Enabling an Accelerated and Affordable Clean Hydrogen Future - Fossil Energy Sector's Role

Panel Discussion

State/Utility Perspective on Fossil Energy Hydrogen Challenges

September 27, 2022





DUKE ENERGY®

Who We Are

ELECTRIC UTILITIES & INFRASTRUCTURE

- Operating in six jurisdictions, serving 7.9 million retail customers
- Customer rates below the national average in all customer classes and all service areas for the seventh consecutive year

GAS UTILITIES & INFRASTRUCTURE

- Five state LDCs serving 1.6 million customers
- Significant investments in midstream natural gas pipeline and storage facilities

COMMERCIAL RENEWABLES

- Invested ~$5 billion over past 10 years
- Approximately 4 GWs of wind and solar in operation

Our Climate Leadership

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Working to achieve net-zero carbon emissions by 2050

Company CO_2 Emissions Reduction Goals

- Cut CO_2 emissions from electricity generation by at least 50% by 2030
- Attain net-zero CO_2 emissions from electricity generation by 2050

Company CO_2 Reductions Already Achieved

- ✓ Exceeded the 2025 reduction benchmarks agreed to by the U.S. for the Paris climate accord
- ✓ Met the 2030 CO_2 emission-reduction requirements of EPA's former Clean Power Plan almost 11 years early

Path to a low-carbon future

- Collaborate and align with our states and with stakeholders as we transform
- Accelerate transition to cleaner energy solutions
- Modernize our electric grid to optimize renewables and storage deployment
- Continue to operate existing carbon-free technologies, including nuclear and renewables
- Advocate for sound public policy that advances technology and innovation

Long Track Record of Climate Commitments

2010
Initial carbon reduction goal of 17% by 2020

2017
Updated goal to 40% carbon reduction by 2030

2018
Climate report to shareholders

2019
Updated goal to at least 50% carbon reduction by 2030 and net-zero by 2050

2020
Updated Duke Energy climate report to shareholders

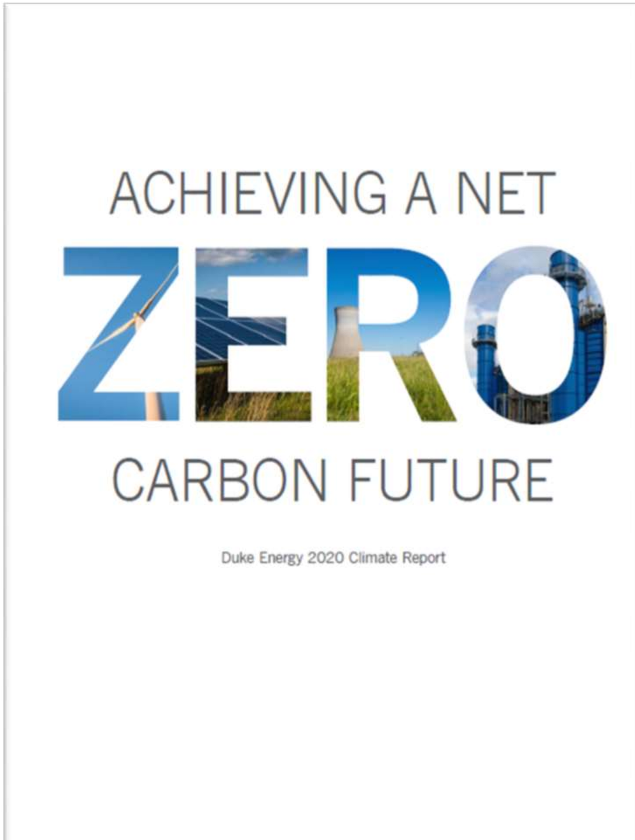
2020
Carolinas IRP filed with pathway to 70% carbon reduction by 2030

2020
Pledge to electrify vehicle fleet by 2030

2018 – 2020 and beyond
Stakeholder engagement greatly enhanced across all jurisdictions

OCTOBER 2020
Announced methane emissions goal of net-zero methane by 2030

2020 Climate Report Net-Zero Scenario Analysis



- **We analyzed an illustrative pathway that achieves our net-zero goal by 2050**
- **To achieve net zero, we will:**
  - ✓ Continue to retire coal
  - ✓ Continue to utilize lower-emitting natural gas
  - ✓ Add significant amounts of renewables and storage
  - ✓ Continue to operate our existing nuclear fleet
  - ✓ Adopt advancements in demand-side management and energy efficiency
  - ✓ Need new zero-emitting, load-following resources (ZELFRs) like advanced nuclear; carbon capture, utilization and storage; zero-carbon fuels (hydrogen, etc.); and long duration energy storage starting as early as 2035

We need ZELFRs to be developed and policy and stakeholder support for our transition as we move down this exciting path

Our Advanced Clean Energy Technology Priorities

	Advanced Nuclear	Hydrogen	Long Duration Energy Storage	Carbon Capture, Utilization and Storage
Current Activity (Selected Examples)	✓ Partnership with TerraPower and GE on Natrium design ✓ Active involvement in developers' advisory boards and other initiatives	✓ Siemens/Clemson/DOE techno-economic study – evaluating pilots at Clemson & elsewhere ✓ Supporting OEM development of H_2 capable resources ✓ Energy Futures Initiative Carolinas green hydrogen hub study	✓ Multiple pilots of advanced battery chemistries (e.g. metal-air, flow batteries) ✓ Partnership with Malta to study repowering coal sites with thermal storage	✓ Completed engineering and economic studies at multiple sites (e.g. Edwardsport, East Bend, Buck) ✓ Monitoring opportunities across our system
Key Requirements for Commercial Viability	❑ NRC regulatory approval (technology and site) ❑ Acceptable cost and deployment timeline	❑ Access to sufficient renewable energy, pipeline capabilities and water (green hydrogen) ❑ Improved cost competitiveness (e.g. electrolyzer)	❑ Cost reduction to enable storage for days, weeks or seasons ❑ Grid scale demonstration	❑ Cost reduction across value chain ❑ Access to geologic storage and/or CO_2 transportation infrastructure
Expected Deployment	~2035	~2035	~2025	~2030

Hydrogen Initiatives

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Evaluating multiple use cases and production pathways

- Decarbonized hydrogen via electrolysis or carbon capture
- Transitioning and future-proofing natural gas infrastructure

Industry & Stakeholder Collaboration

- Anchor sponsor of EPRI and GTI's Low Carbon Resources Initiative
- Partnering with the Energy Futures Initiative to study a green hydrogen hub in the Carolinas

H_2Orange
Techno-Commercial Analysis

Design studies for production, storage and co-firing of hydrogen at Duke Energy's combined heat and power plant that serves the university campus

CLEMSON UNIVERSITY · DUKE ENERGY · SIEMENS · U.S. DEPARTMENT OF ENERGY

Fossil Energy Hydrogen Challenges / Questions

- **Cost –**
  - Can Blue / Turquois hydrogen be competitive.
    - With natural gas as a fuel $1/kg - $7.50/mmBTU
    - With natural gas fired generation with CCS
    - Compared to green hydrogen (electrolysis)
- **Supply**
  - Will the supply meet the demand
- **Market Value**
  - If limited supply will high market value dominate
- **Conversion Location**
  - Close to natural gas sources or close to point of use.
- **Transportation**
  - H2 capability of existing pipelines – Blends and volume limits
- **CO2**
  - Ability to and risk of CO_2 sequestration
- **Storage**
  - Geology with limited storage potential
- **Longevity**
  - Public and Policy positions

Scale

80 MSCF/d SMR

It would require ~8x this systems output, to supply a single 1,200MW CC

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