“Education is not the filling of a pail, but the lighting of a torch”

William Butler Yeats
Today’s Agenda

• Introduction to Celtic Energy
• EE Market History and Future
• Student Engagement
• Green Resilience
• YOUR QUESTIONS!
Who are we?

- **Celtic Energy** is an Energy Efficiency Consulting firm with expertise assisting Commercial, Industrial, Institutional, and Government clients manage Energy Programs
- Hartford, Boston, Charlotte, Las Vegas offices
Client List

NC Government

North Carolina Energy Office
energync.net

WAKE COUNTY
PUBLIC SCHOOL SYSTEM

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

CITY OF GREENVILLE
INCORPORATED 1774
N.C.

NC Universities

Appalachian
STATE UNIVERSITY

THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

UNCW

UNIVERSITY OF NORTH CAROLINA
AT PEMBROKE

UNIVERSITY OF NORTH CAROLINA
AT WILMINGTON

Western Carolina University

Winston-Salem State University

Elizabeth City State University

AT&T

Celtic Energy
ESCO Familiarity

• CEI has overseen almost all of North Carolina’s pre-qualified ESCOs for other Institutions and Government agencies
Owners’ Focus Over Last Few Years:

- Owner capitalized projects
  - External financing has not played a major role to date

- Low cost / low risk initiatives
  - e.g. lighting retrofits

- 2–3 year payback term requirement

- Capital intensive, “deep energy retrofits” (30%+ energy savings) with longer paybacks often delayed due to
  - Lack of internal resources
  - Desire to preserve capital in uncertain economic times
EE Retrofit Market Status

- Pent-up demand to replace outdated energy-consuming equipment represents a significant driver to accelerate EE investment

- Commercially-attractive external financing has emerged to accelerate deep energy retrofit investments

- To realize growth, financing mechanisms must be
  - Easily accessible to building owners
  - Supported by a technically sound & fully-transparent underwriting process able to provide a high degree of confidence in the projected savings
Alternative Finance mechanisms making impact

- PACE (Property Assessed Clean Energy)
- PPAs (Power Purchase Agreements for CHP, solar, wind)
- ESPC (Energy Savings Performance Contracts)
- Grid Resilient Microgrids (Green Resilience)
Principal Obstacle with EE Financing to Date

Key challenge: “Will the projected energy savings be realized?”

- **Problem #1:** Energy savings can’t be measured directly
- **Problem #2:** No standard methodology to underwrite energy efficiency
- **Problem #3:** Without a solution to #1 & #2, EE Financing cannot become a mainstream financial asset class with a high degree of standardization, predictability and scale.

...No longer true today!
Underwriting EE Project Financing

Nationally recognized technical standards are now available that define a process from data collection to energy savings measurement and verification, enabling…

- Energy savings to be forecast with a high degree of confidence
- Actual energy savings performance to be measured and verified in a reliable, consistent and fully-transparent manner
- Risk of underperformance to be low
EE Retrofit Technical & Financial Underwriting
Best Practice Has Emerged to Accelerate Market

Relies on three established industry protocols:

- **ASTM Building Energy Performance Assessment Standard E2797-11**
  - Methodology for collecting & analyzing baseline energy data

- **ASHRAE Energy Audit Guidelines** (Level I, II, III)
  - Methodology to identify energy conservation measures (ECMs) & project energy savings with high degree of confidence

- **International Performance Measurement & Verification Protocol**
  - Methodology for energy savings measurement & verification

Methodology is technically sound, standardized, reliable & transparent
C-PACE provides an innovative financing structure enabling commercial, industrial, & multi-family property owners to access financing for qualified energy upgrades and repay through a benefit assessment on their property.

- Private capital provides 100% upfront, low-cost, long-term funding
- Repayment through property taxes
- A senior PACE lien is put on the property and stays regardless of ownership
Environmental Defense Fund’s Investor Confidence Project (ICP)

- Environmental Defense Fund’s Investor Confidence Project team defining open standards in order to enable the flow of private investment required to launch a global market for energy efficiency in the built environment.
Student Engagement

• CEI commits to engaging with Student/Faculty Groups for brainstorming at the inception of each project
• STEM and Liberal Arts students ‘shadow’ energy professionals during project development, implementation, and performance phases.
• Learn “how to” advocate for their desires in a professional setting
• Learn the ‘fine art’ of collaboration early in their careers
• Focus on the ability to join seemingly disparate topics and objectives into a forward looking, well integrated deal/program/initiative, where all stakeholders benefit
• Non-technical people can be just as important as the engineers in securing successful projects
Green Resilience

• Sustainability includes resilience

• Challenges to critical infrastructure
  – Disasters, climate change, terrorism, pandemics, …
  – Deferred investment in aging infrastructure & workforce

• Legacy: big generators + centralized grid

• Emerging: smaller gen + microgrids

• Future: self-sufficient buildings
Campuses ideal for green resilience

• Comprehensive energy & water efficiency
  – First lower loads, then size more costly generation

• Sustainable energy systems
  – Combined power, heat and cooling networks
  – Renewable power
  – Microgrids

• Capital improvements funded by energy savings

• Portfolio of upgrades mitigates & adapts to risks

• Maintain functionality, shelter in place
From Mendes, Loakimidis and Ferrão, 2011
FDA White Oak campus microgrid
Electrical Energy Security

- Utility Power
  - Two High Voltage Feeders and Transformers
  - Two Feeders to CUP – 20 MW
- Island Mode on Site Generation
  - One Dual Fuel Generator – 5.7 MW
  - Four Natural Gas Generators – 17 MW
- Black Start on Total Outage
  - One Standby Fuel Oil Generator – 2 MW
- Underground Electrical Distribution System
Capabilities – Emergency Preparedness
Black-Start Power Restoration: 30 Seconds – 20 Minutes
Capabilities – Emergency Preparedness
Black-Start Power Restoration: 20 Minutes – 60 Minutes
Connecticut microgrid program (1st in US)

- $15 million for critical facility microgrids
- Structure, goals, design requirements
- Constraints, status, lessons learned
Microgrids lessons learned

• Barriers to implementation
• Bigger is easier
• Business model
• Controls, integration, interconnection
• Generation selection, load matching
• Infrastructure hardening
Self-sufficient buildings are resilient
Aggressive passive
Thank you for your time...

QUESTIONS?

Christopher F. Halpin, PE
LEED Accredited Professional
Certified Energy Manager
Certified Energy Procurement Professional
Certified Measurement & Verification Professional

President
Celtic Energy, Inc.

(860) 882-1515
(860) 328-0535 mobile
chris@celticenergy.com
www.celticenergy.com