Integrating a Community Energy System with Renewable Biomass - Saint Paul Case Study

Ken Smith
Ever-Green Energy
• 501(c)3 non-profit utility
  – No stockholders, cost-based rates
• Public-private partnership
  – city, county, state, federal agencies
  – BOMA, chambers of commerce, industry
• Compete for business
  – 80/60% market share for heating/cooling

• OMM Services
  – Optimize capacity, reliability and efficiency
  – System advancement and integration
• Business Services
• Project Services
  – Complete lifecycle – planning through start-up
  – Integration of adv. tech. and strategies
Community Scale Heating and Cooling

- Underground network of pipes that aggregate building heating and cooling (thermal) loads
- Aggregated thermal loads allows application of technologies and fuels not feasible for individual buildings
- Increases fuel flexibility, efficiency, rate stability, reliability & reduces emissions
Community Energy Vision

Diagram showing various energy sources and their connections to different sectors such as residential, commercial, industrial, and thermal storage. The diagram includes symbols for oil, biomass, natural gas, solar, coal, and future energy sources, illustrating the paths of energy distribution and infrastructure.
St. Paul Cogeneration
Combined Heat & Power

- 25 MW of electricity
- Dual fueled – NG and renewable, clean, urban wood residue
- Greenhouse gas CO$_2$ reduced up to 280,000 tons per year
Sources of Clean Biomass

- Wood residuals from manufacturing processes
- Construction waste/clean dimensional lumber
- Urban and park tree trimmings
- Storm and disease damaged trees
- Trees removed for timber management / restoration
Linking Habitat Restoration to Bioenergy

• In 2007, the Minnesota legislature appropriated $500,000 for ecological restoration by removing ecologically inappropriate woody plant material.

• The Minnesota Department of Natural Resources created small grants pilot project to cut, move and stage woody biomass material from public and private lands.
Processing Wood Waste Into Biofuel
Biomass Advantages

- Large quantities in MSP metro area
- Using for biofuel diverts clean wood waste from landfills
- Provides communities an economical way to dispose of wood waste
- Stable fuel cost
- Biofuel expenditures stay in local community
Integrated Energy System Vision
Thermal Storage

- 6.5 million gallons of storage capacity
- Chilled water storage reduces peak-electric demand
- Firm capacity for weather events
Solar Thermal Integration
Heating and Cooling a City
Biomass Integration in Duluth

Biomass Co-firing

[Diagram of biomass integration in Duluth, including steam and cooling systems, open loop, DULUTH STEAM PLANT, Downtown System Consumers, chemicals, 13.5M gallons of sewage per day, +50% of all city electricity per year, wastewater treatment plant, processes 5,600M gallons of water per year, Lake Superior, 90M gallons of water per year, and water processes use.]
Montpelier, Vermont

**DISTRICT HEAT MONTPELIER**
*AN ENERGY INDEPENDENT DOWNTOWN*

- City/State Partnership
- Biomass-fired steam and hot water district heating system
The DMC Initiative  Opportunity
DMC Aspirations

• “...transforms the epicenter of Rochester into a vibrant urban center and one of America’s model cities.”

• Energy Vision: “Implement the most progressive, responsive, and resilient district energy network in the country”

• Climate Vision: “Achieve climate neutrality across the Destination Medical Center”

Source: DMC Development Plan
Achieving Energy Goals Requires Planning
Local Energy Planning – Where We Start

• What is the vision? What are the goals?
• What are the wants and needs?
• Are we just as willing to solve future problems as we are to fix current ones?
• What local resources are available to meet the goals and vision? How can they be applied in a practical matter?
• Can we find a balance between environmental AND economic stewardship?
• Are there opportunities for partnership?
• *Are we willing to admit from the start that we may not yet fully understand the challenge, therefore we can’t possibly know the answer?*
What are the Goals?

- Energy Efficiency
- Equity
- Reliability
- Livability
- Innovative
- Effective
- Competitive
- Local Resilience
- Reduction of GHG Emissions
- Affordability
- Infrastructure Improvements
- Affordability of Energy
New Normal in “Model” Cities

Energy Change in Hamburg

- **Energy Efficiency**
  - Building efficiency
  - Efficiency in firms
  - Cogeneration
  - Public buildings

- **Smart Grids**
  - Extension and conversion, smart grids
  - Heat supply
  - Storage integration
  - Virtual power plants

- **Renewable Energies**
  - Wind power plants
  - Biomass thermal power plants
  - Photovoltaic power plants
  - Solar thermal power plants
Local Energy Planning – What are the trends?

• District approach – address energy, transit, water, waste, fiber, and other infrastructure needs
• Infrastructure grids are becoming less isolated (electric, thermal, transportation, water, waste)
• Increased diversity of energy sources & technical solutions
• Increased stakeholder involvement
• Local government leadership
• Finding alternatives that are environmentally-minded and cost-competitive – the market is changing
Infrastructure Partnership Opportunities
Lessons from Leading “Model” Cities

• Breakdown the silos
  – Holistic approach to energy planning
  – System integration

• Define shared vision, principles and metrics, and measure results

• Engage the community

• Competition / contests used to encourage creativity

• Achieving world class results requires planning, collaboration/partnership, perseverance, leadership
Questions
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