
Global Energy Ecosystems

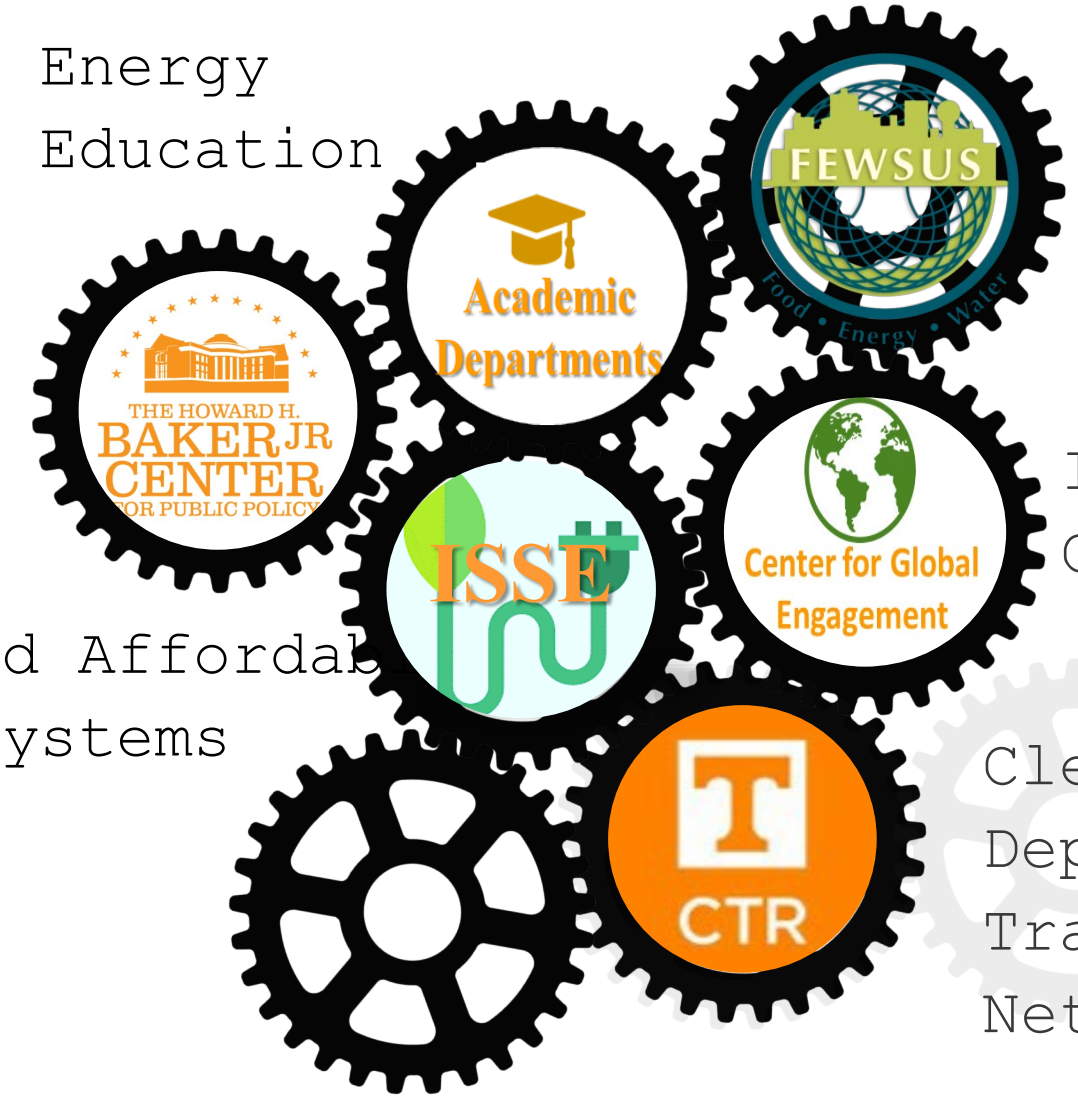
Global Energy Ecosystems (GE^2)

Goal: To develop and deploy sustainable and equitable energy technologies for industry, agriculture, and communities.

Principles

- Impact-oriented
- Bold and audacious
- Integrated, linked, systems, convergent

Global Energy Ecosystems: GE^2



Energy Education

Sustainable Regional Systems through FEWS

Energy Policy and Markets

International Collaboration

Clean and Affordable Energy Systems

Clean and Dependable Transportation Networks

Impacts – based on UN SDGs

Technology Development

Principles
- **UT strengths or TN relevance**
- **New areas with national significance**

1 Energy Supply

- Hydrogen
- Carbon capture and conversion
- Critical Energy Minerals
- Nuclear (Micro reactors)
- Bio-energy (FLW)
- Micro-hydropower

2 Energy Distribution

- Infrastructure (EV Charging, grids) (TVA, TDOT, TDEC, DOE)
- Storage (Battery and fuel cell) (ORNL, VW)

3 Energy Usage

- Manufacturing (AMO)
- Building (Commercial/residential) (SE)
- Transportation (Alternative Fuel Vehicle adoption and policy)
- Agriculture (energy and water use efficiency)

4 Energy Industry Supply Chain, Market, Policy

Impacts

- Affordability
- Cleaner (Carbon Emissions)
- Equity (Accessibility)
- Sustainability (regional systems)
- International Collaboration

Policy

- Policy advocation

5 Outreach

- TDEC
- NGOs
- ET Cities and Counties

6 Technology Transfer

- UTRF
- Cherokee Farm
- SPARKS

7 Education

- Sustainability Program at CAS
- CEE, EE, ME, CBE, ISE at TCE
- ESE PhD at Brendon Center
- New Executive Program

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Smith Center

Center for Global Engagement

GE^2 Thrust Areas

Principles
- **UT strengths or TN relevance**
- **New areas with national significance**

Research and Technology

1. Energy supply : hydrogen, carbon capture and conversion, micro-hydrogen, FEWS (FLW), possibly nuclear, and mining/refining elements for energy
2. Energy distribution: battery, fuel cell, EV charging infrastructure
3. Energy usage: smart manufacturing for energy efficiency, smart technologies for building energy efficiency
4. Energy supply chain, marketing analysis, and policy study to support other areas, including the adoption and promotion of EV and other alternative fuel vehicles, energy management systems for manufacturing and building environment, supply chains for energy materials, TEA

Deployment, Workforce Development, and International Collaboration

5. Policy advocacy and stakeholder engagement (led by Baker Center)
6. Technology transfer and commercialization
7. Education and workforce development
8. International collaboration: focusing on South America (Smith Center), Europe (?), Asia (Japan, Southeast Asia, South Asia through Global Engagement Office)

GE^2 Outcomes(Funding Example)

- **NSF Regional Innovation Engines for Green Energy Ecosystem in East TN**
  - Connected with ORNL
  - Rooted back in the Knoxville International Energy Exposition in 1982
  - Use-inspired **research and developme**nt; the translation of the resulting innovations to practice through **entrepreneurship**, **stakeholder development**, and meaningful **partnerships**; and **workforce development** at all levels
  - Type-1 $1M Proposal in Three Years based on the Ming's NSF SRS Planning Grant
  - Type-2 $160M Proposal in Five Years
- **NSF Sustainable Regional Systems program** (currently several planning grants at UT, pursuing $15M Type-1 proposals.
- **Hydrogen Hub**
- **DOE Industrial Assessment Center ($2M):** Based on Ming's recent $400k Technical Assistance Program (East Tennessee Initiative for Smart Energy Management (ETISE))
- **Foundations** (Gates, …)
- **US Manufacturing Institute**?
- Other Funding Opportunities

GE^2 Outcomes

- **Policy**
  - Energy policy advocacy
- **Outreach**
  - Annual Energy Forum with ORNL, TVA, TDEC, … for stakeholder engagement, technology dissemination, policy promotion, etc. (for Appalachian region and for Southeast)
- **Commercialization**
  - One or two startups based on UTK/ORNL energy-related technology: Hydrogen, EV
- **Educational Programs and Workforce Training**
  - Support the establishment of the new Environmental Engineering program at TCE
  - Support and grow the Energy Science and Engineering PhD program
  - New workforce non-degree training programs (energy auditing, new energy-related manufacturing, renewal energy.
  - Executive program for energy and sustainability (Chief Sustainability Officers)
- **International Collaboration Network**
  - Continue FEWSUS and expand it from exiting connections at South America and China to Europe and South and Southeast Asia (Have talked to Global Engagement Office)
  - Help with the IMPACT ranking

How will GE^2 Help you?

- A research coordinator at ORIED for
  - Forming teams
  - Program management
  - Proposal development coordination
  - Compiling experts and opportunity repository
  - Communication/branding (working with ORIED and UT Communication Office)
- Team/network forming and strategic investment to build unique and interdisciplinary capability at UT and pursue larger opportunities
- Seed projects (together with ISSE) with open calls, which may help GEE identify strategic investment opportunities
- Policy and community engagement: stakeholders meetings, forums, …
- Build a regional, national, and international network of collaborators (Conferences and workshops, travels, special issues of top journals, perspective paper development) …
- Workforce development: Certification program and possible executive educational program

Vision: A self-sustaining research center around GE^2 with national and international impacts

GE^2 Planning Process

Stage 0: Initiation

- Brad Day

Stage 1: Strategic Planning

- Ming Jin (ISSE, TCE)
- Charles Sims (Baker Center)

- Working with the communication office for branding
- Working with CGE for international collaboration

Stage 2: Brainstorm

- Nikki Luke (Geography and Sustainability)
- Amy J. Elias (Humanity Center)
- Alycia Stigall (Earth and Planetary Sciences)
- Tom Gill (UTIA): Smith Center for International Collaboration in Bioeconomy and Green Energy
- Tim Rials (UTIA):
- Yemisi Bolumole (Supply Chain Management)
- Kevin Tomsovic (CURENT)
- Feng-yuan Zhang (MABE): representing Hydrogen group (Matthew Mench and Tom Z)
- Kevin Heaslip (CTR)

Stage 3: Community Engagement, Buy In, and More Ideas

- Larger groups with about 25 people (More diversity, including junior faculty members)

Campus Engagement

Asst: 5; Assoc: 3; Prof: 11; Admin: 2

Disciplines

Advanced materials
Agriculture
Businesses
Carbon capture
Climate
Community sustainability
Ecosystems
Electricity
Environment
Global engagement
Geography
Government
International development
Law
Microbiology
Nuclear energy
Policy
Soil health
Social justice
Policy
Water

Units

BSE
CBE
CEE
CEHHS
CGE
CRC
ECE
ECON
English
EPP
FWF
ISE
Law School
Micro
SOC

Baker Center
Bredesen Center
Haslam
Humanities Center
ISSE
Smith Center
UTIA