Energy-Related Research and Education at NC State



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NC Legislature

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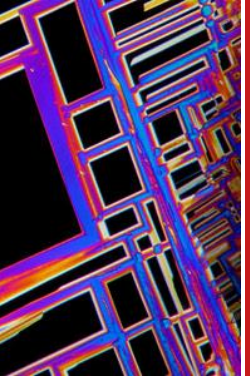
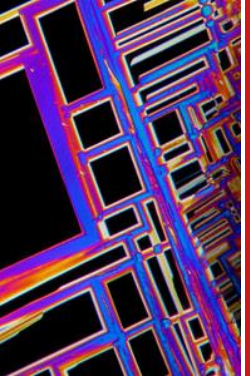
Overview

- History of Energy Research and Education at NC State
- Energy-Related Research
- Energy-Related Educational Programs



History

- NC State is a National Leader in Energy Research & Education
- From power electronics to nuclear reactors, from wind-and-sun driven sources to fuel from resource extraction and sweet potatoes….NC State is on the leading edge of energy research, education and economic development
- 1953 – NC State commissioned the world's first nuclear reactor designed, built and operated by an academic institution
- 2014 – NC State selected to lead the $140M Next Generation Power Electronics National Manufacturing Innovation Institute



Energy-Related Research

NC STATE UNIVERSITY

125 YEARS

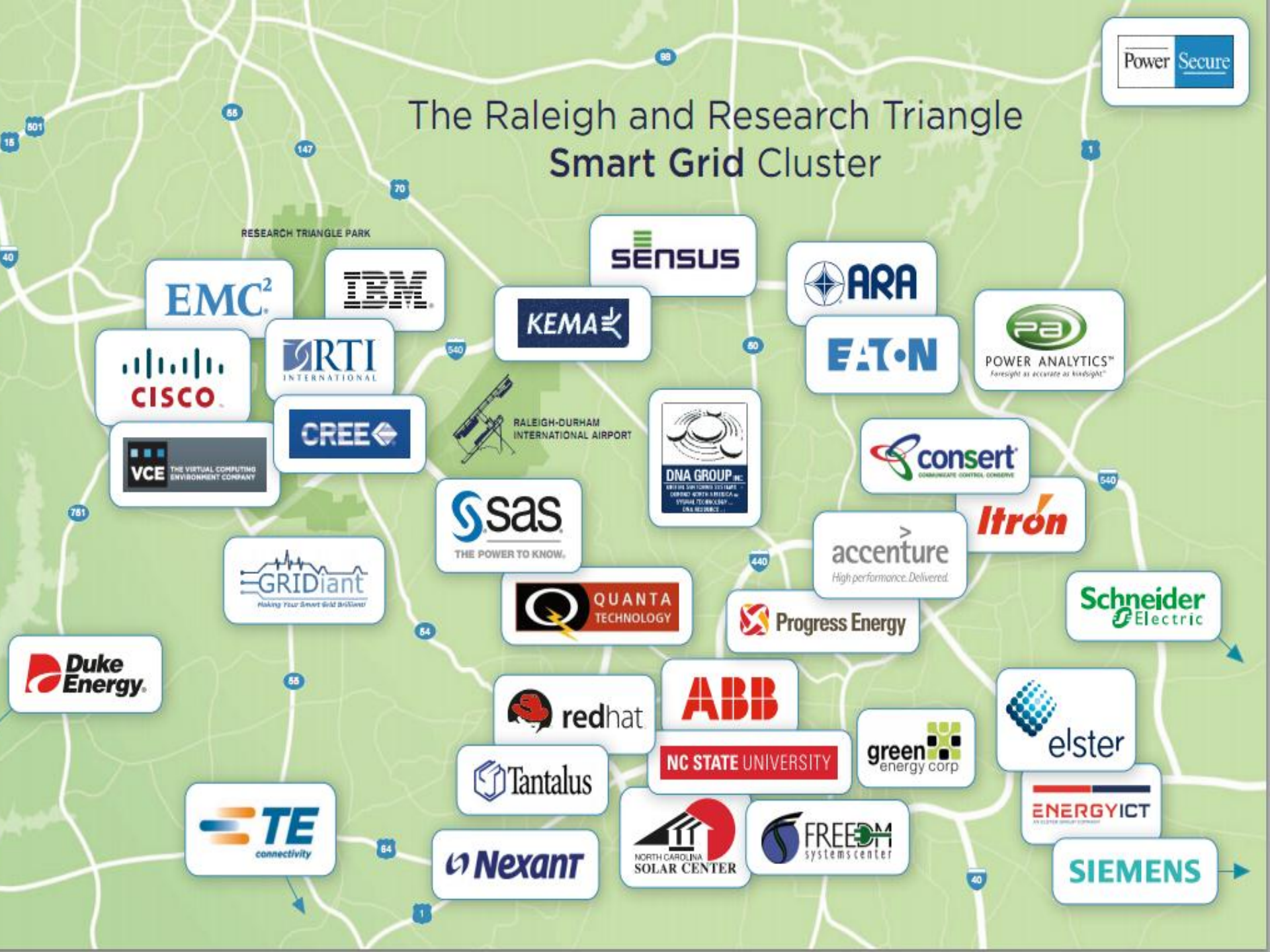
- Renewable Energy and Energy Efficiency
  - FREEDM ERC, NC Clean Energy Technology Center, Integrated Biomass Research Initiative, Renewable Ocean Energy Program, Wind Energy Program, Efficient Solar Cells, Energy Management Program...
- Nuclear Energy
  - CASL National Modeling and Simulation Hub, Nuclear Energy Facilities and Structures Center, Nuclear Reactor Program
- Other Areas
  - Plasma Combustion and Chemistry, Biofuels, On-Shore and Off-Shore Resource Extraction, Off-Shore Energy Storage, Energy Conversion & Systems,…..

Engineering Research Center (ERC) – Class of 2008

Future Renewable Electric Energy Delivery and Management (FREEDM) Systems Center

50 **Industry Partners**

The smart solid state transformers being developed at the NSF FREEDM Systems Center have been named to MIT *Technology Review*'s 2011 list of the **world's 10 most important emerging technologies**.


The Raleigh and Research Triangle
Smart Grid Cluster
RESEARCH TRIANGLE PARK
RALEIGH-DURHAM INTERNATIONAL AIRPORT
Power Secure
EMC²
IBM
sensus
KEMA
ARA
EATON
POWER ANALYTICS
Foresight as accurate as hindsight
CISCO
RTI INTERNATIONAL
CREE
VCE THE VIRTUAL COMPUTING ENVIRONMENT COMPANY
DNA GROUP INC.
consert
Itron
sas THE POWER TO KNOW.
accenture High performance. Delivered.
GRIDiant Making Your Smart Grid Brilliant
QUANTA TECHNOLOGY
Progress Energy
Schneider Electric
Duke Energy
redhat
ABB
NC STATE UNIVERSITY
green energy corp
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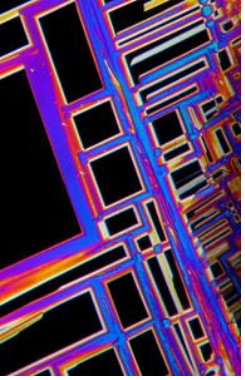
Tantalus
ENERGYICT
TE connectivity
Nexant
NORTH CAROLINA SOLAR CENTER
FREEDM systemscenter
SIEMENS



NC Clean Energy Technology Center

NC STATE UNIVERSITY

125 YEARS

- Created in 1988 as the NC Solar Center
  - Resource for renewable energy programs and information, training, technical assistance and applied research
    - Funded by NC State Energy Office and other federal and state grants
- Major Program Areas
  - Renewable Energy, Clean Power and Efficiency, Clean Transportation, Economic Development, Energy Policy, Workforce Development, Education & Outreach
- Partner Affiliations
  - US DOE Southeast Clean Energy Application Center, Southeastern Regional Resource Center (RRC) for Wind Energy

CASL: The Consortium for Advanced Simulation of Light Water Reactors

A DOE Energy Innovation Hub for Modeling & Simulation of Nuclear Reactors

Core University Partners

- NC State University (Lead)
- University of Michigan
- MIT

Core National Lab Partners

- Idaho National Laboratory
- Los Alamos National Laboratory
- Oak Ridge National Laboratory
- Sandia National Laboratories
- Electric Power Research Institute

Core Corporate Partners

- Tennessee Valley Authority
- Westinghouse Electric Company

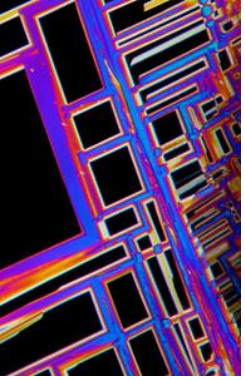
Vision

Create a virtual reactor for predictive simulation of Light Water Reactors

NC State Leaders

Chief Scientist for CASL:
Dr. Paul Turinsky

Education Chairman:
Dr. John Gilligan

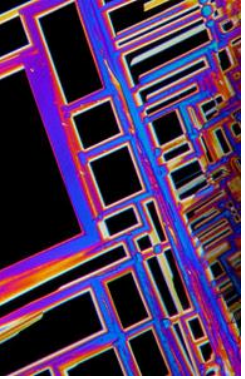


Center for Nuclear Energy Facilities & Structures

NC STATE UNIVERSITY

125 YEARS

- Created in 1991
  - Premier University-Based Research Center in the areas of structures, equipment and piping in Nuclear Power Plants
  - Research on Innovative and Rigorous Solutions that:
    - Reduce Uncertainty, Increase Safety and reduce Cost of Operations
  - Industry Oriented - Existing and New Nuclear Power Plants
  - Wide range of Short Courses and Training Programs
    - Construction Management for Nuclear Facilities, Seismic Analysis and Design of Equipment and Piping, Reliability-Based Design, Regulatory & Design Requirements for Future Nuclear Power Plants



Energy-Related Educational Programs and Offerings

NC STATE UNIVERSITY

125 YEARS

- BS, MS and PhD programs in:
  - Electrical & Computer Engineering, Nuclear Engineering, Mechanical Engineering, Civil, Construction & Environmental Engineering, Chemical and Biomolecular Engineering, Biological & Agricultural Engineering, Materials Science & Engineering, Chemistry, Physics, Biology, Natural Resources, Social Sciences and other relevant areas
- Over 200 courses in:
  - Energy Theory, Production and Efficiency, Energy Distribution and Storage, Energy and the Environment, Energy Policy and Economics
- New Degree Programs related to Energy
  - MS in Electric Power Systems, Graduate Certificate in Renewable Electric Energy System