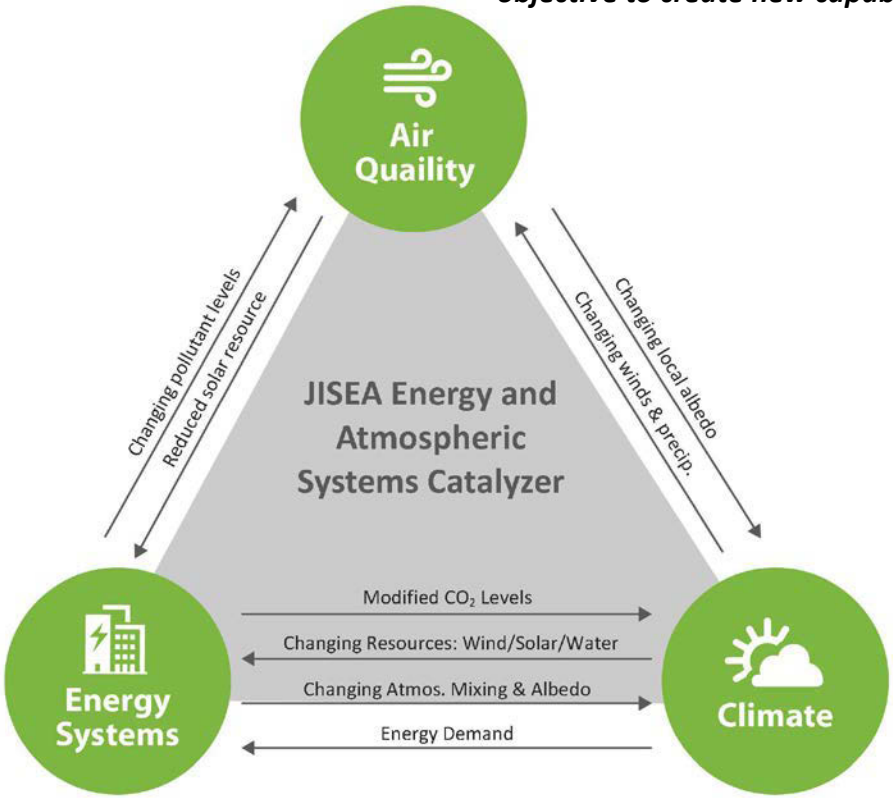
JISEA Catalyzer Theme: Energy and Atmospheric Systems

catalyzer = an incubator with the objective to create new capability

Model and quantify multidirectional relationships of climate, air quality, and energy systems

Lead PI: Garvin Heath; co-PI: Michael Martin

- Climate and air quality are drivers of global transitions in power, transportation, industry, buildings, and product design.
- Clean energy technologies will be affected by a changing atmosphere and will impact atmospheric systems in more ways than reduced CO_2 emissions (see figure).
- Contributes to potential new NREL critical objective on sustainability and environmental justice.



Energy, Climate and Air Pollution

Speakers

1. Nigel Jenvey, Global Head of Carbon Management, Gaffney, Cline & Associates
2. Noelle Selin, Associate Professor, MIT
3. Carolyn Synder, Director, Climate Protection Division, US EPA

Thank you!

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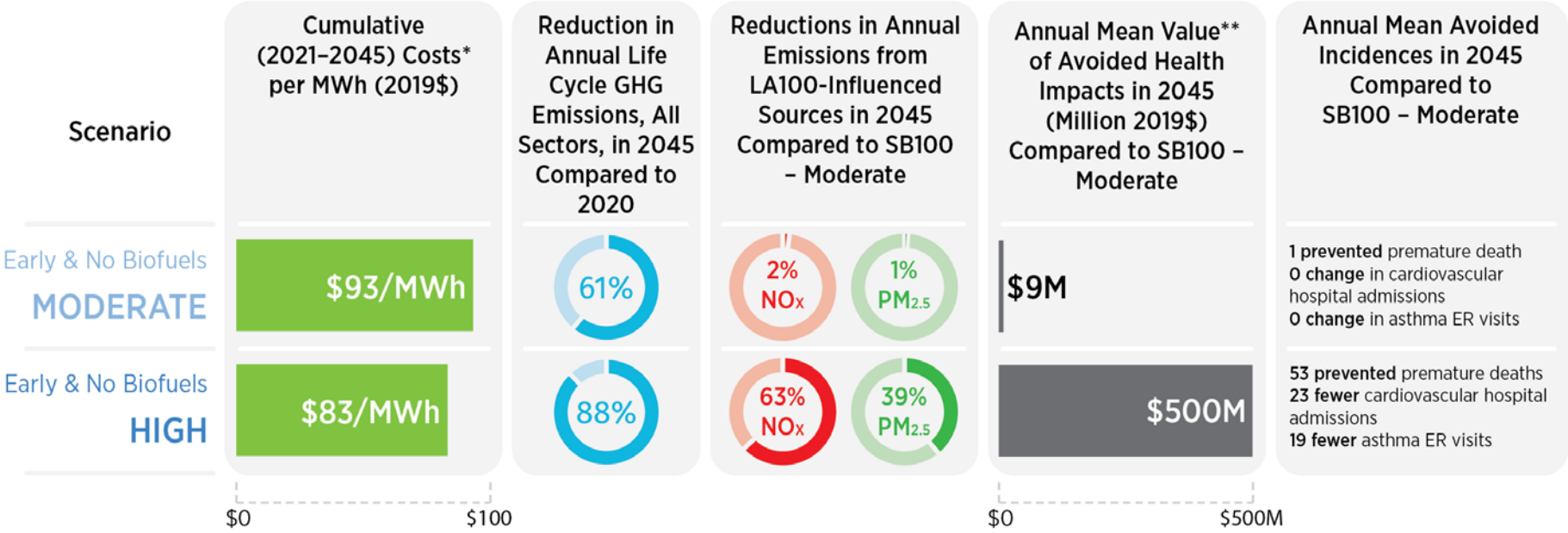
Backup

High vs. Moderate Electrification
Greater benefits, lower per-unit costs



*Annual per-MWh costs do not equal rates—these costs represent the revenue requirement (per unit of generation) to cover the annualized costs associated with expenditures measured in LA100.

**95% confidence interval of values of avoided health impacts in 2045 compared to SB100 – M is: Early & No Biofuels – M ($1M–$24M) and Early & No Biofuels – H ($19M–$1,400 M).