

Fuel Chargeable To Power
Methodology For Calculating CHP Performance

Electricity and Natural Gas Committee Workshop

April 13, 2009

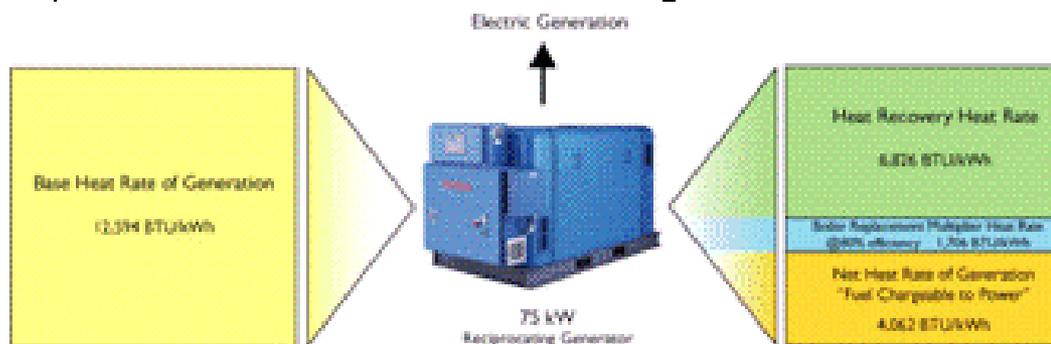
Keith Davidson, DE Solutions, Inc.

Fuel Chargeable To Power

- Mindset - CHP displaces part or all of a boiler's function
- Power is a by-product
- Avoided boiler fuel is subtracted from fuel input to CHP system
- Remaining fuel requirement is "chargeable" to power production.

CHP Savings Methodology

Step #1: Determine "Fuel Chargeable to Power"



$$HR_{FCP} = HR_{base} - \frac{HR_{recovered}}{Eff_{generator}}$$

Step #2: Calculate Annual Savings Compared to Grid

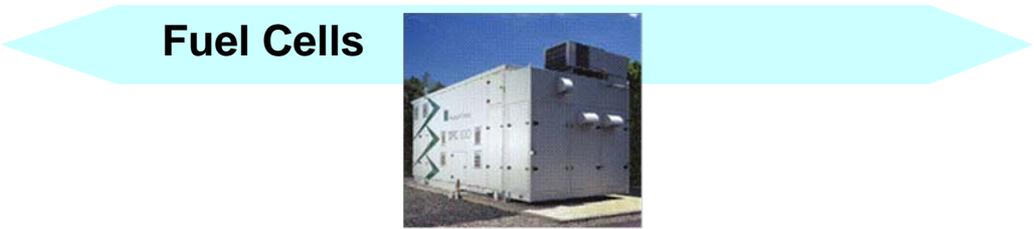
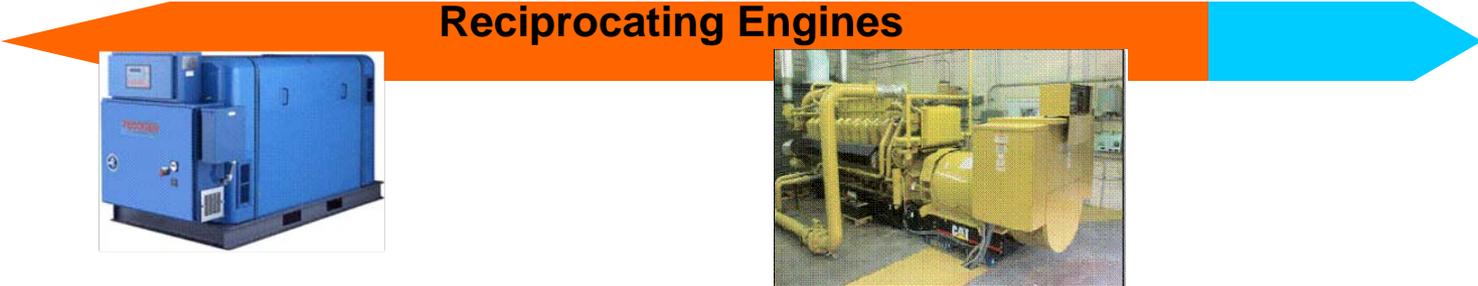
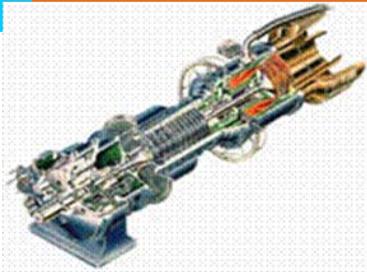
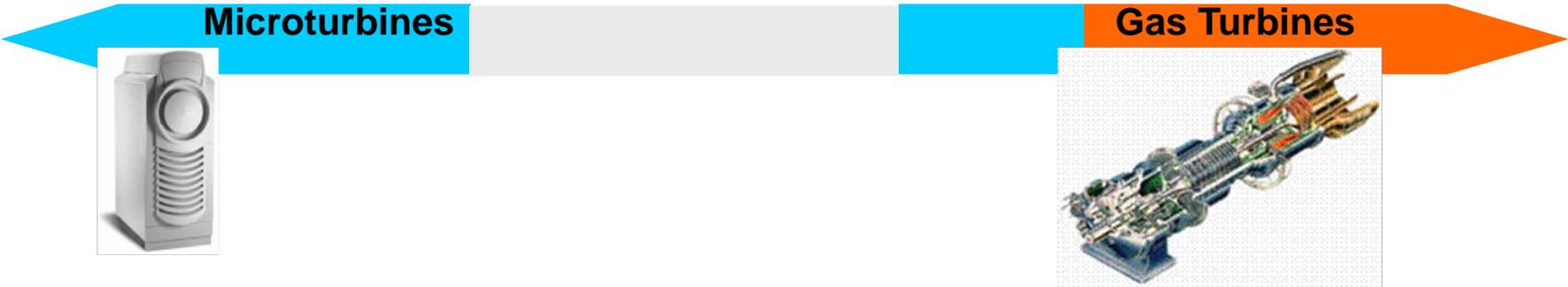
$$kW_k = \frac{HR_{FCP}}{HR_{GRID}} \times kW_{generator} \times hours_{operation} \times (T\&D)$$

- CHP Eligible for Incentives
 - ODOE: 35% tax credit over 5 years or discounted cash payment
 - ETO: Incentive linked to energy savings
 - Climate Trust: CHP eligible to sell carbon offsets
- CHP policy is consistent with energy efficiency and renewable energy policy
- CHP incentives are consistent with energy efficiency and renewable energy incentives

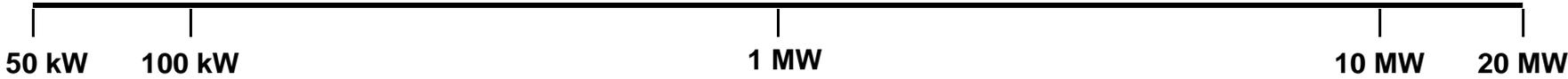
Oregon Program Tidbits

- Avoided resource - 8,600 BTU/kWh
 - Based on Aurora model for base-load power
 - Avoided resource mix includes 8% coal
- T&D Losses
 - 6% transmission
 - 10% primary & secondary
- Fuel Chargeable To Power Eligibility Threshold
 - 6,120 BTU/kWh
 - 10% better than 6,800 BTU/kWh power plant

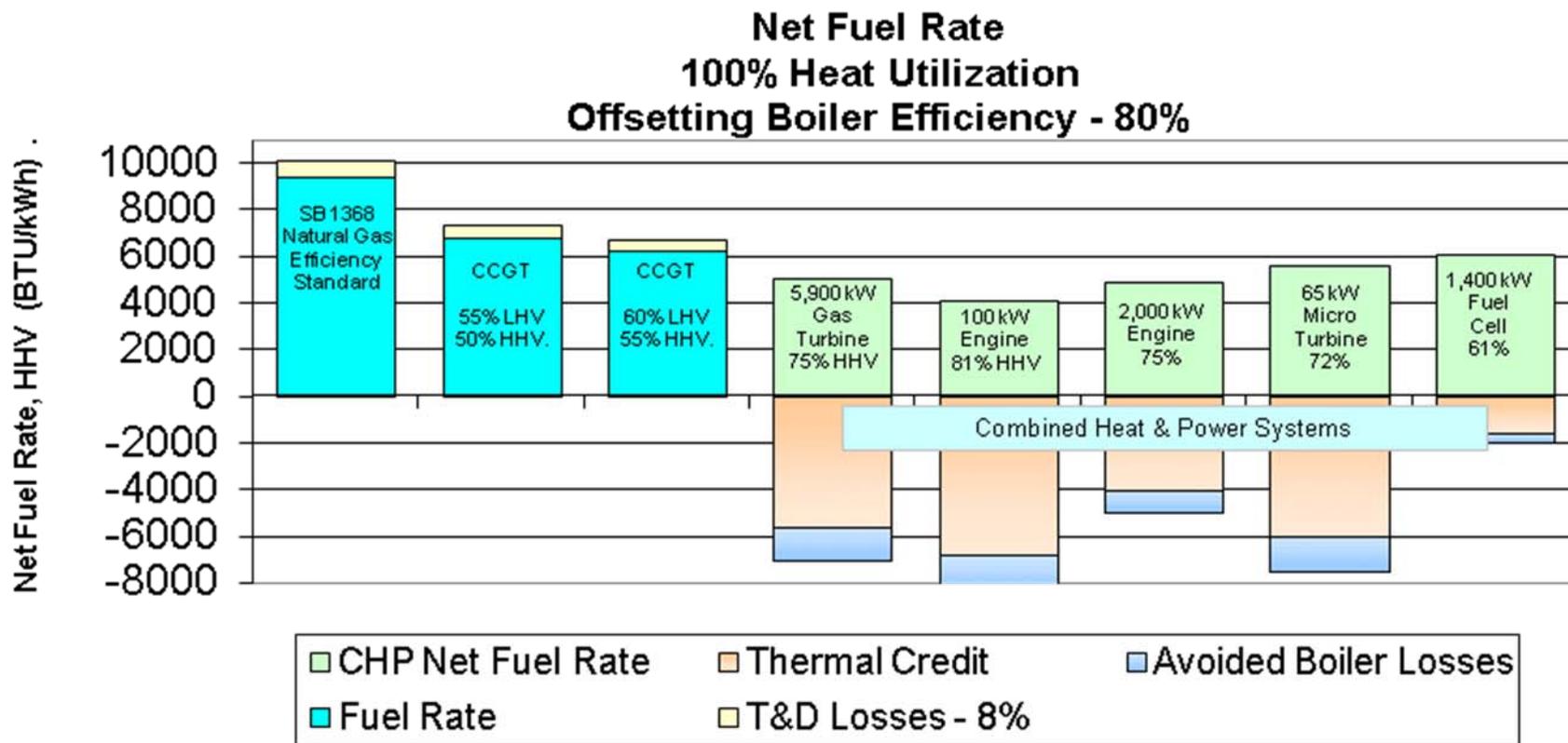
CHP Prime Movers



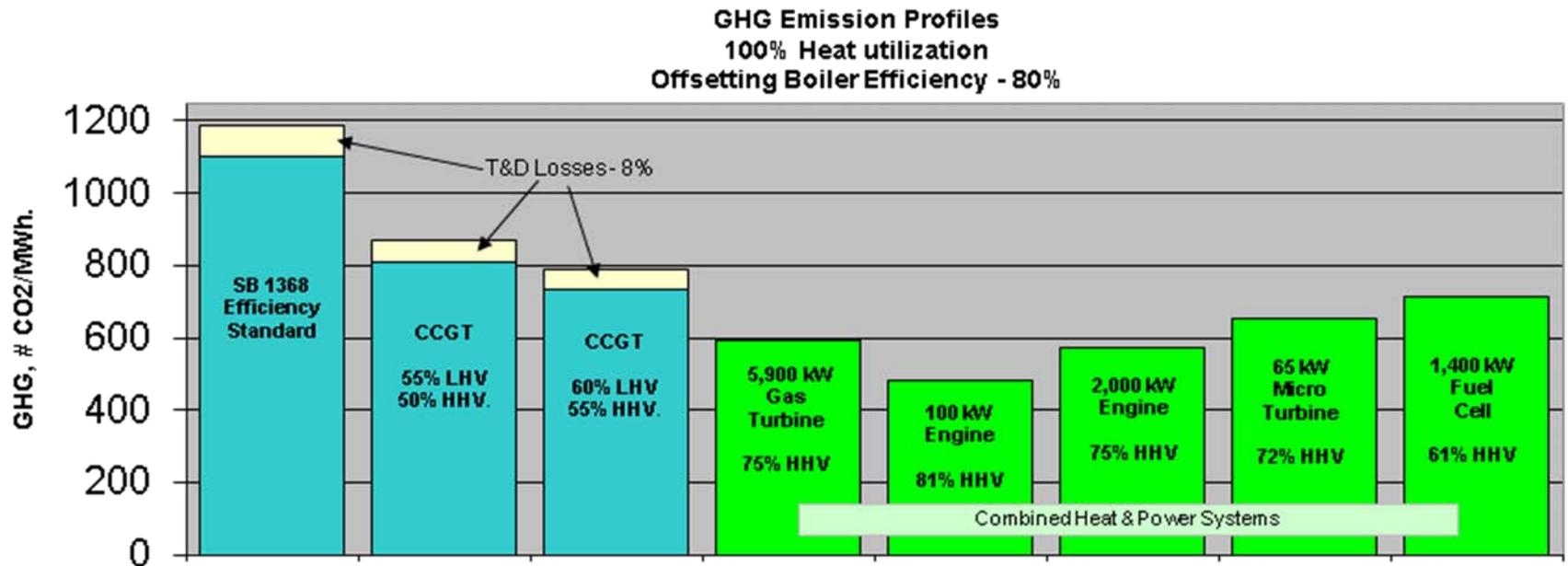
- Market Position**
- █ Strong Market Position
 - █ Secondary Market Position
 - █ Emerging Market Position
 - █ Weak Market Position



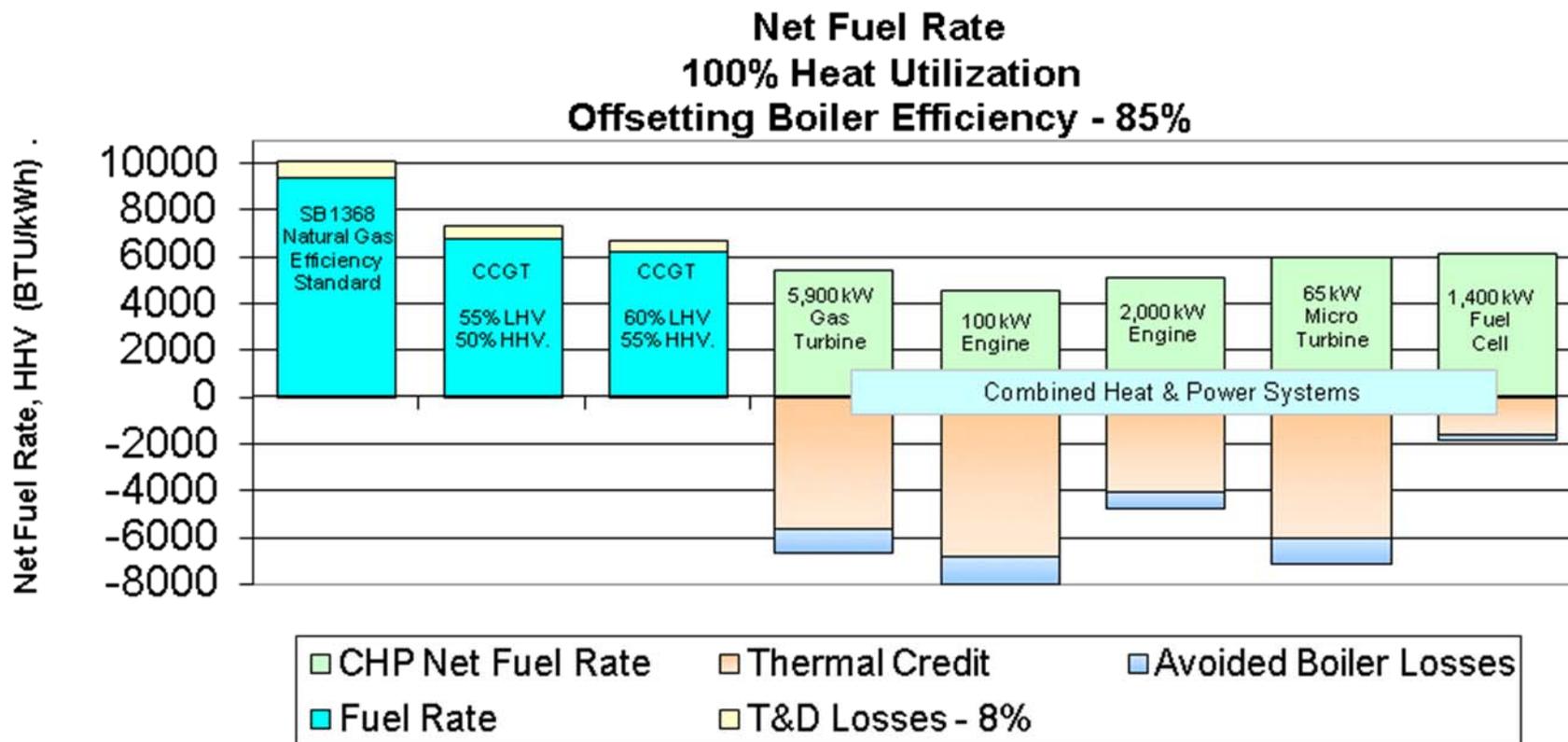
Fuel Chargeable TO Power (FCP) - 100% Heat Use



GHG Chargeable To Power

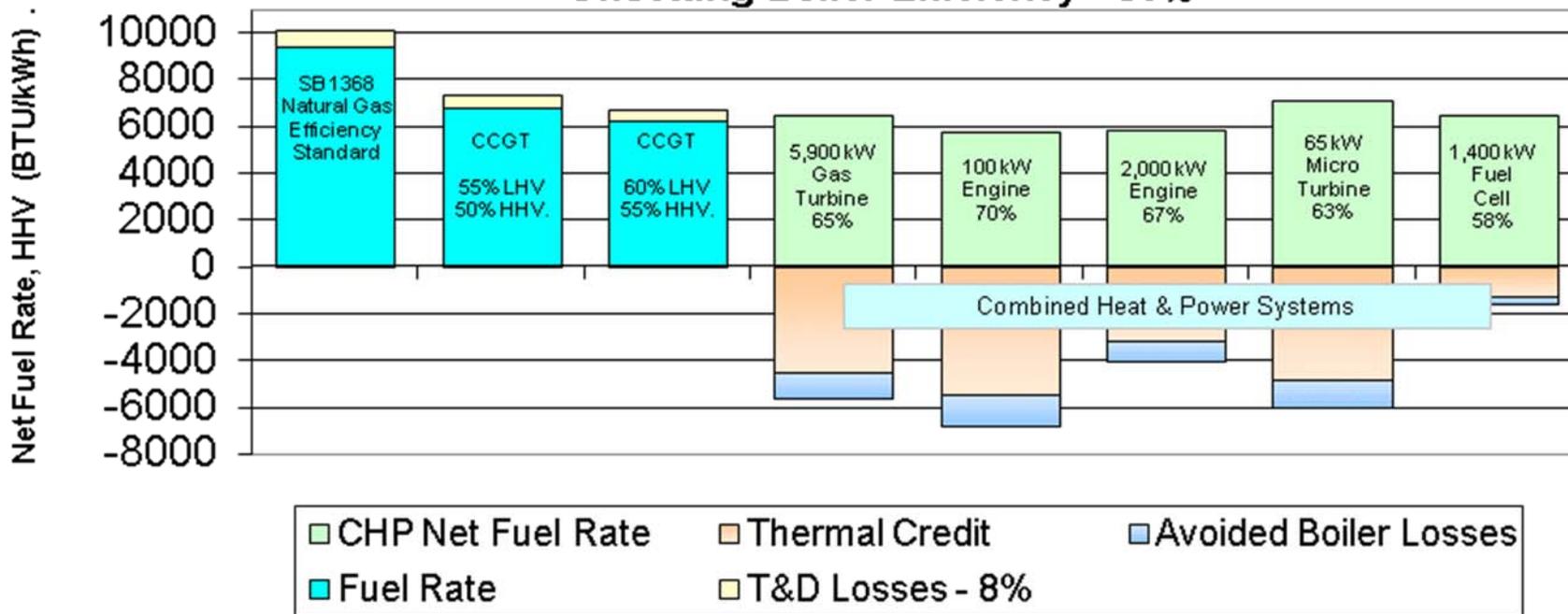


FCP - 100% Heat Use; 85% Offsetting Boiler Efficiency

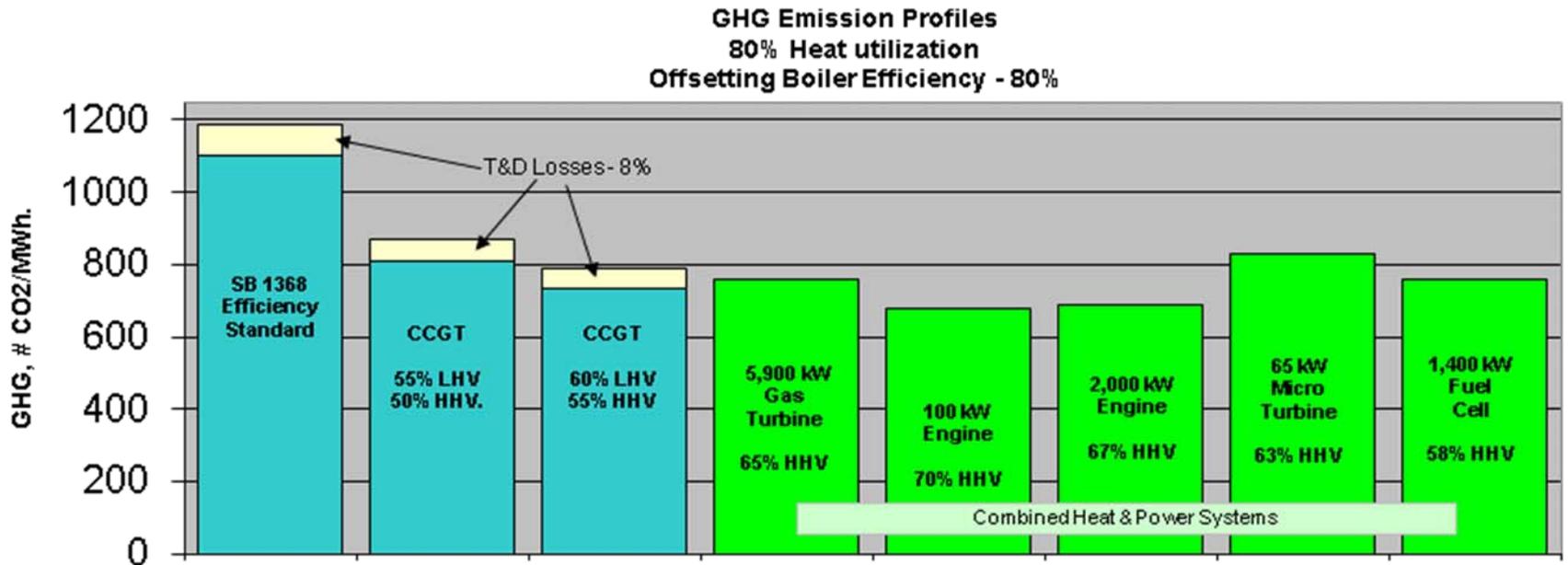


FCP - 80% Heat Utilization

**Net Fuel Rate
80% Heat Utilization
Offsetting Boiler Efficiency - 80%**

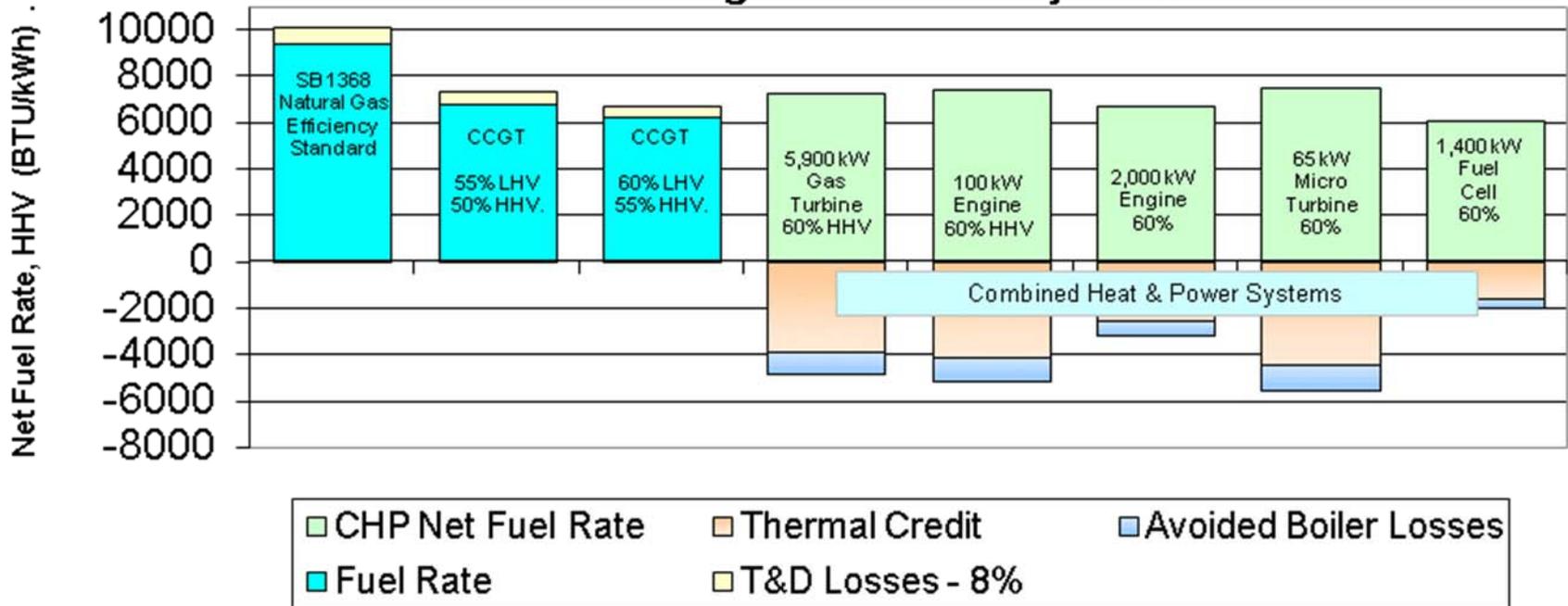


GHG Chargeable To Power - 80% Heat Utilization

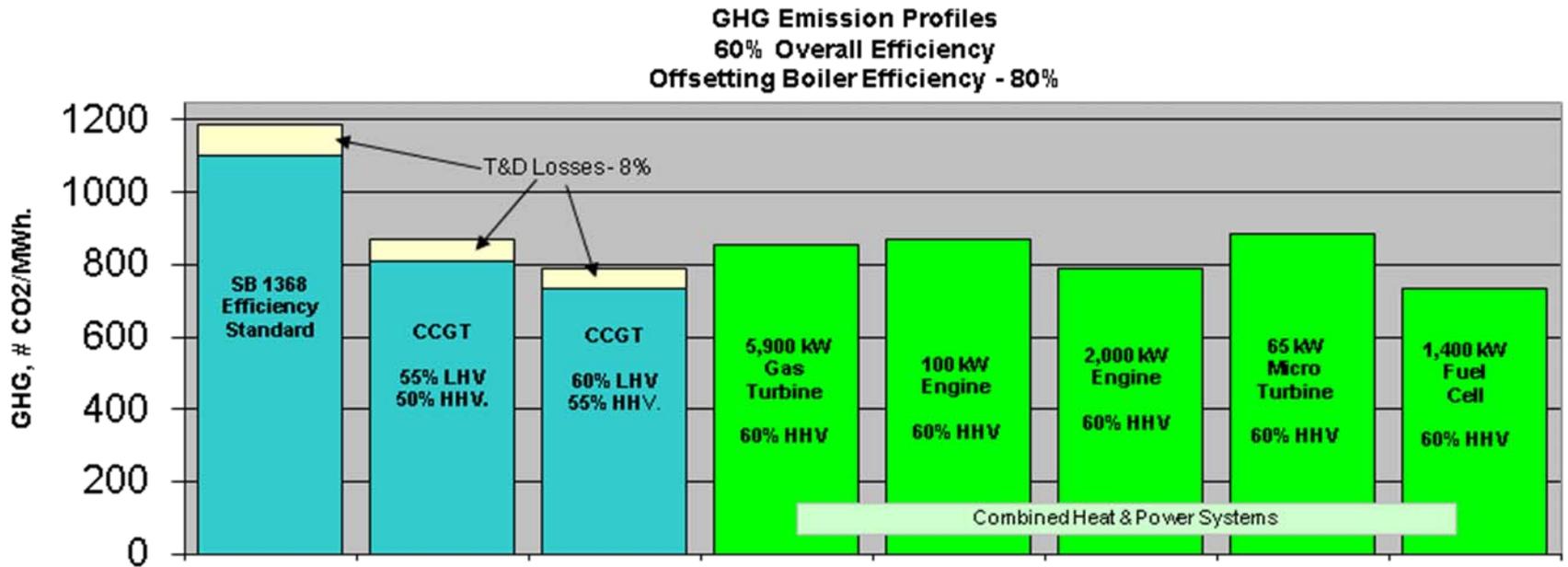


FCP - 60% Overall Efficiency, HHV

**Net Fuel Rate
60% Overall Efficiency
Offsetting Boiler Efficiency - 80%**



GHG Chargeable To Power - 60% Overall Efficiency



CHP Implementation is Good for California

- Reduces natural gas usage
- Reduces GHG emissions
- Air emissions comparable to central station power
- Lower energy costs to adopters
- Provides capacity and T&D value to grid
- Keeps downward pressure on energy costs to all ratepayers
- Enhances reliability to implementer and to local grid

Recommendations

- Implementation of retail CHP with Accretive Benefits should be encouraged and incentivized
- Incentives should be consistent with those applied to efficiency, demand response and renewable measures

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