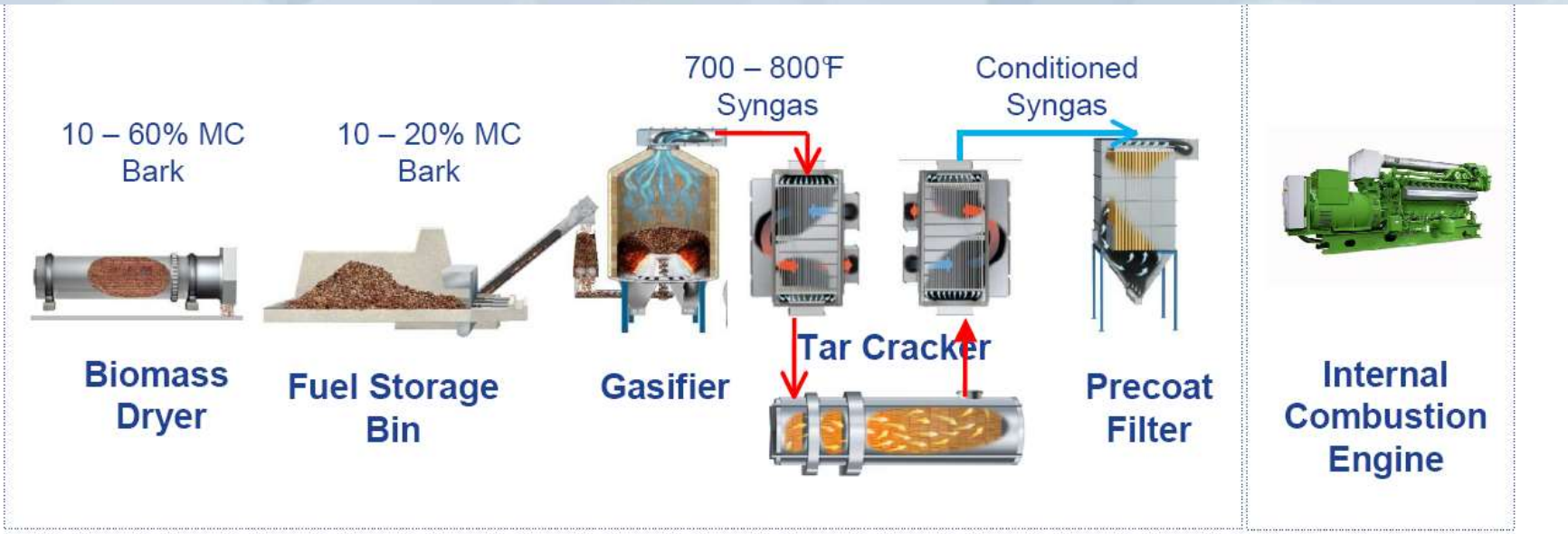
Bioenergy Research and Demonstration Facility

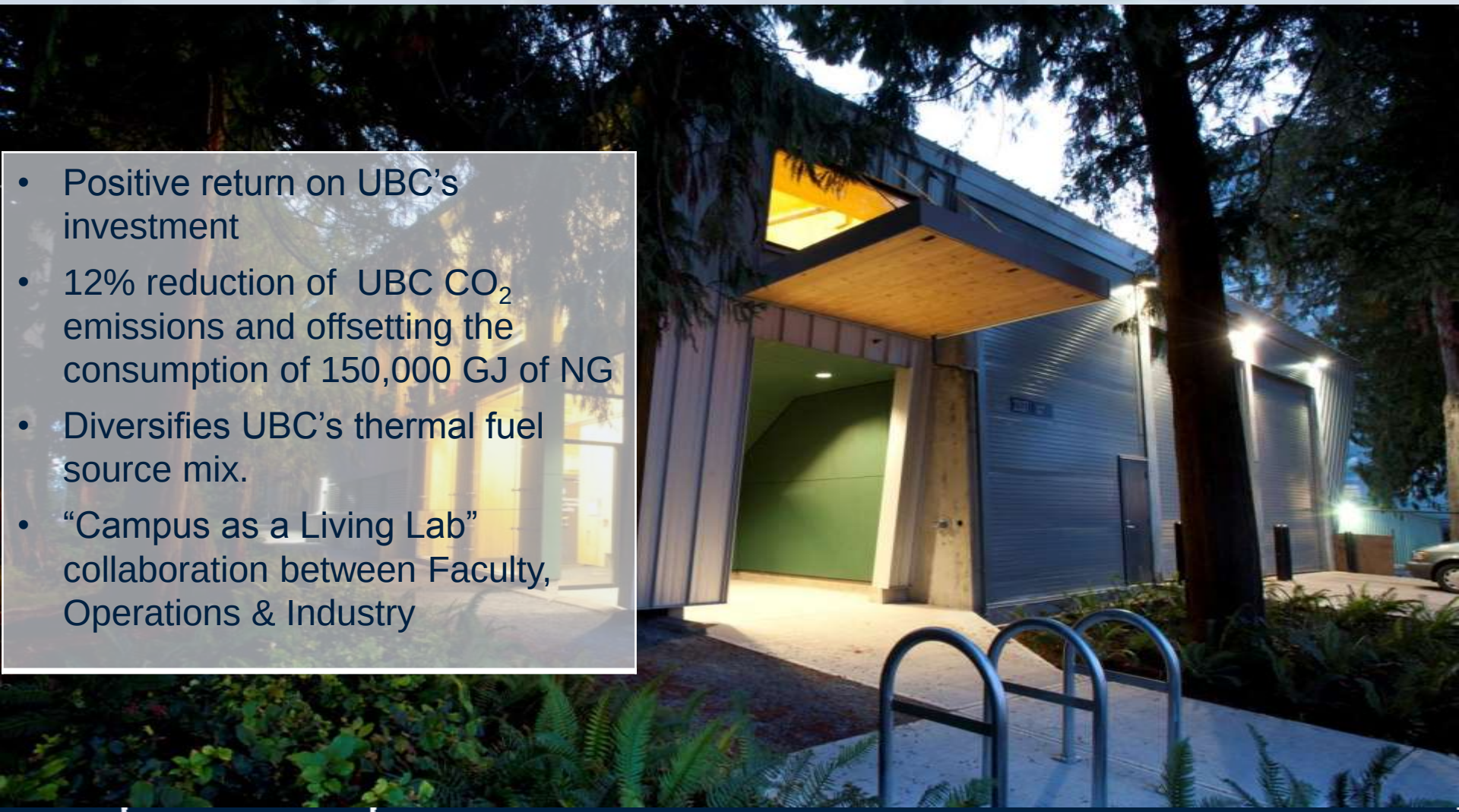
IDEA December 2015

What is the BRDF?



- 1st or it's kind Biomass cogeneration demonstration project using Nexterra syngas clean up technology
- Cogen Mode: 2.9 MW_t & $2MW_e$
- A social license demonstration
- A $27.4M multi-partnership project
- Building constructed from Canadian produced Cross Laminated Timber (CLT)

Why the BRDF makes sense



- Positive return on UBC's investment
- 12% reduction of UBC CO_2 emissions and offsetting the consumption of 150,000 GJ of NG
- Diversifies UBC's thermal fuel source mix.
- "Campus as a Living Lab" collaboration between Faculty, Operations & Industry

Who's Involved

UBC Operations, Faculty, Students, Researchers, with industry partnerships; Nexterra, General Electric, BCHydro and the local community UNA and SHUSH

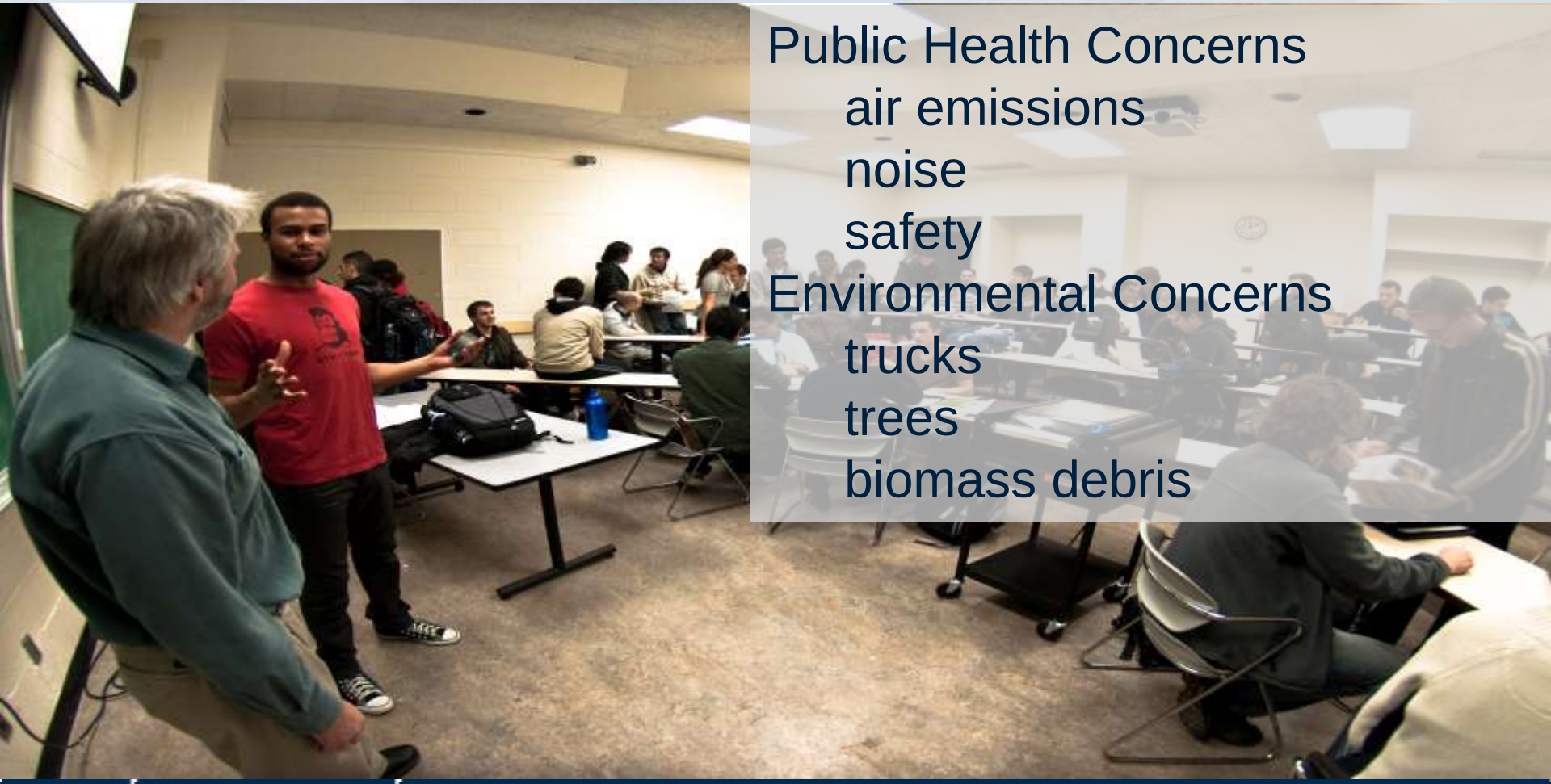
UBC project partners include:

- BC Bioenergy Network
- BC Ministry of Energy, Mines
- BC Ministry of Forests
- BC Hydro
- Ethanol BC
- City of Vancouver
- FP Innovations
- GE Energy
- Natural Resources Canada
- Nexterra Systems Corp.
- Sustainable Development Technology Canada

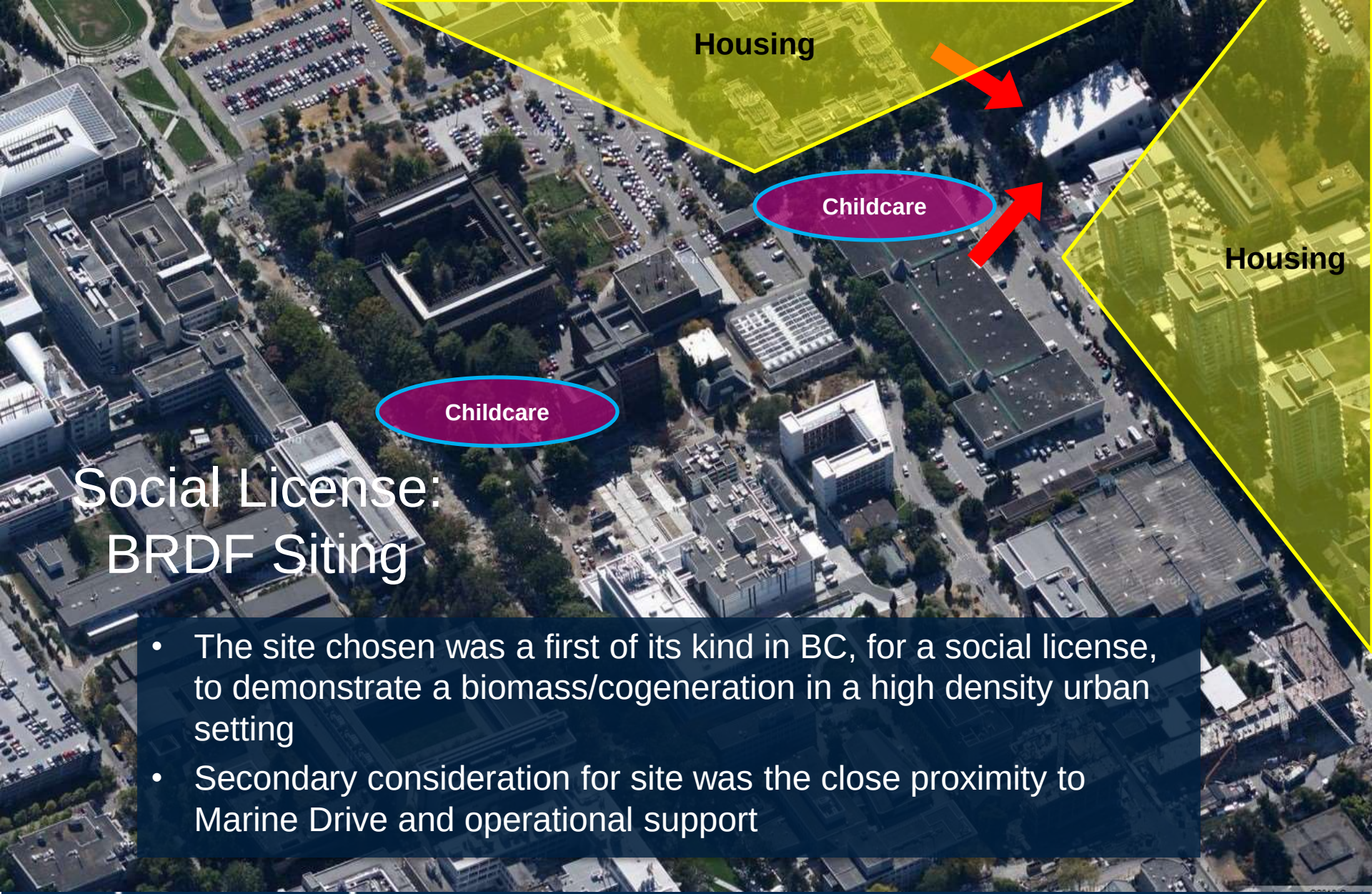
Project Roadmap

- Spring 2009 BRDF Concept devised
- Spring- Fall 2010 Public Engagement
- April 2010 UBC Board Approval
- Sept 2012 Grand Opening Ceremony

Public Engagement



- Public Health Concerns
  - air emissions
  - noise
  - safety
- Environmental Concerns
  - trucks
  - trees
  - biomass debris



Social License: BRDF Siting

- The site chosen was a first of its kind in BC, for a social license, to demonstrate a biomass/cogeneration in a high density urban setting
- Secondary consideration for site was the close proximity to Marine Drive and operational support

Above & beyond: Ambient Air Monitor

Air monitor

- Emission Dispersion Study showed Marine Tower 5 as the most likely residential building for air emission impact
- June 2012, UBC proactively installed a real time Ambient Air Monitor on Marine Tower 5

Biomass Plant

- Automatic emails alerts if air quality limits are exceeded
  - **24 hour average PM 2.5 < 25 µg/m^3 or**
  - **1 hour NO_2 < 107 ppb**
- **Air emissions remain well below Metro Van limits**

1st Year Successes:

- **Best in class air emissions** (well below permitted levels and on par with Natural Gas)
- **Noise Emissions below guidelines**
- **Public advisory committee**
- **1st LEED Gold facility made from locally sourced cross laminated timber frame construction**
- **100+ of tours**
- **Achieved 2 MW electrical production using syngas**
- **Strong engagement with faculty and students**

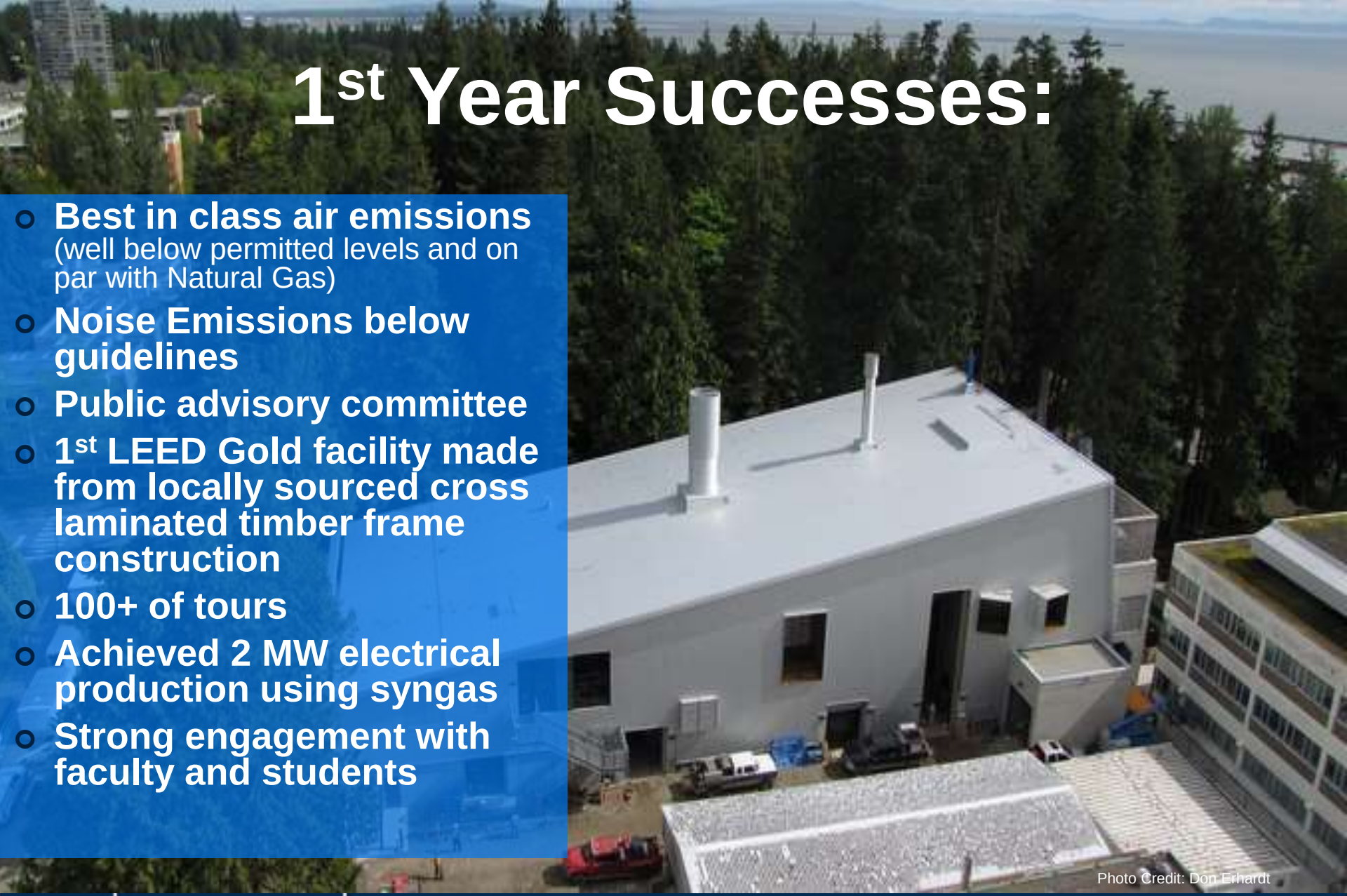
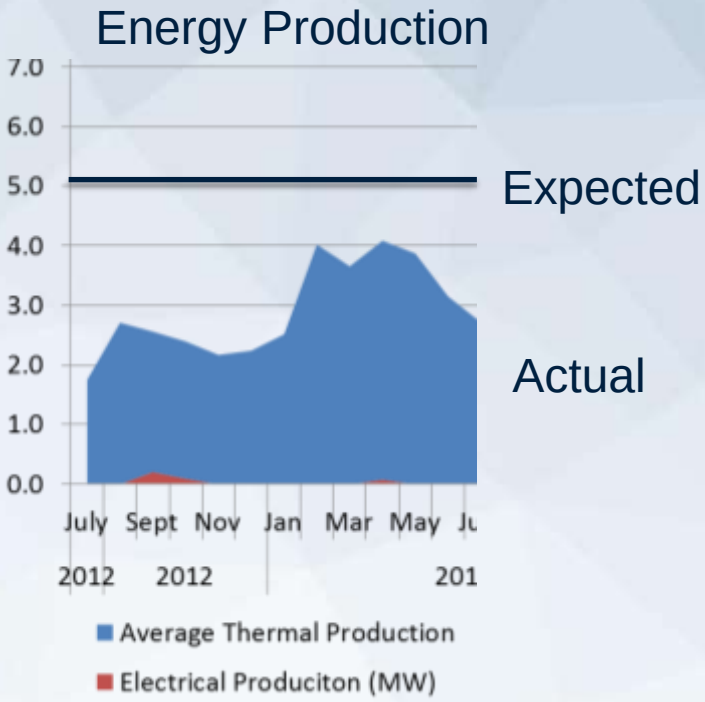
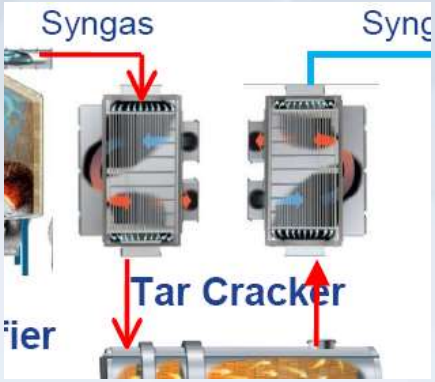


Photo Credit: Don Erhardt

1st Year Challenges



- Syngas clean up process equipment failures.



- Requires a higher fuel quality than expected (~30% MC)

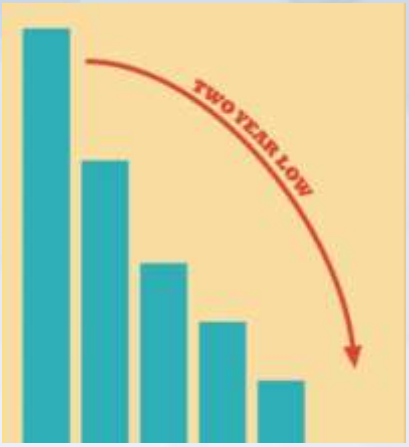
- Higher operational costs than expected e.g. people, maintenance and materials

2st Year Successes

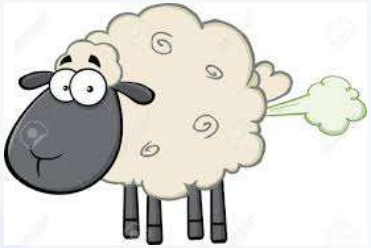
Improvements in energy production due to:

- Syngas Valve replacement
- Fuel quality improvements
- Boiler turn down at the old steam plant (powerhouse)
- Employee moral
- Leadership

2nd Year Challenges



- Lower then expect natural gas prices
- Electrical Peak demand
- Desire to make use of stranded assets with out compromising research or GHG objectives

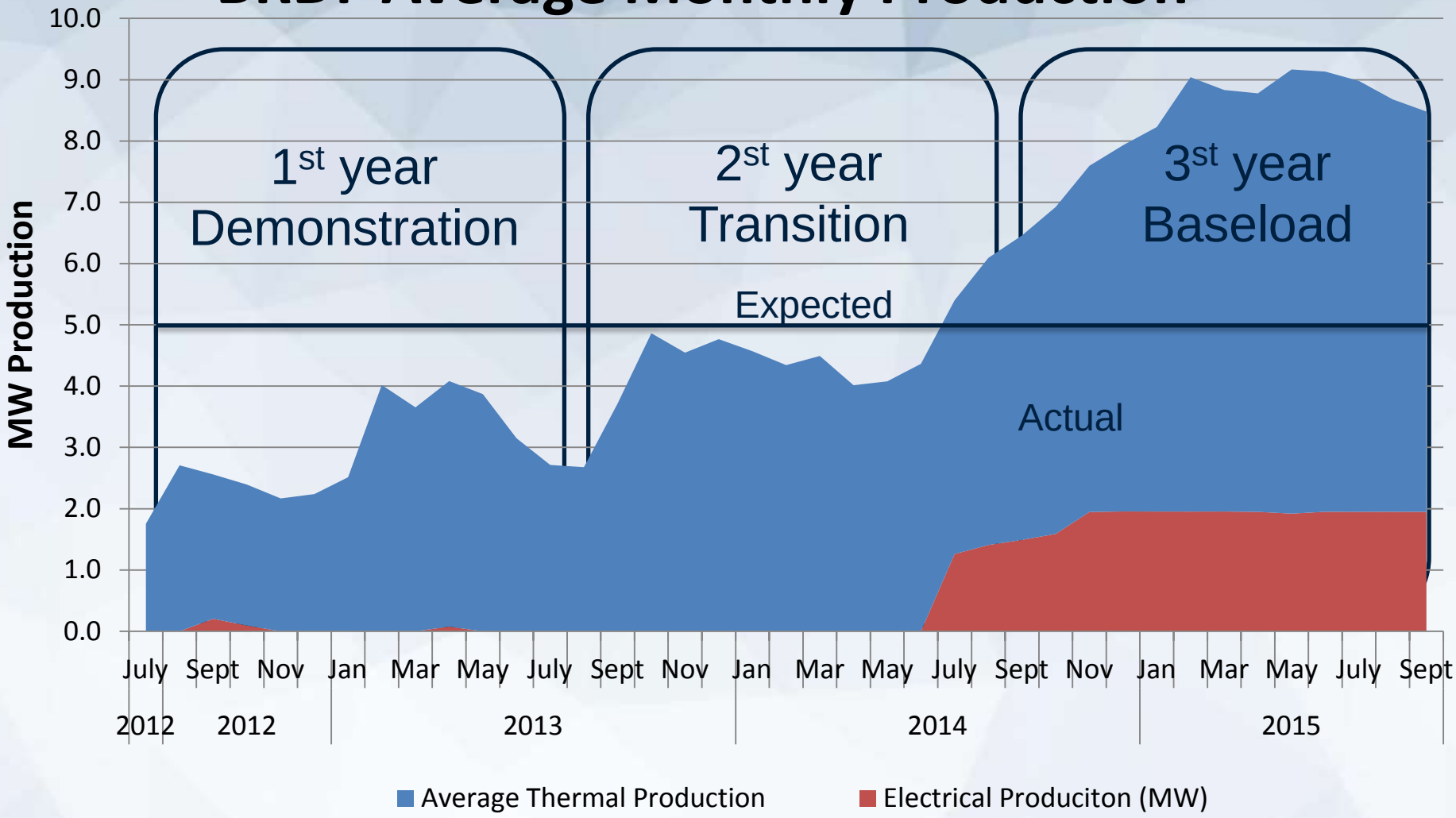


3rd Year Successes:

- Engine converted to allow ether Syngas or Natural Gas fuel
- Renewable Natural Gas used to offset electrical production
- Waste heat captured through HRSG and new hot water district energy system
- 7,000 LBS/hr back-up boiler added for redundancy

Photo Credit: Don Erhardt

BRDF Average Monthly Production



BRDF: INTANGIBLE BENEFITS

- Mitigates UBCV electricity capacity constraints
- Mitigated steam capacity constraint and avoided powerhouse boiler replacement cost.
- Enables transition from the existing powerhouse to the campus energy centre by providing the thermal summer base load of the campus (2015).

Thank you

Jeff Giffin - Energy Conservation Manager

James Torcov – Chief Engineer