



UBC's DES Goes Green Expanding Biomass

**IDEA – Campus Energy 2018
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Agenda

- Background
- Current Situation & Challenges
- Why Biomass?
- Biomass Expansion Project
- Operational Impacts
- Conclusions
- Questions



The University of British Columbia (Vancouver)

UBC at a Glance 2016/17



- 62,923 total students
- 54,236 Vancouver students
- 8,687 Okanagan students
- 14,434 international students from 162 countries
- 12,800 degrees granted in 2016
- \$12.5 billion in economic impact
- 199 companies spun off from UBC research
- 1,326 research projects with industry partners
- 1,172 research contracts and agreements with government and non-profits



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UBC's Steam DES (1925-2017 RIP)

Natural Gas
Oil (Backup)

**Steam
Plant**

**Steam
70MWt peak load**

2007 baseline snapshot

- 1,000,000+ GJ/yr
- 60% System Efficiency
- 0% Renewable Energy
- 50,000+ tCO₂
- Aging system
- Major losses



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UBC GHG Commitment Confirmed

UBC 2010 Climate Action:
Greenhouse Gas reduction targets of:

33% below **2007** levels by **2015**

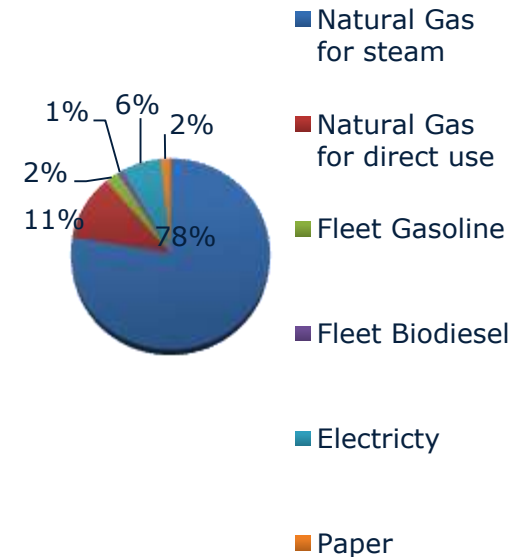
67% below **2007** levels by **2020**

100% below **2007** levels by **2050**



**2007 First
Comprehensive
campus GHG
inventory**

**Baseline is 61,090
tons Co2 equivalent**



UBC sets aggressive new targets to reduce greenhouse gas emissions

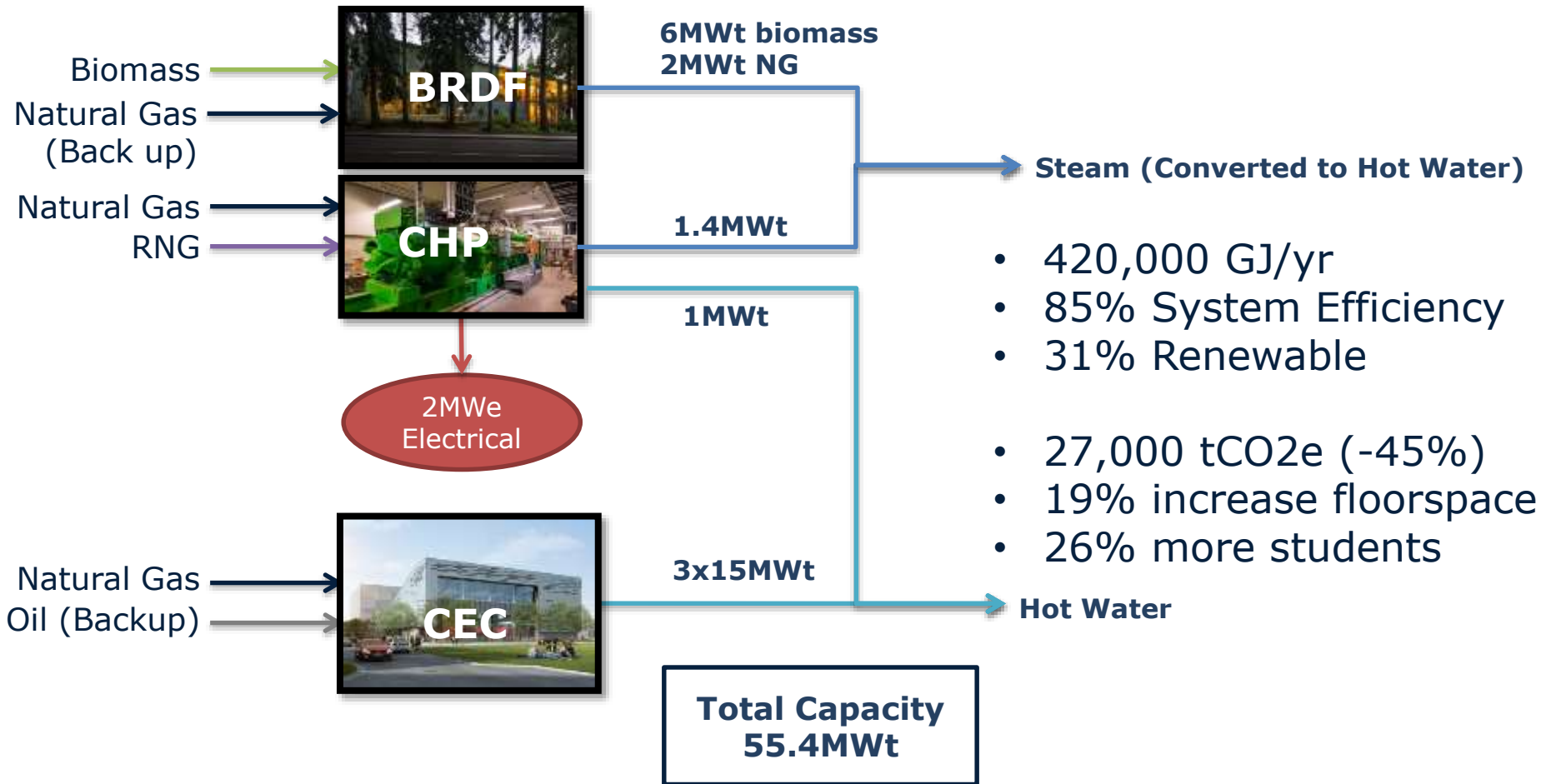
Media Release | March 24, 2010

University of British Columbia President Stephen Toope announced aggressive new greenhouse gas (GHG) emissions targets for UBC's Vancouver campus today. Toope made the announcement to delegates at the GLOBE 2010 conference in Vancouver, one of the world's largest environmental conferences.

<http://news.ubc.ca/2010/03/24/ubc-sets-aggressive-new-targets-to-reduce-greenhouse-gas-emissions/>

Background: UBC CO2 Emissions Reduction Commitments

UBC's Current DES



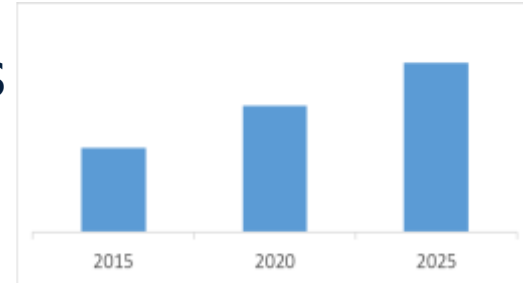
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BRDF: Bioenergy Research & Demonstration Facility
CEC: Campus Energy Centre
CHP: Combined Heat & Power
DES: District Energy System
RNG: Renewable Natural Gas

Current Challenges

- Address Rapid Campus Growth
 - 25% of additional floor space connect to HW DES by 2025.
 - Maintain N+1 thermal redundancy.
 - Business as usual would be to add a 4th natural gas boiler to the CEC
- While meeting UBC's 2020 Climate Action Plan
 - 2020 67% GHG reductions targets
- And must financially be better than business as usual



\$

?

Our solution?



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Biomass



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Biomass – Clean Waste Wood



- Fuel is ground & chipped waste wood:
 - Sawmill residuals
 - Furniture/carpentry/lumberyard waste
 - Municipal trimmings
 - Land clearing operations
- Fuel Spec
 - 3" minus, <10% fines, <2% dust
 - 5-40% MC, <3% Ash
 - No paint, chemicals, glues etc



The Business Case for Biomass

- Relative to new gas boiler at Campus Energy Centre

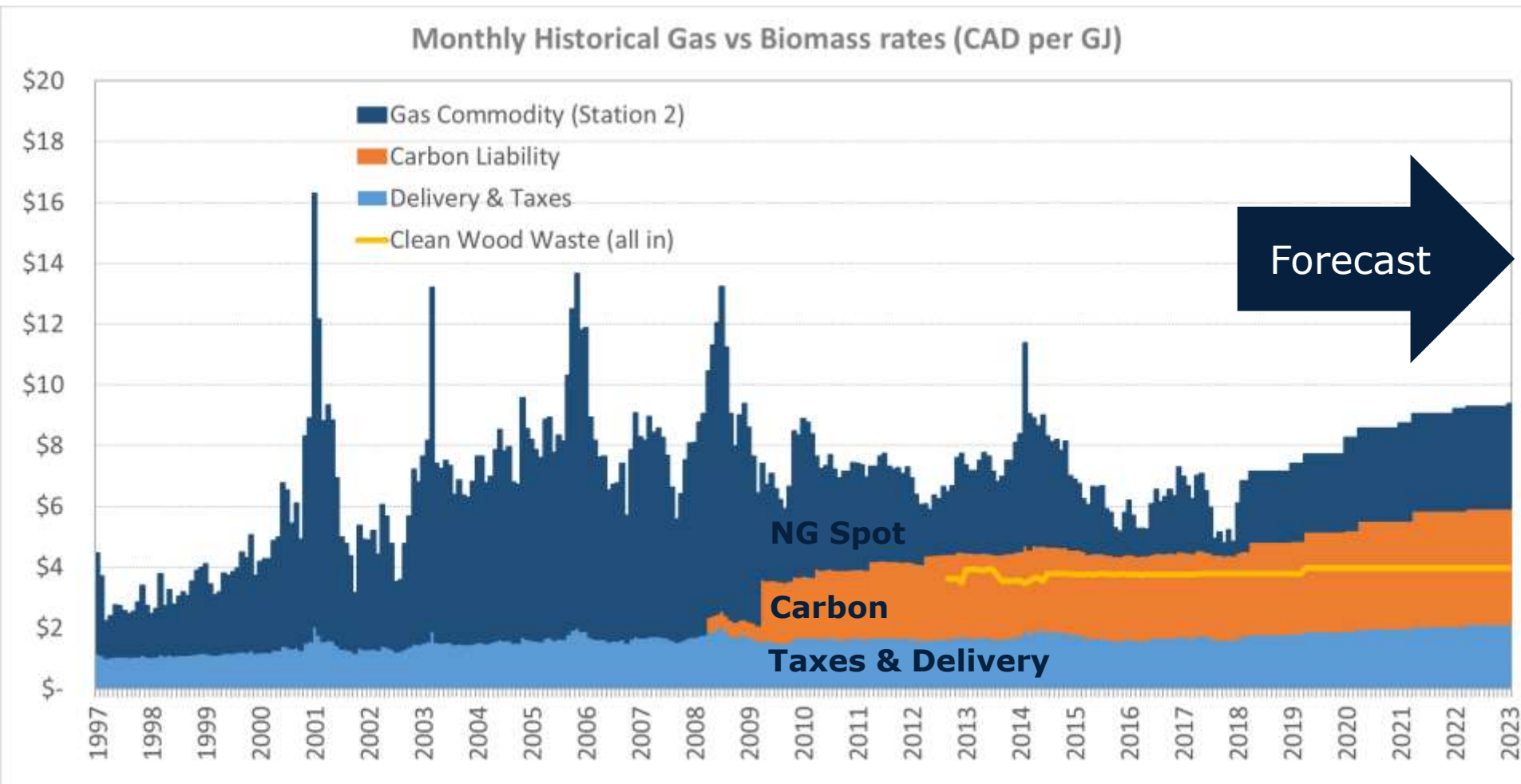
- \$15M Capex
- Access to \$5M of External Funding
- \$1.3M Annual Operational Savings
- 7yr SPB
- 250,000 GJ reduction in NG

NPV (15) with Expected funding

		Natural Gas & Carbon				
		High	Expected	Low		
Biomass	Low	\$22.9	\$14.5	\$10.4	12MW	Operating Capacity
	Expected	\$21.0	\$12.7	\$8.5		
	High	\$18.8	\$10.6	\$6.4		
	Low	\$20.3	\$12.8	\$9.0	10.5MW	
	Expected	\$18.5	\$11.1	\$7.3		
	High	\$16.6	\$9.2	\$5.4		
	Low	\$17.5	\$10.8	\$7.5	9MW	
	Expected	\$15.9	\$9.3	\$6.0		
	High	\$14.2	\$7.6	\$4.3		



Why Biomass? Price Stability



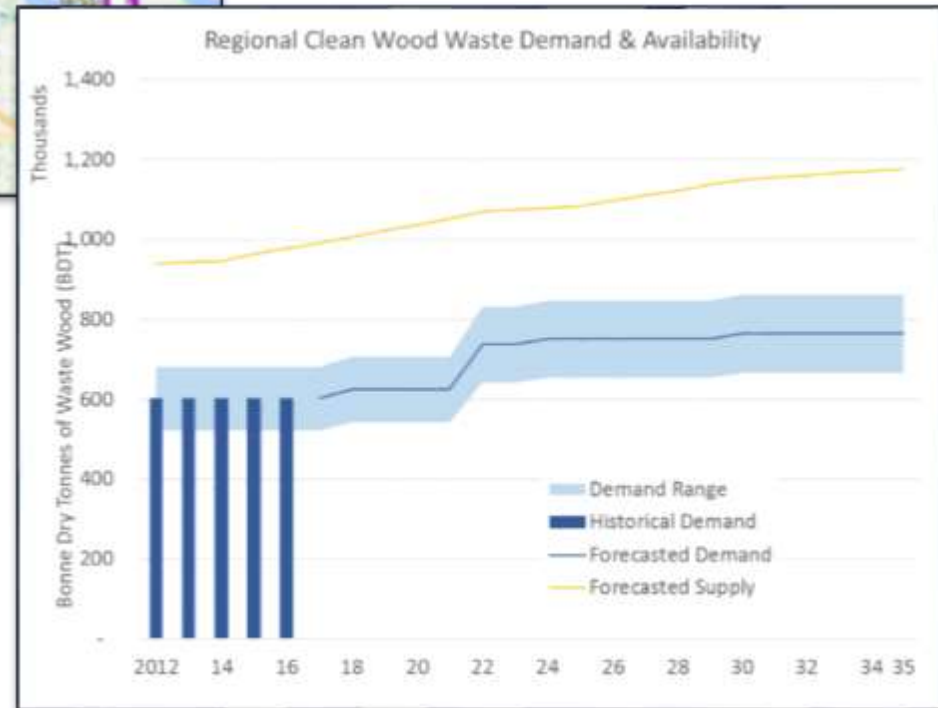
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Why Biomass – Local & Available

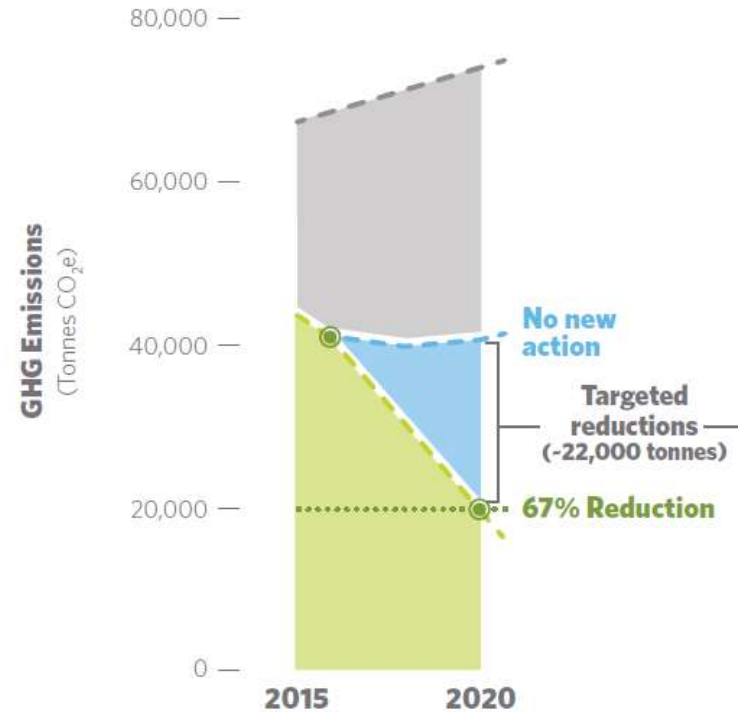
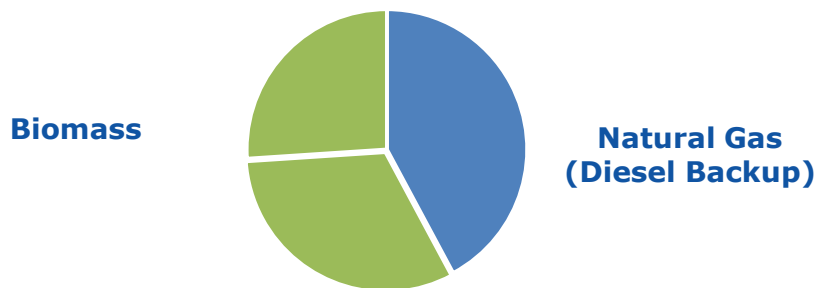


- Region produces 1 million tonnes of wood waste annually
- Sawmills, Secondary Processors, C&D, Land Clearing, trimmings
- Only half is used
- UBC currently uses 10,000 tonnes per year or 1% of total supply, pushed up to 2% when expanded

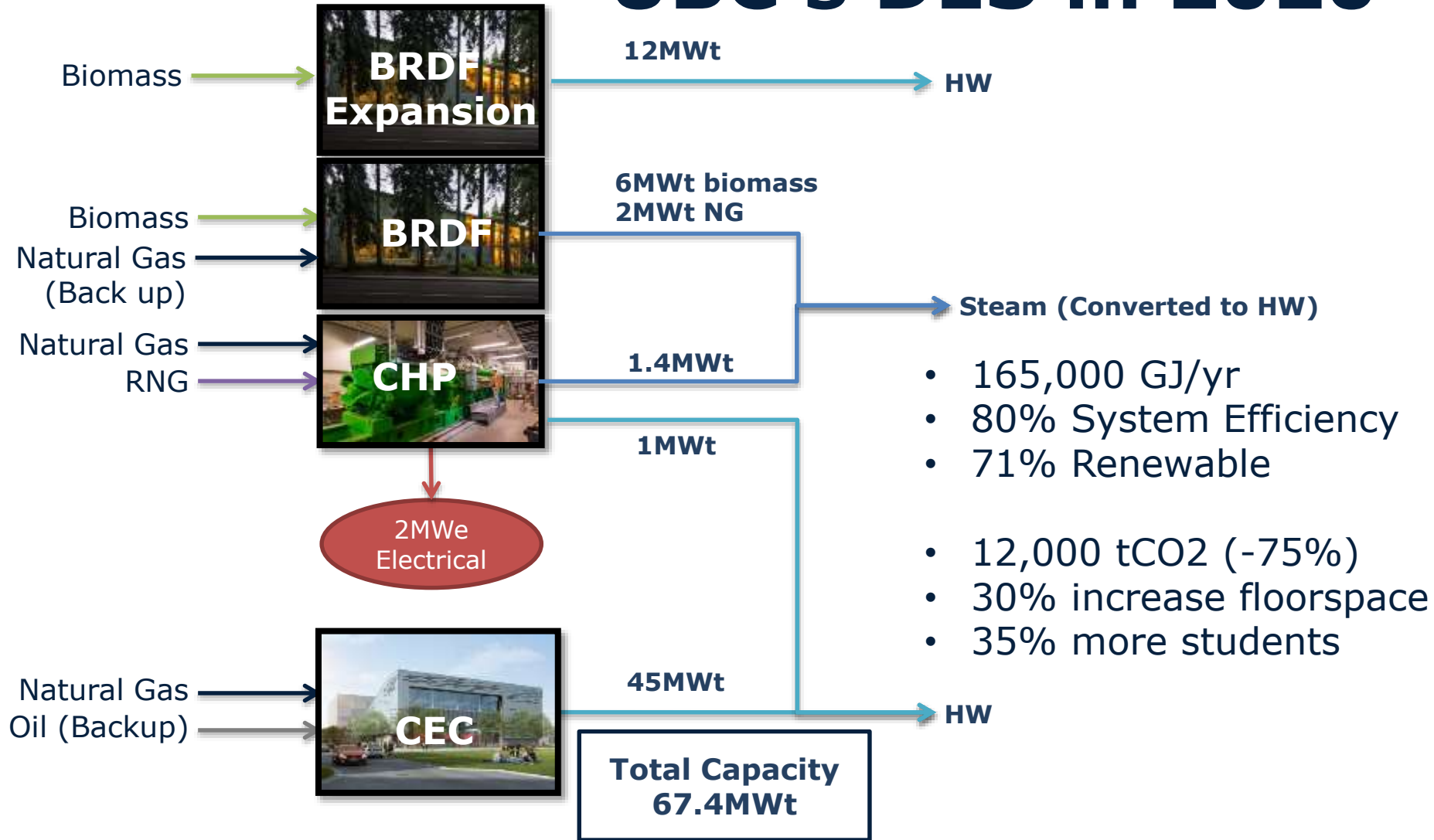


Additional benefits

- Contributes to Climate Goals
 - 12,500 tCO₂ reduction
- UBC has experienced with biomass systems and suppliers
- Research Opportunities
- Diversification of fuel supply



UBC's DES in 2020



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BRDF: Bioenergy Research & Demonstration Facility
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How will UBC expand the BRDF?



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Project Roadmap

- 2015 Pre-feasibility study
- 2016-17 Public Engagement, Feasibility Study
- Dec 2017 UBC Board Approval
- 2018 Design & Demolition
- 2019 Construction
- 2020 Operational

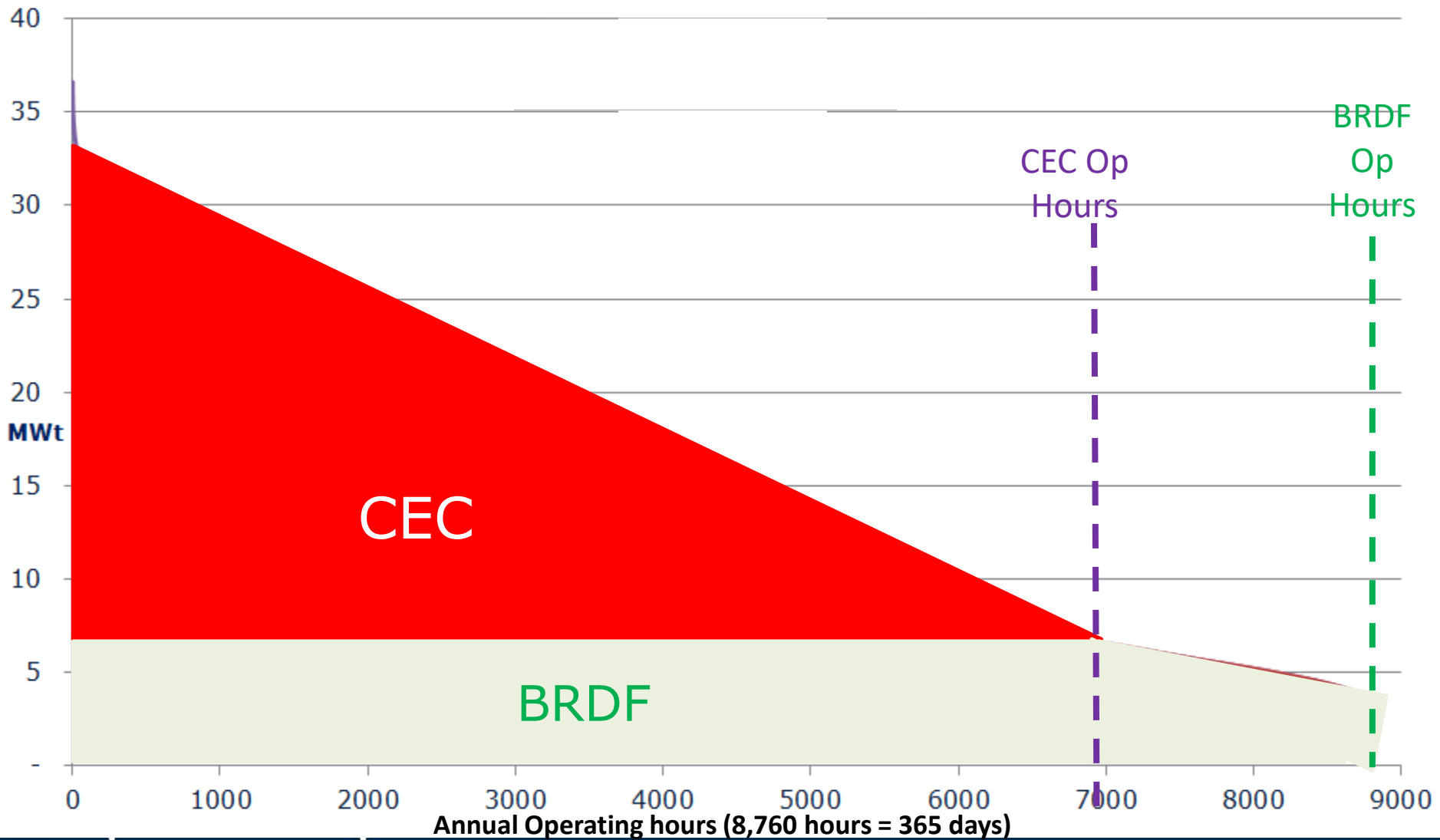


New Biomass Capacity

- New 12MW Biomass Hot Water Boiler at the BRDF
- Technology has yet to be determined
- Biomass will now produce ~67% of UBC total annual thermal district energy load requirements



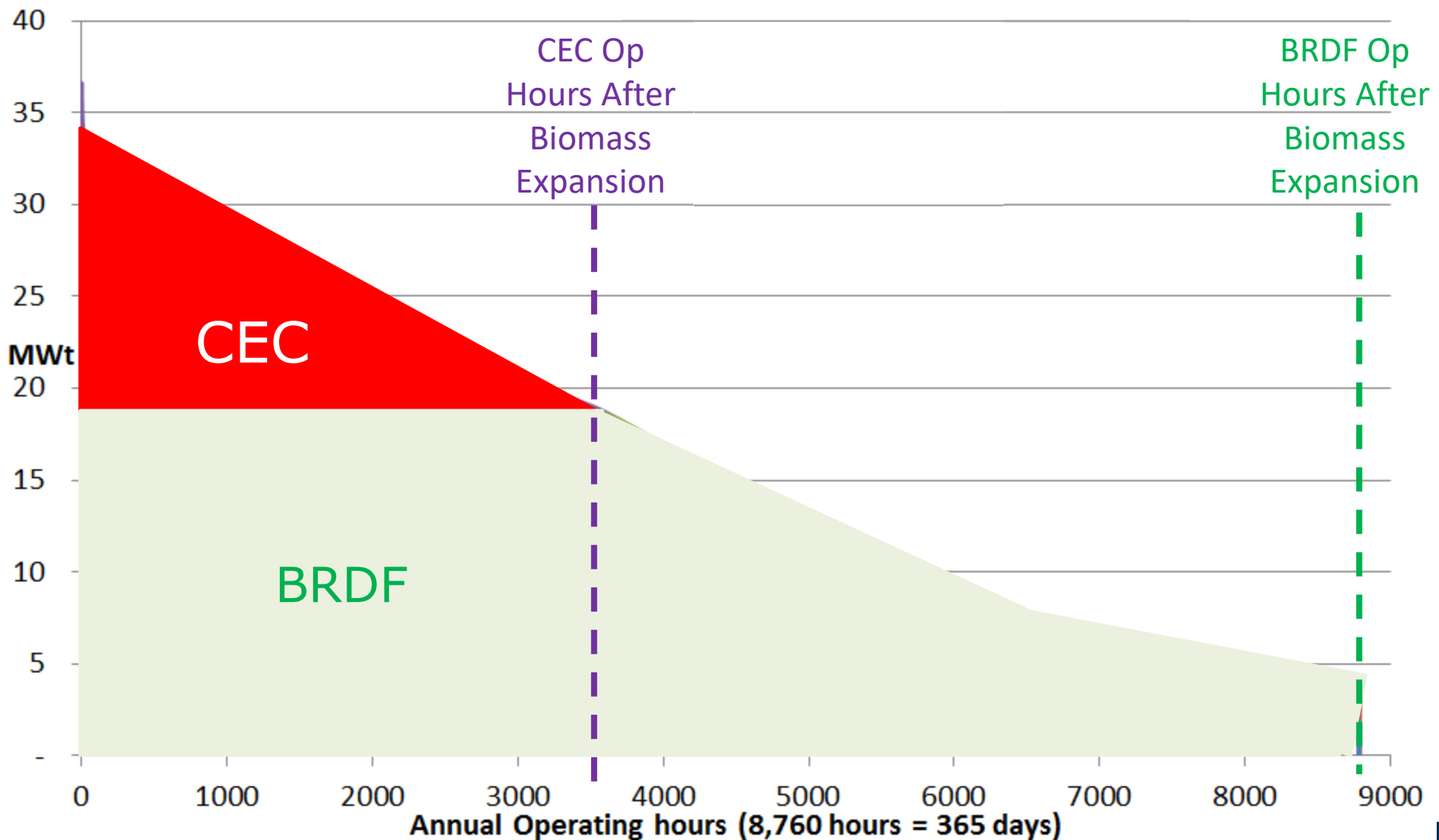
UBC Thermal Load Profile (Current)



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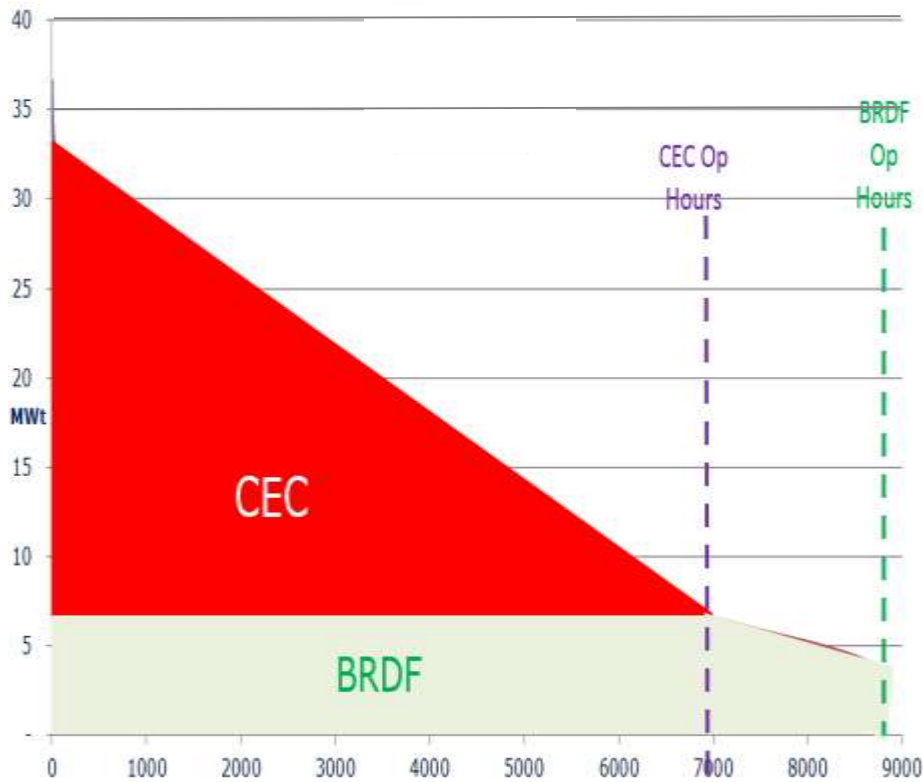
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UBC Thermal Load Profile with New Biomass Boiler

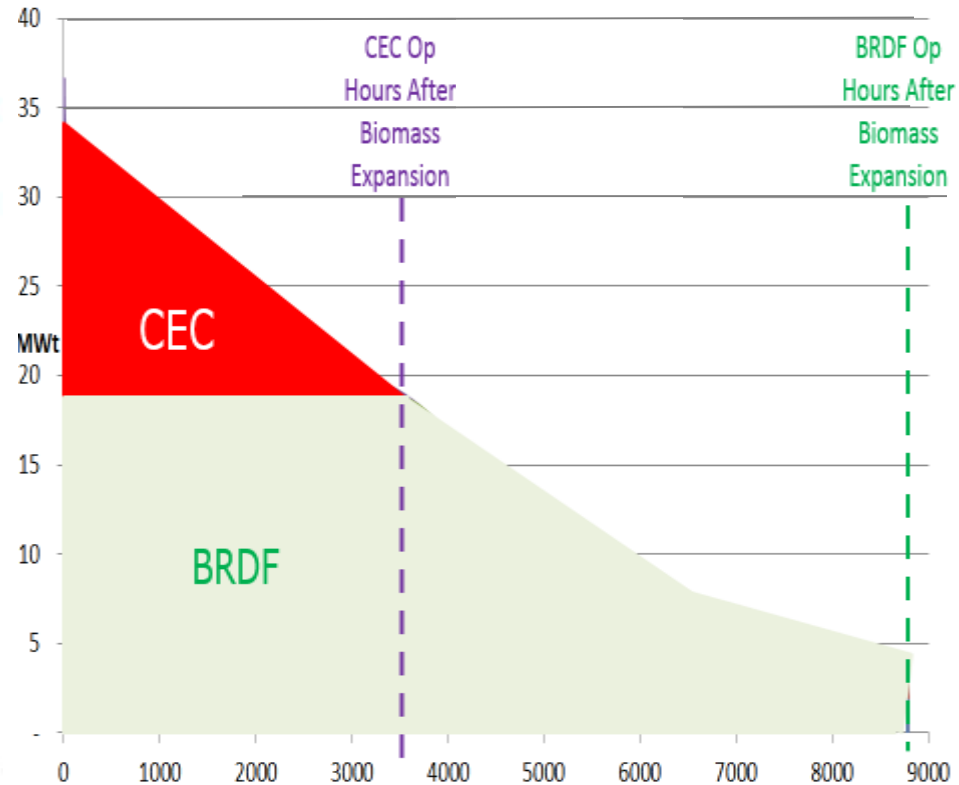


UBC Thermal Load Profile(s)

Current



After Biomass



Annual Operating hours (8,760 hours = 365 days)

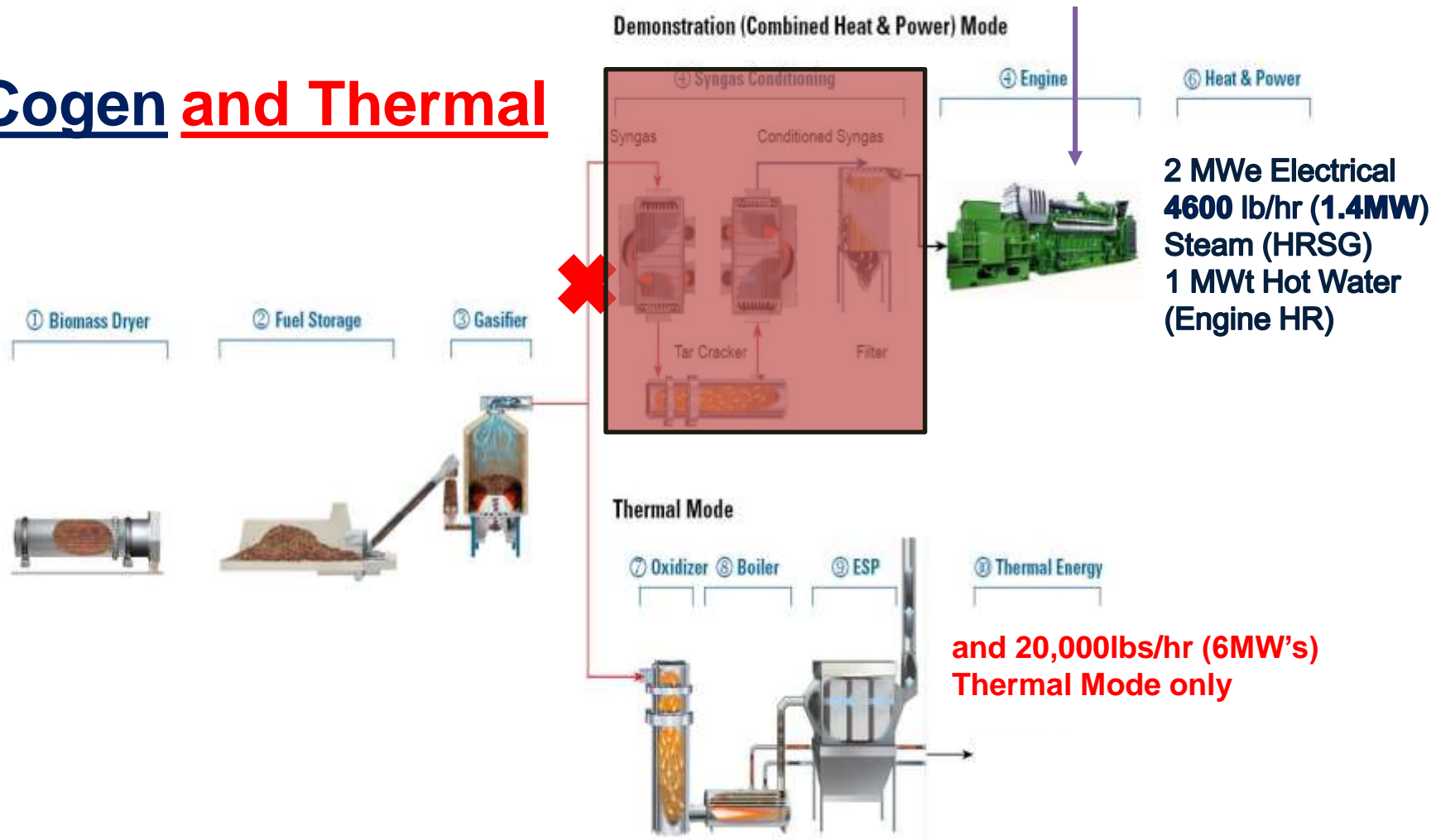


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New use for an old space

Cogen and Thermal



Original Mode vs Current Operation

Current Plant Layout:

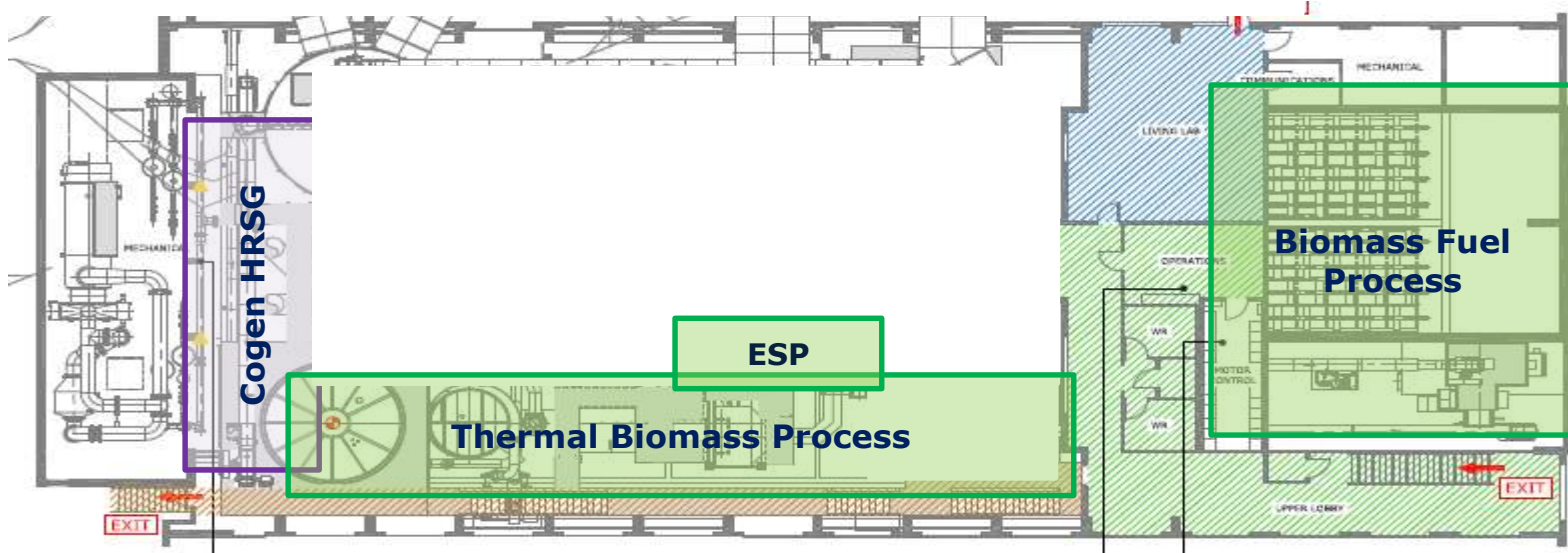


Where to site the new Boiler: Original Syngas Cleanup Equipment to be Removed

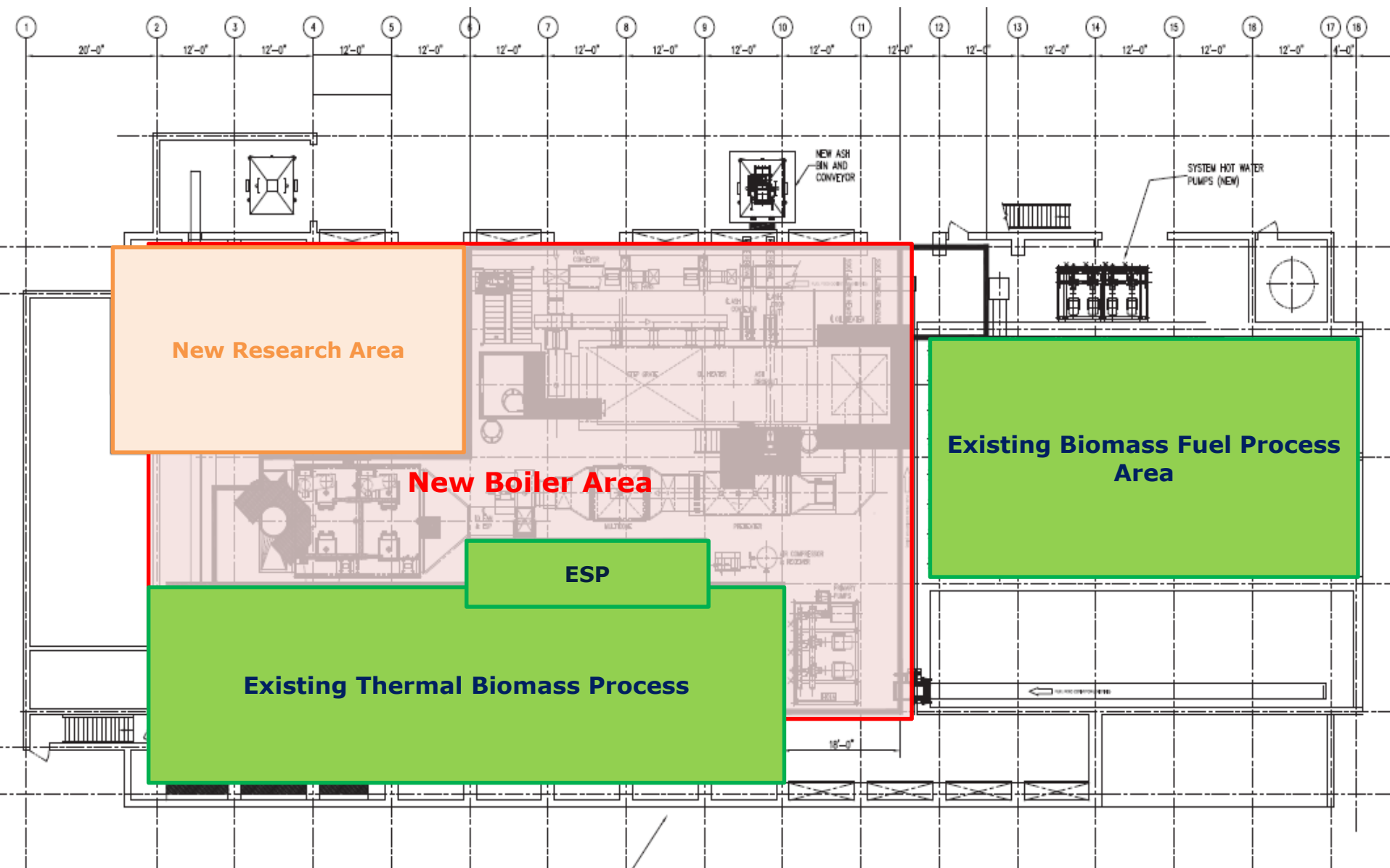
Plant Layout

Wood Silo and Syngas Clean up Process cleared out
Two remaining areas of operation:

- Biomass Thermal Process
- Cogeneration



Clean Site Layout to allow for new Biomass Expansion



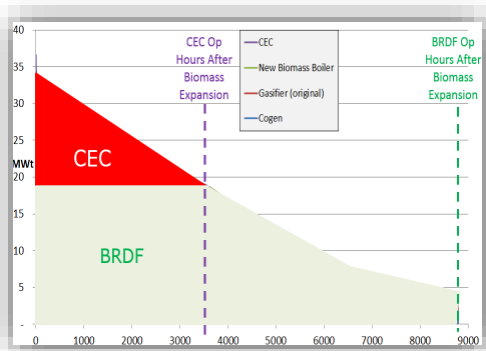
Repurposed Site: Contains the Original Thermal system, a new Research Area and the new Biomass Boiler

What are the Operational Impacts with Expanded Biomass

Increase from 2-3 to 2-9 trucks/day



4 annual shutdowns vs 2



CEC in Service from Nov-Mar only



Amended Air Emission Permit



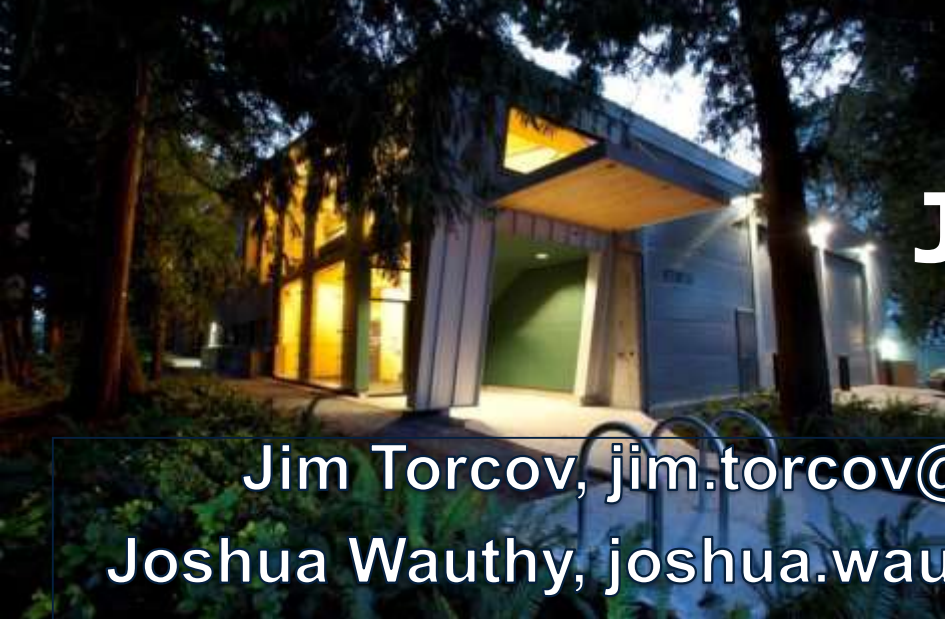
Conclusions

- Biomass expansion increases BRDF production to ~67% of all UBC district energy thermal requirements
- Biomass expansion matches UBC buildings & thermal load growth profiles. It enables n+1 thermal redundancy for next 10 years.
- Biomass Expansion allows UBC to meet its 2020 GHG targets
- Biomass commodity price stability, availability and diversity of fuel use beneficial
- Ability to repurpose space within current plant
- CEC will provide seasonal peaking thermal only (4.5 months per year)





Questions?



**Come visit us in
June at IDEA2018**

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