# Combined Heat & Power

PAs report on Program Design process

EEAC meeting June 22, 2009

# Agenda

- Background of CHP
- Current market review
- Current program design with work streams

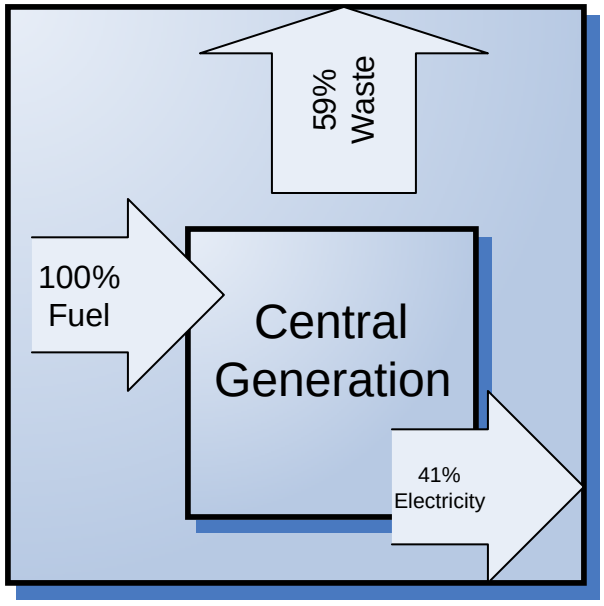
# Executive Summary

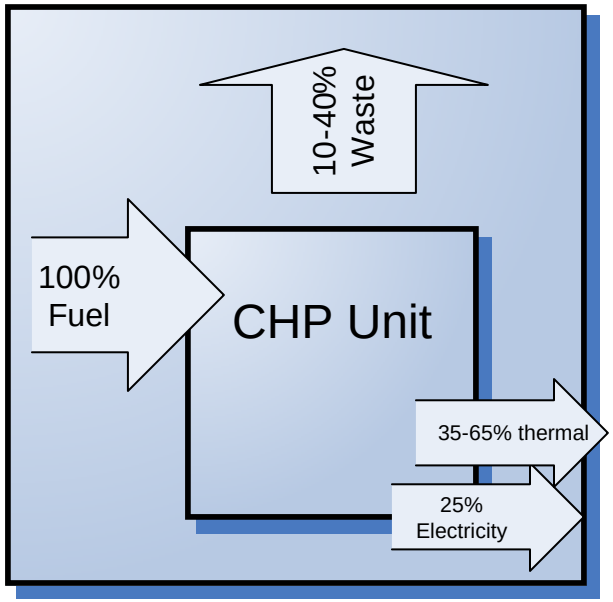
- Historically CHP has had limited support/focus from efficiency programs
  - We see an opportunity to do much more, moving forward
- However, there is much to learn about proper application
  - Improper use of CHP could increase GHG
- We have moved to the next level of detail on previous studies
- Our approach is to do a portfolio of projects with a do-learn-adapt mentality

# Background: What is CHP?

**Combined Heat & Power** – Utilization of waste heat created through the production of electricity

- Not necessarily distributed generation, central plants can also be CHP
- Generators are primarily internal combustion engines or turbines
- In most cases thermal is in the form of hot water



# Some Typical CHP Customers

<table>
<tr><th>MICRO</th><th>SMALL/MEDIUM</th><th>LARGE</th></tr>
<tr><td>< 5 kW</td><td>30 kW to 2000 kW</td><td>> 2000 kW</td></tr>
<tr><td>Cost: $15,000 per kW</td><td>Cost: $3,000 per kW</td><td>Cost:  < $2,500 per kW</td></tr>
<tr><td>Reciprocating Engines</td><td>Reciprocating Engines/Micro Gas Turbines</td><td>Reciprocating Engines/Gas Turbines/Steam Turbines</td></tr>
<tr><td colspan="3">Types of Facilities:</td></tr>
<tr><td rowspan="4">Residential</td><td>Hospitals/Nursing Homes</td><td rowspan="4">Manufacturing facilities, large universities, etc. with large hot water or steam loads and multiple shifts</td></tr>
<tr><td>Colleges</td></tr>
<tr><td>Hotels/Multi-level apartment buildings</td></tr>
<tr><td>Commercial Laundries</td></tr>
</table>

CHP reciprocating engines are similar to an automobile engine

CHP gas turbines for power generation are similar to a commercial airliner jet engine

# Learning from other Programs

| EVALUATED NYSERDA CHP SITES WITH AVERAGE EFFICIENCY | |
|---|---|
| **Customer** | **Average 2008 CHP efficiency** |
| **Pepsi Co** | **40%** |
| **Hilton NYC** | **43%** |
| **Fonda Fultonville** | **67%** |
| **East Rochester Elementary** | **64%** |
| **Riverpoint Towers** | **55%** |

**Only 2 projects evaluated near their projected efficiencies**
**Source: http://chp.nyserda.org/reports**

- **Efficiency of CHP is predicated on effective use of thermal output, year-round**
  - Industrial Processes
  - Large central plants
  - Laundry
  - Significant year round domestic hot water load
- **Initial TRC analyses show need for average annualized efficiencies should be higher than 60-65% based on project cost per kW, and plant run-hours**

# Opportunities, Issues, and Approach

| | RESIDENTIAL | SMALL/MEDIUM | LARGE |
|---|---|---|---|
| **Opportunities:** | Many homes | Large number of facilities | Sophisticated facility managers are able better able to understand potential benefits & risks |
| **Issues:** | Due to extremely high first cost, not currently cost-effective from a utility BCR standpoint | High first cost relative to size. | Larger size results in lower first cost per installed capacity |
| | Would require an very high utility incentive to be cost-effective for the customer | | Potential requirement for stand by power |
| | Few residential contractors are familiar with technology | Facility managers may lack sophistication to understand technology and vendor proposals | Lower cost of purchased power may reduce economic benefit |
| | Summer load may be too low to support required hours of operation | Summer load may be too low to support required hours of operation | Higher total installed costs may result in large incentives which could put pressure on overall budget issues |
| | | May be other more cost-effective measures to consider first | |
| | Customers may lack the sophistication/financial appetite to have necessary maintenance and replacement | | |
| | Economics are very sensitive to volatile electric and fuel prices | | |
| | Environmental benefits may be eroded if thermal output is not utilized year-round | | |
| **Approach:** | Monitor technology and costs, pilot small number of projects, and consider a program when cost-effective | Perform adequate pre-screening of candidates to increase success rate | Could have line item in annual budgets for specific projects |

# Triangulating on the market

- Identify markets using PA specific and rich information
  - Sales leads from Gas Sales
  - Gas usage
    - High summer gas usage indicates good potential
  - Customer types
- PAs are working to compile information. Sample data below:

| PA Sales Leads | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Customer** | **Estimated Size** | **NG Customer** | **Electric Customer** | **Dual Svc Customer** | **Trade Ally** | **Probability** | **Type** | **Size** | **Screen** | **Prop** | **Prob of kW** |
| Customer #1 | 2mW | Yes | Yes | Yes | DG vendor | High | IND | 2000 | 0.9 | 0.75 | 1350 |
| Customer #2 | ?kW | Yes | Yes | Yes | DG vendor | Low | NH | 75 | 0.5 | 0.25 | 9.375 |
| Customer #3 | ?kW | Yes | Yes | Yes | DG vendor | Low | IND | 200 | 0.9 | 0.25 | 45 |
| Customer #4 | ?mW | Yes | Yes | Yes | DG vendor | Low | IND | 200 | 0.9 | 0.25 | 45 |
| Customer #5 | ?mW | Yes | Yes | Yes | DG vendor | Low | IND | 200 | 0.9 | 0.25 | 45 |
| Customer #6 | ?kW | Yes | Yes | Yes | DG vendor | Low | HSP | 200 | 0.9 | 0.25 | 45 |
| Customer #7 | ?mW | Yes | Yes | Yes | DG vendor | Medium | IND | 500 | 0.9 | 0.5 | 225 |
| Customer #8 | ?mW | Yes | Yes | Yes | DG vendor | Medium | LGO | 2000 | 0.9 | 0.5 | 900 |
| Customer #9 | ?kW | Yes | Yes | Yes | DG vendor | Low | IND | 200 | 0.9 | 0.25 | 45 |
| Customer #10 | 250kW | Yes | Yes | Yes | DG vendor | Medium | IND | 250 | 0.9 | 0.5 | 112.5 |
| Customer #11 | ?kW | Yes | Yes | Yes | DG vendor | Medium | HSP | 200 | 0.9 | 0.5 | 90 |
| Customer #12 | 1mW | Yes | Yes | Yes | DG vendor | High | COL | 1000 | 0.9 | 0.75 | 675 |
| Customer #13 | 75kW | Yes | Yes | Yes | DG vendor | Low | MF | 75 | 0.5 | 0.25 | 9.375 |

# CIS Data Mining

- Can use PA gas CIS data to identify customers with high summer gas use
  - These customers should be targeted for CHP and other energy efficiency measures
  - 4000 therms per month translates to a fully loaded 75 kW system

| cust_last | Summer Use | Suggested Size | Annual Use | Monthly dthrms | sic_number | FirstOfSICTEXT |
|---|---|---|---|---|---|---|
| Customer #1500 | 62,996 | 352 | 349,699 | 2,914 | 8734 | Testing Laboratories (except veterinary testing laboratories) |
| Customer #1501 | 19,527 | 109 | 287,205 | 2,393 | | |
| Customer #1502 | 16,007 | 89 | 143,051 | 1,192 | 5311 | Department Stores (except discount department stores and su |
| Customer #1503 | 35,252 | 197 | 428,155 | 3,568 | 3900 | |
| Customer #1504 | 16,086 | 90 | 80,361 | 670 | 6531 | Real Estate Agents and Managers (appraisers) |
| Customer #1505 | 29,999 | 168 | 283,181 | 2,360 | 6531 | Real Estate Agents and Managers (appraisers) |
| Customer #1506 | 16,893 | 94 | 257,164 | 2,143 | 6531 | Real Estate Agents and Managers (appraisers) |
| Customer #1507 | 24,982 | 140 | 134,333 | 1,119 | 6531 | Real Estate Agents and Managers (appraisers) |
| Customer #1508 | 25,059 | 140 | 229,553 | 1,913 | | |
| Customer #1509 | 82,459 | 461 | 298,531 | 2,488 | | |
| Customer #1510 | 1,314,651 | 7,349 | 5,071,723 | 42,264 | | |

# Our analysis of the market has gone one level deeper and identified some questions…

- To better understand this market we:
  - Spoke to Lauren Mattison & Dr. Beka Kosanovic (UMass potential study)
  - Reviewed previous potential studies, consulted with distributed generation vendors, and analyzed actual gas & electricity consumption

- Some of our findings included –
  - UMass potential study was intended to be a very high level assessment
    - Did not have access to gas/electric usage
    - Relied on statistical methodology for technical potential and did not address the intricacies of the applications
  - Many of the previous studies turned to the UMass study

- Identified sectors may not have potential, for example…
  - Car washes have very little gas use (they don't heat the water)
  - Metal finishing may not applicable if it uses high pressure steam
  - Use of CHP with absorption cooling could use 1.5 to 3 times as much energy as electric cooling

- With this background, we know that thoughtful market analysis will allow successful penetration

# Current Program Design

# Program Design Process

- All PAs are working as a team
- Weekly meetings
- Organized into sub-teams
  - The Math Team
  - Program implementation
  - Technical requirements and screening
  - Marketing
- A combined gas and electric offering

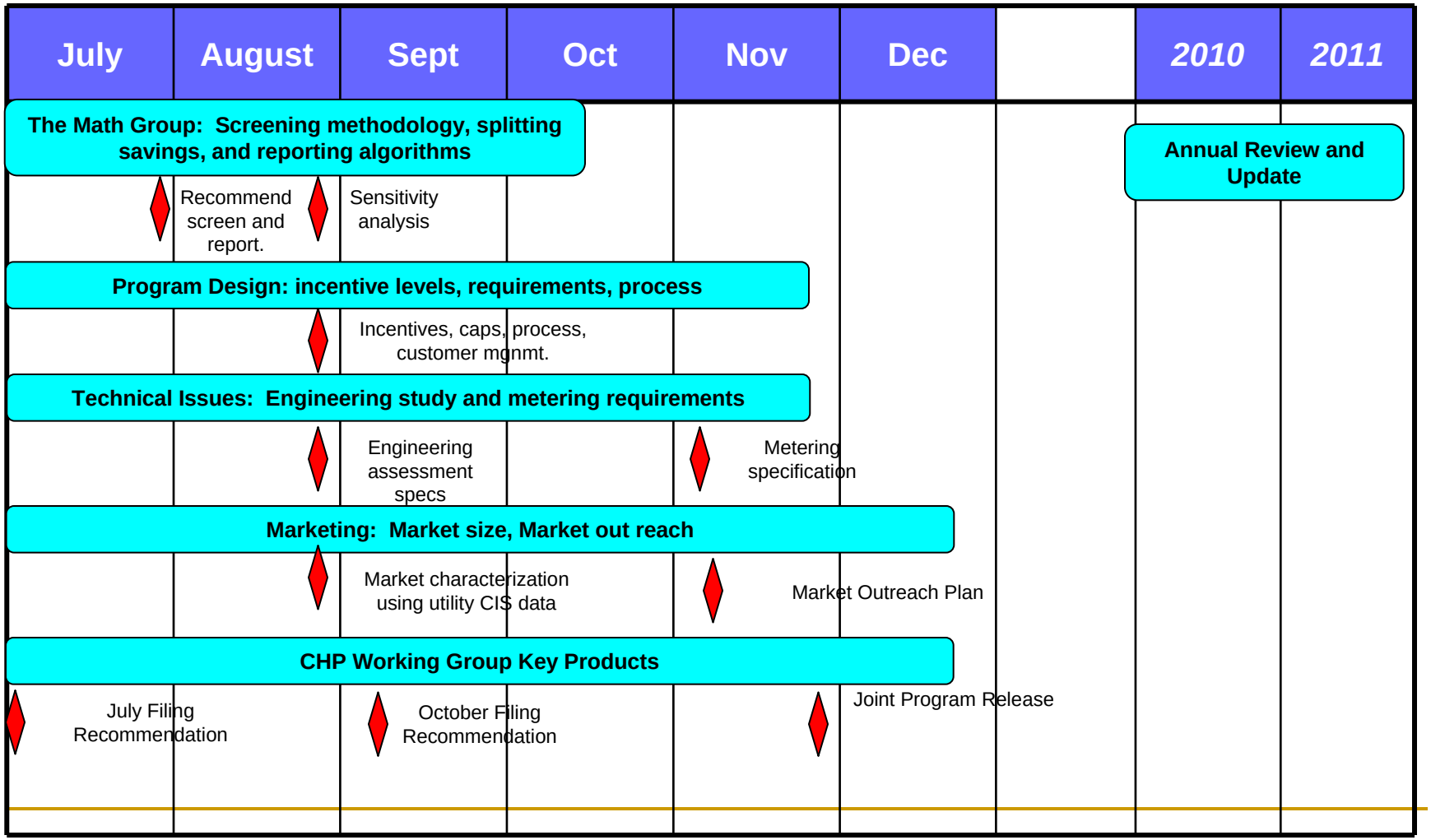
# Integrated gas and electric program

- PAs have agreed that a CHP program will be promoted through the gas and electric efficiency programs
  - Builds on gas programs with CHP experience and relationships with the customer
  - First area where determining proper allocation of costs and savings for DPU filings will be attempted (gas and electric programs are reviewed and approved separately by the DPU)
- Co-funded engineering study required
- Energy efficiency measures should be implemented first – need to "right size" CHP system
- So as to properly evaluate initial funded systems, some level of output electric and useful heat metering may be required

# Integrated gas and electric program

- 2009 pilot program from the Electric Energy Efficiency C/I metric #5 uses a $750/kW installed incentive – is this the right number?
  - Need to better understand budget impact of CHP
    - How do we handle large projects within annual budget cycles?
    - Need to understand impacts of differing project specifics
      - Municipal Electric Co. service areas
      - Oil-fired or biomass fired CHP
- Single statewide, fuel blind process and uniform application
- Preliminary review of market potential seems to indicate volume of projects could be in the small-medium segment, but would work to capture the larger, longer lead-time projects as well

# Timeline – Subgroups and Tasks



# Summary

- Marketing of CHP opportunities will be done by:
  - Providing overall technical assistance studies for customers with gas use exceeding 4,000 therms per month in the summer months
  - Look for comprehensive projects to “right-size” CHP with other efficiency measures
- Actively reviewing a number of potential projects for 2009 installation to learn more
- Future evaluations will allow fine-tuning of the program
  - Will likely need specific operating requirements for CHP requiring most of thermal output is used so that overall efficiencies don’t drop in future evaluation studies.
  - Once overall program is determined, some work needs to be done relative to splitting appropriate allocation of rebates and savings for DPU filings
- A thoughtful and educated approach will ensure success from all stakeholders
  - Customers
  - State goals
  - Vendors