IS CHP A VIABLE OPTION FOR BC?

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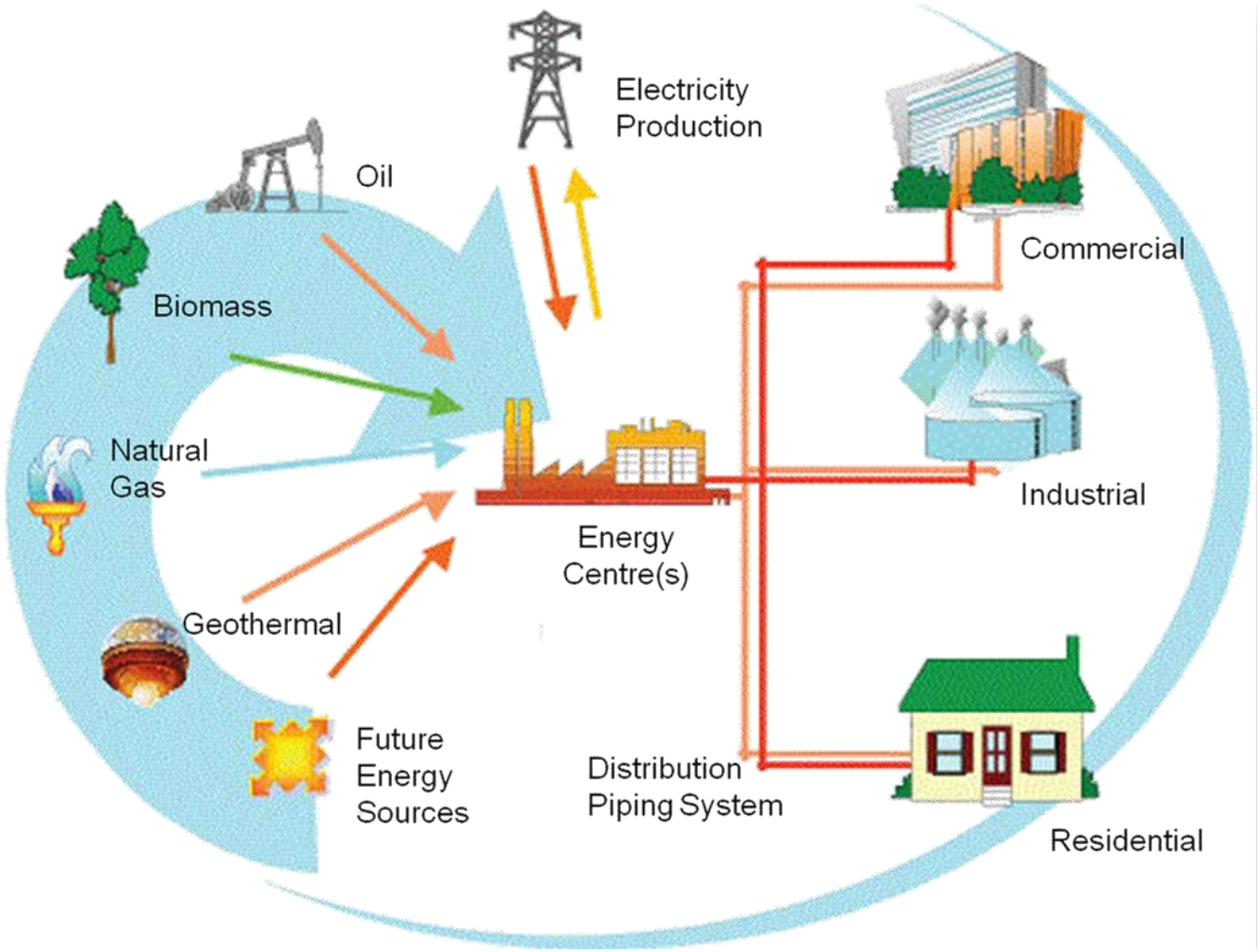
David Trigg, PEng, CEM
FVB Energy

District Energy



District Energy in BC

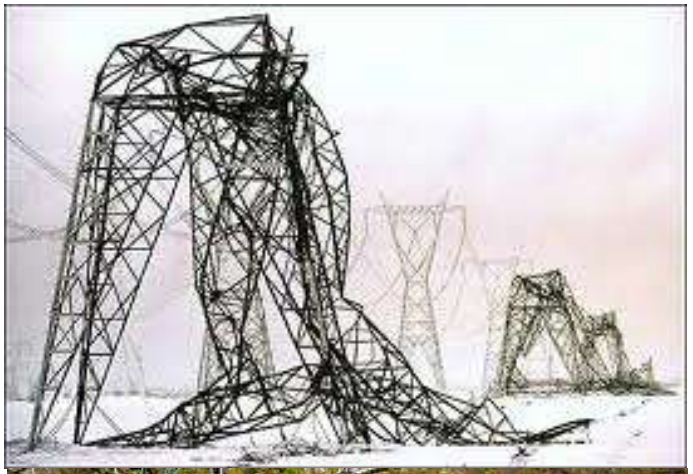
- Significant interest in DE
- New systems starting to develop quickly
- Generally a focus on biomass and sewer heat recovery

CHP Across North America

- Ontario is leader in Canada
  - CHPSOP 2.0
  - PSUI
- US EPA Clean Power Plan
  - Regulates GHG emissions
  - CHP is a compliance measure

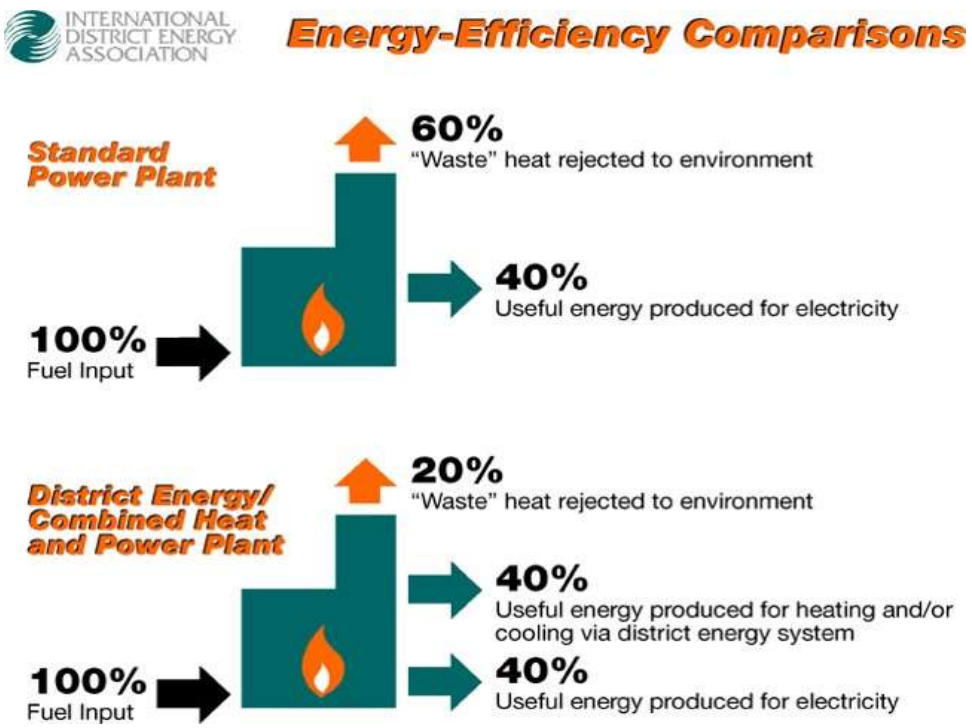
Energy Resiliency & Security

- Maintain service through major natural disasters
  - Montreal ice storm (1998)
  - San Francisco earthquake (1989)
  - Hurricane Irene (2011) and Sandy (2012)
- CHP can be an integral part of a community's natural disaster response plan.



Environmental & Social Benefits

- Very high efficiency, reduces GHG emissions
- Benefits of DE and distributed generation to the local community
  - Local employment and economic development
  - Keeps energy dollars in the community



CHP in British Columbia

- Little penetration
  - Industrial CHP (pulp & paper, mines, etc.)
  - Often large-scale biomass CHP
  - Minimal Natural Gas CHP
- Why?
  - GHG Emissions
    - Electricity in BC is very green
  - Economics – inexpensive electricity
    - *However*, current spark spread is $50-70/MWh$_e$
  - No current power purchase program for Natural Gas CHP

Current CHP Programs in BC

- BC Hydro Standing Offer Program (SOP)
  - Generation between 0.1 – 15 MW_e
  - Offer is \$100-110/MWh_e (2015\$)
  - NG CHP is currently ineligible
- "Behind-the-meter" DSM
  - Large industrial customers, hospitals, universities
- Local distribution companies
  - E.g. New Westminster, Fortis electric

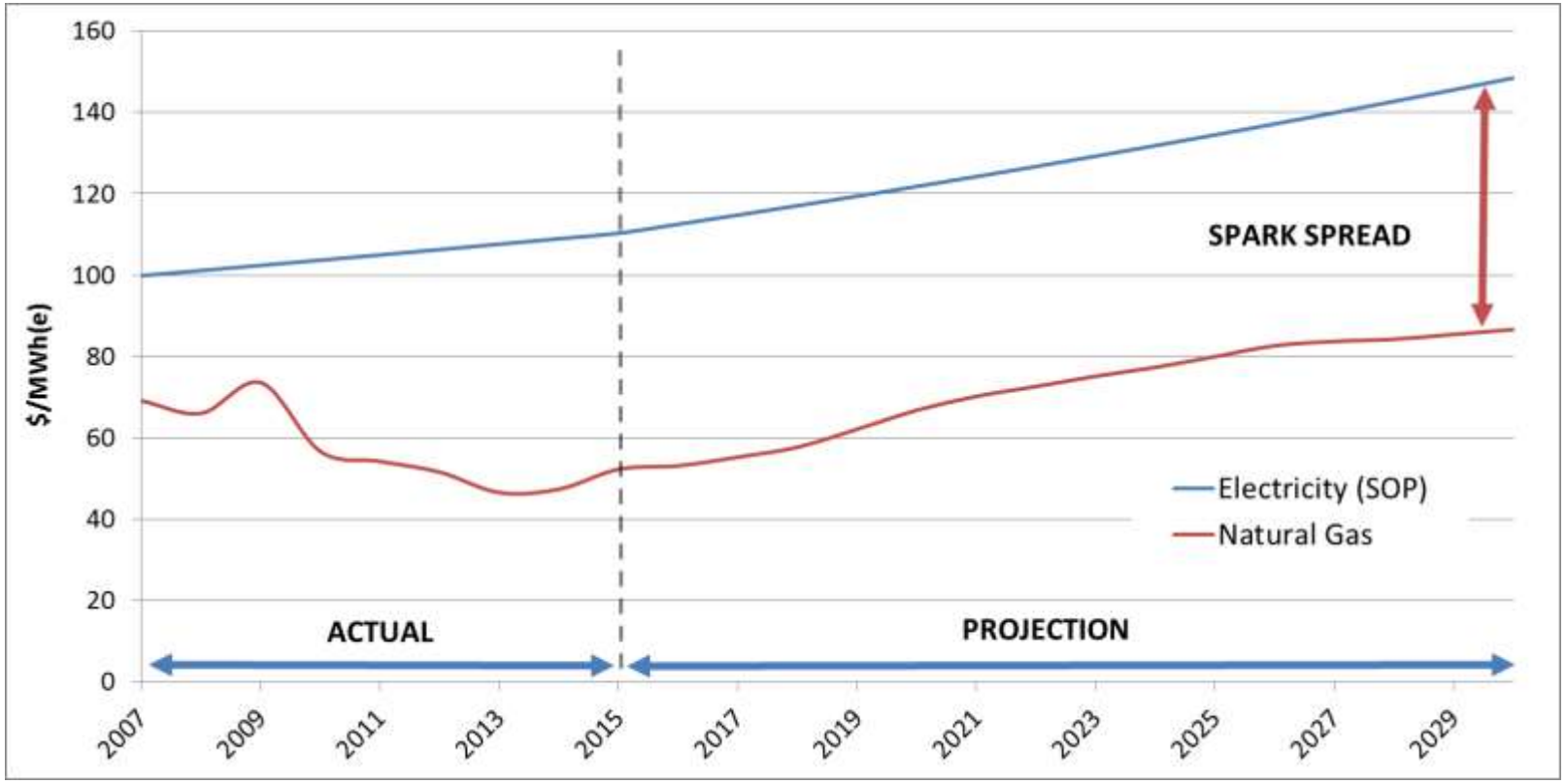
Business Case Example

- Incremental analysis (existing DES)
- 4.4 MW_e NG Engine, thermal-load following
- Spark spread (current) = \$60/MWh_e
- Electrical Revenue = \$2.9M/yr
- Avoided cost of thermal energy production = \$600,000/yr
- Capital Cost ~ \$12M
- Fuel cost = \$1.4M/yr
- Non-fuel O&M + Capital Replacement (Sinking Fund) = \$400,000/yr

Simple Payback = 7 years

Economic Considerations

- Energy arbitrage (gas vs. electricity)
- Financial hedge (NG contracts)

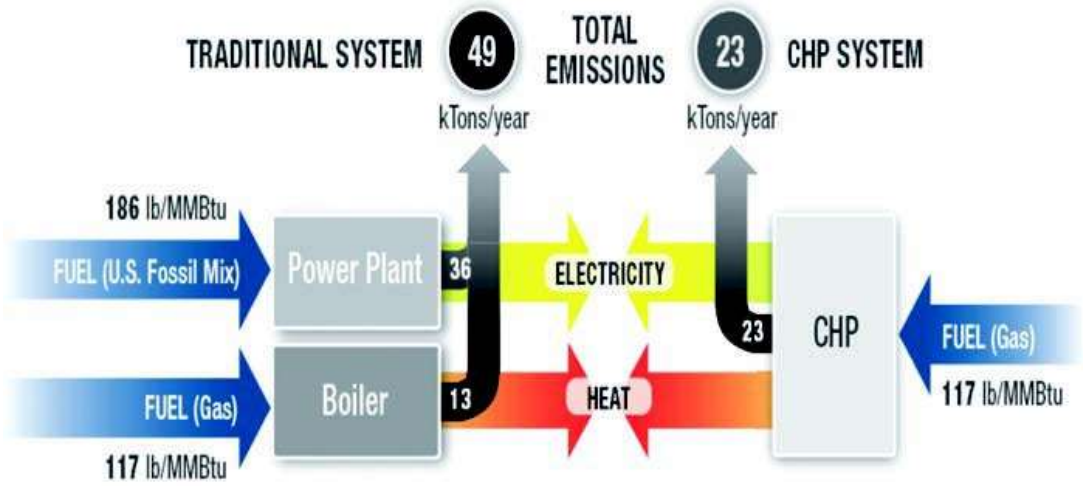


Other Benefits

- Reduces peak-loads on power grid
- Enhances energy security and resiliency
- Significant local CHP potential with new district energy in Metro Vancouver
- Low technical risk

Greenhouse Gas Emissions

- BC 10 kg / MWh_e
- Ontario 100 kg / MWh_e
- NGCC 400 kg / MWh_e
- Alberta **800** kg / MWh_e



Greenhouse Gas Emissions

	CHP DES	BAU (BC Elec)	BAU (Ontario Elec)	BAU (NGCC)
NG Consumption	230,000 GJ	125,000 GJ		
Electricity	26,200 MWh_e	26,200 MWh_e		
Heating Emissions	11,300 tonnes	6,200 tonnes	6,200 tonnes	6,200 tonnes
Elec Emissions		300 tonnes	2,600 tonnes	10,600 tonnes
Total Emissions	11,300 tonnes	6,500 tonnes	8,800 tonnes	16,800 tonnes
Emission Factor	220 kg/MWh	130 kg/MWh	170 kg/MWh	330 kg/MWh
% of CHP	-	*60%*	*80%*	***150%***

Renewable Natural Gas (Biomethane)

- Currently offered by Fortis
- Cost premium $12/GJ
  - spark spread disappears
- 50% RNG results in GHG reductions relative to BC Hydro
  - Spark spread ~ $10/MWh$_e$

CHP is likely not feasible with current RNG pricing

Renewable CHP

- Biogas
  - Landfill
  - WWTP
  - Anaerobic digestion
  - Others?
- Biomass CHP
  - Better economics at larger scale
- Waste to Energy
- All eligible under current BC Hydro SOP

WHY CHP IN BC?

- Low NG cost and rising electricity costs
- Real value in DG in the major load centres
- Economic development within the community
- Improve energy resiliency and reliability
- Reduce GHG emissions (when viewed on a global scale)

HOW DO WE GET THERE?

- Reverse ineligibility of high-efficiency NG CHP under the SOP
- More pragmatic and flexible view on electricity carbon intensity
- Greater incentive for distributed generation in major population centres
- All levels of government should recognize the value of CHP

Thank You

Questions?

David Trigg, PEng, CEM
FVB Energy
dtrigg@fvbenergy.com
604-689-3410 Ext. 402

FVB ENERGY INC