Community Energy Efficiency & Conservation Strategy Plan (CEP)

Creating a Globally Competitive Community

Preliminary Indications

May 5th, 2011
City of Holland, Michigan
Scope of Assessment
City of Holland

Current CEP Scope

Should the Scope be Expanded?

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CEP Measures of Success
Three Groups of Benefits

1. Energy cost
2. Employment
3. Investment

4. Supply security
5. Supply quality
6. Flexibility

7. Greenhouse Gas Reduction

Framing goals need to be set early

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Holland at a Glance
2010 Baseline and Outlook

- Population
  - 33,100 growing to 41,100 by 2050

- Employment
  - 9,767 jobs
  - No approved growth forecast
  - Optimistic estimates 6000 to 8,500 in next decade

- Residential
  - 7,433 Single family detached homes
  - 5,125 Multi-family homes / Row houses / Duplexes
  - 15.4 M sq ft total

- Non-residential and Industry
  - 6.7 M sq ft Offices and Retail
  - 4.5 M sq ft Institutional and Recreation
  - 12.6 M sq ft Industrial with substantial growth

- Transportation
  - 280,000,000 vehicle miles travelled
  - Cars, trucks, SUVs ~ 92%
Holland Community Energy Plan
2011 to 2050 Candidate Goals

Energy Mission
Enhance City attractiveness to investors, businesses and residents through cost effective, reliable clean energy supply

CEP Goals
- Lower cost energy than neighbouring communities
- Highly reliable electricity supply from local sources
- Industrial Energy Service tailored to investors’ needs
- Flexibility to meet changing technologies, legislation, fuel costs and other market conditions
- Meet commitment to the U.S. Conference of Mayors Climate Protection Agreement
- Be a leader in developing regional energy productivity strategy
Energy efficiency – *If you don’t need it don’t use it*

Heat Recovery – *It it’s already there – use it*

Renewable energy – *If it makes sense, go carbon free*

Energy distribution – *Invest where it makes sense*
City of Holland Baseline
Energy Profile ~ estimated $135 M

Primary Energy / Fuel 2010
9,898,000 MMBtu_e / 2,900,000 MWh_e

by type

by sector

340 MMBtu_e / 100 MWh_e for each Resident

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2010 Greenhouse Gas Emissions
792,500 metric tons / 873,600 short tons CO$_2$e

by type
- Gasoline/Diesel: 17%
- Heating oil: 0.2%
- Natural Gas: 14%
- Electricity: 69%

by sector
- Transportation: 17%
- Residential Buildings: 19%
- Non-residential Buildings: 25%
- Industrial: 39%

24 metric tons for each Resident

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Greenhouse Gas Emissions
Proxy for Energy Performance

- Energy use with fossil fuels is the main source of greenhouse gas emissions.
- Greenhouse gas emissions are a widely used metric for overall energy productivity.
- GHG emissions reflect both energy efficiency and carbon-content of fuels.
- Carbon dioxide-equivalent is the measure and CO$_{2e}$ per capita allows benchmark comparisons.
### Greenhouse Gas Indicators

**Metric Tons / Capita**

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What should be 2050 Framing Goal?

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2050 - GHG/Capita Goal Setting

**Background**

- **Base Case**
  - Current trajectory would be approaching 37 mt/capita
  - Roughly a 50% increase

- **Climate Protection Agreement**
  - About 20 to 22 mt/capita by 2012
  - No Kyoto 2050 target yet

- **Draft US Federal legislation**
  - About 4 mt/capita by 2050
  - About same as UNFCCC guidelines

- **Comparable Benchmark City - Mannheim**
  - High industrial component
  - Mostly coal fired electricity
  - About 11 mt/capita Baseline with 9 mt target by 2020

- **Global Best-Practice Cities – Scandinavia**
  - Comparable climates
  - Range 3mt to 6 mt/capita (Stockholm, Helsinki, Copenhagen)

**Suggested Framing Goal ~ 10 mt/capita**
Greenhouse Gas Evolution

**Metric Tons / Capita**

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10 mt/capita Goal – Challenging but Achievable

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Baseline Energy Demand 2010

City of Holland Energy Districts

Total Energy Demand – Baseline 2010

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Baseline GHG Emissions 2010

City of Holland Energy Districts

GHG-Density – Baseline 2010

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City of Holland Energy Districts

GHG-Density – Base Case 2050

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Energy Supply Outlook
2010 to 2050 Base Case

Base Case Energy Supply
2010 Through 2050

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Community Energy Efficiency & Conservation Strategy Plan (CEP)

Creating a Globally Competitive Community

Future Scenarios

May 4th, 2011
City of Holland, Michigan
CEP Scenario A
Home and Buildings

- All Buildings
  - 45% of all energy use in City
  - Efficient renovation of 2.6% of building stock per year
  - New construction more efficient - 50% of current code by 2050
  - Selective densification

- Home and Building Energy Performance Labeling
  - “Aggressive” voluntary approach from 2011
  - Use ASHRAE/EU approach

- Single Family Homes
  - Standardized renovation packages financed by owner & City or HBPW
    - 2013 to 2033 – “Moderate” package – 53% efficiency
    - 2034 to 2050 – “High efficiency” package – 66% efficiency
  - Facilitated by neighbourhood or other community groups
  - AC and Refrigerator exchange programs

- Non-residential, Large MFH and Retirement Communities
  - Public buildings and churches act as living examples
  - Early adopters of Energy Performance Labeling
  - Equal focus on both efficient operation and construction
  - Energy master planning – clusters; major renovations; large developments

Systematically Raise Efficiency
Energy Performance Labeling

- Low-cost performance validation tool
- Available when sold or rented
- Display in public buildings
- Independent certification
- Access to discount financing
- Voluntary or mandatory approaches possible

Basis for Market Driven Improvement
Example of “Efficiency” Loading Opportunity
Single Family Homes – Status 2030
Shared Benefits

- 7.433 SFH ~ 70% of all Residential area
- 85% Pre-1980 Code and inefficient
- Rate: 200 to 250 homes/year
- “Moderate” package ~ $28K
  - 53% efficiency gain
  - Windows-insulation-weatherization-furnace-AC-controls
- By 2030 – 4,500 units renovated ~ $125M max
- Benefit for HBPW
  - 10 to 15 MW\textsubscript{el} Peak Demand Reduction
  - Avoided generation investment
- Benefit for homeowner
  - Reduced energy costs
  - Reduced risk from future energy price increases
  - Probable property value enhancement
Residential Efficiency Opportunity
Gaining National Focus

One Fifth of all US Energy Consumption

HUD, Fannie offer loans to help pay for energy-efficiency improvements

By KENNETH R. HARNEY
WASHINGTON POST WRITERS GROUP

WASHINGTON — Homeowners looking for a way to pay for energy improvements could find help in new programs from the Federal Housing Administration and mortgage investor Fannie Mae.

FHA’s called “PowerSaver” and allows eligible owners to borrow up to $35,000 at fixed rates between 5 percent and 7 percent for as long as 20 years to finance retrofits including high-efficiency windows and doors, heating and ventilating systems, solar panels, geothermal systems, insulation, and duct sealing.

PowerSaver officially is a pilot program, but HUD Secretary Shaun Donovan estimated that 30,000 PowerSaver loans will be closed in the next two years and it eventually could become a major national program for residential energy upgrades.

Most participating lenders are expected to encourage owners to sign up for an energy efficiency analysis by a certified specialist. The analysis should pinpoint where the house is inefficient in energy use and should recommend specific upgrades or additions.

FHA will insure the loans under the following guidelines:

- The house must be a principal residence, detached and single-family only.
- The borrower must have a FICO credit score of at least 660, and total household monthly debt-to-income ratio cannot exceed 45 percent.
- The combined primary mortgage debt plus the PowerSaver loan cannot exceed 100 percent of the appraised market value of the house.

Lenders are likely to take an extra hard look at income and asset documentation because, unlike other FHA-insured mortgages, PowerSavers will cover only 90 percent of the lender’s loss or insurance claim in the event of a default.

Eighteen lenders across the country have signed up so far to participate, ranging from giant Quicken Loans to regional and local players such as Stonegate Mortgage in the Midwest and Pennsylvania-based AFC First Financial Corp. A spokesman for Quicken Loans said the company hopes to offer PowerSaver in as many as 34 states during the pilot period.

PowerSaver’s biggest plus is its low fixed interest rate and long term. The main potential drawback: Because the program permits total household mortgage debt loads of up to 100 percent of market value, there’s the chance that some borrowers could encounter payment problems if they experience even slight income declines or if property values in the area decrease.

Fannie Mae’s program folds the cost of the improvements — capped at up to 10 percent of the estimated market value of the house after the efficiency enhancements — into the mortgage amount itself.

Most single-family properties except manufactured houses and cooperative units are eligible for the program, which is now available through participating lenders nationwide.

Fannie requires an audit by a certified Home Energy Rating Systems expert upfront to justify the proposed modifications to the house as truly cost-efficient. The audit must be paid for by the borrower, but Fannie will credit an extra $250 through the lenders to partially defray this expense.
Tailored Industrial Energy Services
- 20MW CHP phased with Battery Cluster growth
- District heating services using CHP, existing boilers and waste heat
- Environmental services for Battery Cluster for VOC elimination*
- Additional utility and efficiency services tailored to investors’ needs
- Up to 1.0 % efficiency/year based on corporate programmes

District Heating
- Develop district heating services north from 24th Street
- “Anchor tenants” – Hope College / Hospital / Aquatic Center / City
- Snow melt services as option in heating service package

City Energy Supply
- Maintain existing solid fuel plant through 2050
- Add 55MW CCGT De Young Site in three phases by 2026
- Configure CCGT to supply District Heating
- “Green Power” sourcing Landfill (10MW)

Extended Opportunities for HBPW

*Turbine combustion air
District Heating

- Operated by HPBW
- Serve higher density areas
- Buildings and Apartments
- Network of insulated pipes
- Multiple supply sources
  - Combined Heat & Power
  - Boilers/Furnaces
  - Biomass
  - Waste heat recovery

Centralized supply and delivery
- Heating
- Domestic hot water

Widely deployed - proven technology

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Distric Heating
Installation elements
CEP Scenario A
Transportation and Enabling Strategies

- Transportation
  - Efficiency gains from market evolution
    - Revised Federal CAFE Standards
    - Weight reduction from new materials
    - Trend to smaller vehicles
    - Drive-train efficiency increases
  - Efficiency gain from urban design and city services
    - Modest densification combined with mixed use
    - Snow melt extends use of walkable neighborhoods
  - Opportunity for experimentation
    - Biodiesel / Ethanol
    - Tied with economic development / University

- Training, Education and Outreach
  - In development

- Economic Development Support
  - In development

- Incentives, Regulatory, Business Models
  - In development
CEP Scenarios B and C

**Scenario B**
- *CEP Scenario A plus…*
- 24MW of Solar PV to eliminate summer peak – start in 2012 complete by 2050
- Add 20MW Biomass Generating Block after 2030 using bio-gasification
- Blend bio-gas/natural gas starting in 2013 and leveling off at 10% by 2023 for CHP and CCGT
- Add 37 MW_{nom} Wind by 2020

**Scenario C**
- *CEP Scenario B with …*
- Add 70 MW Solid Fuel with 30% biomass by 2050
- CCGT not implemented

All Scenarios Focus on Efficiency
Scenario C
Biomass/Coal Fuel Mix

- **Biomass Content**
  - Woodchips for about 21MWel (30% of 70MW)
  - Energy content 7 MBtu/lb (4.5 kWh/kg)
  - Assume 33% efficiency and 7,500 hours/year

- **Fuel Needs**
  - 15.5 US tons (14 metric tons)/hour
  - 116,000 US tons/year (106,000 metric tons)/year
Scale Projects
Jump Starts Implementation

1. Community Activity
   • Many initiatives
   • No changes in policy

2. Stand alone projects
   • Fewer larger initiatives
   • Minor changes in policy

3. Scale Projects
   • Neighborhood size
   • Local changes in “policy”

4. Integrated policy
   • County wide norms
   • New “business-as-usual”

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Scale Projects
Selection Criteria

- High probability of being implemented
- Manageable number of participants
- Large enough for integrated energy solutions
  - New business models possible
  - Efficiency levels
  - Distribution – heating, cooling, power, other..
  - Distributed clean and renewable supplies
  - Smart micro-grids…
- Economically, socially, environmentally and operationally attractive
- Future linkage to other Scale Projects

Jump-start the implementation process
Single Family Homes Renovation
Possible Approach – Scale Project 2

- Evaluate implementation approach with SP
- Historic District Single Family Neighborhood
  - Historic neighborhood with about 150 homes
- Approach
  - Develop neighborhood energy plan with neighborhood association, City and HBPW
  - Renovation at least to “moderate” package level
  - Evaluate near-passive/aggressive renovation level
  - Develop standardized financing options
  - Evaluate low-temp District Heating (“geothermal”)
  - Implement and adjust based on experience
  - Parallel education of wider community
- Roll out to other neighborhoods
Scale Project 5: Initial District Heating
Nodes for Downtown System
Impact of Scenarios

Total City Fuel Mix - 2010 to 2050

Total Fuel Mix City of Holland

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Impact of Scenarios  
Electricity Fuel Mix - 2010 to 2050

Fuel Mix Electricity Generation City of Holland

- Baseline 2010
- Base Case 2050
- Scenario A 2050
- Scenario B 2050
- Scenario C 2050

Fuel MWh per year

- Solid Biomass
- Biogas/Landfill gas
- Fuel Oil
- Natural Gas
- Coal

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2010-2050 Results

GHG Emissions Total

Development of GHG-Emissions City of Holland

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2010-2050 Results

GHG Emissions per Capita

Development of GHG-Emissions per Capita - City of Holland

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**CEP Scenarios**

**Benefits for HBPW**

- Increased fuel flexibility
  - Coal, gas, bio-gas, bio-mass . . . .
  - Decrease of fuel price risk
  - Reduced carbon cost risk

- Additional revenues
  - Heating, domestic hot water, snow melt
  - Environmental services
  - Potential industrial energy management services

- Capacity for sale outside Holland

- Configured for PV peak reduction
  - Reduced infrastructure and operating cost
  - Decision timed based on markets costs
  - Actively seek incentives

- Future sales of municipal energy service skills to other municipalities

- Higher returns
CEP Scenarios
Benefits for City of Holland

- High-quality industrial jobs
- Local labor opportunity
  - SFH upgrade programme
  - Ongoing energy and environmental services
  - PV Installation
  - Refrigerator and AC buyback
- Higher property values and sales taxes
- Improved “dividends” from HBPW
  - Added value businesses in Holland
  - Future added-value businesses outside Holland
  - Reduced cost of capital
- Reduction of GHG emissions
- Increased attractiveness for all residents

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Benefits of Winning!
Competitive-Sustainable-Flexible

**Resident**
- Lower utility costs
- Improve resale value
- Enhance employment
- Improve quality of life

**Academic**
- Sustainable curriculum
- Lower costs
- Student magnet
- Global network

**Commercial**
- Reduced costs
- Rental values
- Low vacancy
- Productivity

**Developer**
- Premium prices
- Low carrying time
- Reduced investment

**Industry**
- Tailored energy
- Lower costs
- Sell waste energy
- Reduced CO2 risks

**Utilities**
- Higher returns
- Emissions reduction
- Customer intimacy
- Diversification

**Banks**
- Collateral Value
- Credit worthiness

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## Community Process to Refine Plan

### Key Milestones

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*Launch EECSPT Action Plan*