

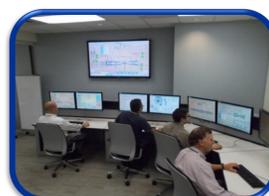


## Motivation/Challenges

- Clean energy plants are large, highly-integrated, power and process systems requiring safe, reliable, and efficient operation and control
- Renewable generation increases need for cycling and load following, while minimizing derates, emissions, and equipment damage
- Changing demographics and rapidly evolving automation, control, and smart manufacturing technologies necessitate training the next generation of engineering and operations professionals

## Technology/Capability Overview

- Simulation-based Technology and Tools
  - Portfolio of high-fidelity real-time dynamic simulators for energy plants with CO<sub>2</sub> capture
    - Integrated Gasification Combined Cycle (IGCC)
      - Natural Gas Combined Cycle (NGCC)
      - Supercritical Once-Through (SCOT) Pulverized Coal
- World-class simulator and training facilities at NETL and West Virginia University
  - Full-scope operator training systems (OTSs)
  - 3D virtual immersive training systems (ITSs)



## Industry Significance

- Accelerate progress toward achieving Operational Excellence for clean energy plants
  - 1) Asset, 2) Control, 3) Environment & Safety, and 4) People
- Effectively evaluate operational and control performance of CO<sub>2</sub> capture technologies (Virtual Carbon Capture Center - VCCC)



## Benefits to Partners

- Research and Development
  - Access to virtual energy test beds, modern simulator facilities, and leading energy experts
- Training and Education
  - Industry workforce training and engineering education via hands-on, simulator-based experiential learning
  - Team-based operations and safety training for control room and plant field personnel using integrated OTS/ITS solutions

## Opportunities

- Research and Development
  - Opportunities for collaborative, internationally-recognized R&D on the safe, reliable, and efficient operation and control of clean energy plants
  - Specify, develop, test, and deploy dynamic simulators/OTSs/ITSs
  - Virtual energy test beds for R&D on plant operations, dynamics, advanced process control, sensor networks, real-time optimization, virtual plant technology, smart/advanced manufacturing, and modern grid
  - Virtual carbon capture center for commercial-scale operations testing
- Training and Education
  - Utilize AVESTAR simulation-based solutions for industry workforce training and engineering education

## Development Status

- CRADA between NETL and Invensys to develop NGCC dynamic simulator with OTS and ITS
- CRADA between NETL and Invensys to develop SCOT dynamic simulator with OTS with CO<sub>2</sub> Capture hooks
- Software copyright license agreement with Invensys for IGCC dynamic simulator with OTS and ITS, as well as derivative works
- MOU between NETL, WVU, and Pierpont Community & Technical College (PCTC) to provide simulation-based industry workforce training

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