Delivering the Promise of Eco-Districts

MEP Associates & GI Energy IDEA 2017
What is an Eco-District?

- Multiple integrated technologies
- A system that is greater than the sum of its parts
- Various sizes - corporate campuses to cities
Benefits

Environmental
Resiliency
Health
Lower maintenance costs
Reduced capital and operating expenditure
Future-proofing
Integrated Technologies

Sustainable energy generation & storage

Advanced IT

Resource reuse

Other smart infrastructure
Case Studies

Epic Systems, Madison, WI

Carlton College, Northfield, MN

Ford Motor Company, Dearborn, MI

Bay Area Eco-District, San Francisco, CA
Entire campus approximately 1,051 Acres
9,000+ employees in 27 buildings, with 12 more under construction
Over 7 Million sq ft occupied space including 7,338 underground parking stalls
1.5 MW Solar PV
10 MW Wind Generation
<table>
<thead>
<tr>
<th>Technology</th>
<th>Description</th>
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<tbody>
<tr>
<td>Water-to-air &amp; water-to-water heat pumps</td>
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<td>Distributed Central Energy Plants</td>
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<td>Geothermal bore fields and pond system</td>
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<td>Open lake water system</td>
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<td>Domestic water heating system utilizing geothermal water</td>
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<td>Snow/ice melt systems</td>
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<td>Photovoltaic solar panels</td>
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<td>Wind farm</td>
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Epic Systems – Impacts

EPIC SYSTEMS – VERONA, WI

PHOTO CREDIT: KATIE WHEELER
Carleton College

Highly selective undergraduate college, 2,100 students and 250 staff on 1,040 acre campus.

With a focus on replacement and renovation, Carleton anticipates only 3% net growth in total campus square footage over the next 25 years.
Carleton College – Seasonal Load Profile

![Seasonal Load Profile Diagram]

- **MBTU / Hr**
- **Month**:
  - December
  - January
  - February
  - March
  - April
  - May
  - June
  - July
  - August
  - September
  - October
  - November
  - December

- **Electric chillers**
- **Geothermal cooling (to heat pump)**
- **Simultaneous load (heat pump)**
- **Geothermal heating (to heat pump)**
- **High efficiency boiler load**
Carleton College – Impacts

Utility Cost ($/yr)
- Base Case: 760,023
- Proposed: 319,900

Carbon Emissions (lb CO2/yr)
- Base Case: 18,436,725
- Proposed: 4,896,709

Energy (MBtu/yr)
- Base Case: 132,296,653
- Proposed: 87,349,061
Low Entropy Campus

Design Goals encompass building heating, cooling, and ventilation systems:

1. Provide comfortable, effective, well-connected work environments
2. Heat and cool with energy streams as close to room temperature as possible
3. Recycle energy streams effectively and introduces new ones judiciously
4. Minimize energy system distribution losses
5. Bank and retrieve energy flows over time

Led to

- Central heat pumps, chillers, cooling towers, geothermal heat exchange, thermal storage, cogeneration, and photovoltaics
Ford Campus – Energy Infrastructure & Central Plant
Ford Campus – Impacts
Bay Area Major Redevelopment & Eco-District

- 8,000,000+ square feet of new development
- New Master Utility Plan designed along with street grid and development blocks
- Third party funded systems: Solar PV & energy storage, geo-exchange HVAC, recycled water, automated waste collection, EV charging and self-sustaining street lights
- Mix of direct-use third party offtake contracts, and partnerships with local municipal utilities
• Over 800 acres for residential, commercial & municipal use
• Master planned site under single real estate developer, with GIE as eco-district development partner
• ~450,000 GPD water recycling system
• 10-15MW of rooftop PV planned
• 15,000 ton capacity geothermal heating & cooling system
Financing – Third Parties

| What                                      | Capital Markets are chasing investment opportunities in renewable and sustainable energy |
| Who                                       | Private equity, infrastructure funds, venture capital and institutional investors are all interested |
| Why                                       | Mix of revenue types create diversified portfolio in single project |
| So…                                       | No longer as reliant on tax credits to unlock financing |
Typical D-BOOM Structure

Potential SPC Members
- Financer
- Operator
- Builder
- Manufacturer

Customer

Project Formation/ Customer Representation

Consignment Agreement

Project Specific: Special Purpose vehicle (SPV)

Equity Shareholder Agreement

Project Debt

Debt Agreement

Project Equity

EPC Contract

O&M Agreement

Project Designer / Contractor

Interface Agreement

Project Operator

Subcontracts

Vendors

Subcontractors

Subject matter experts

Vendors

Subcontractors

Subject matter experts
Public Private Partnerships (PPP)

- Tool to help pay for infrastructure that maintains competitive energy prices
- Third party finance + municipalities and local agencies (+ developer) = sustainability services to end users
- Limited public investment in infrastructure
What can you do on YOUR campus?

- Power and water purchase agreements
- Long-term capital leases
- Service and use fees tied to HOAs
- Thermal energy management agreements
- Subscription-based, user-funded models (EV charging stations)
Any questions?

Contact

Tom Chadwick
📞 (312) 894-4646
✉️ tchadwick@gienergyus.com

Peter Falcier
📞 (646) 785-1256
✉️ pfalcier@gienergyus.com

@gienergyus

Mike Walters
📞 (608) 225-8608
✉️ mikew@mepassociates.com