2021 CANADIAN GREEN BUILDING AWARDS

UNIVERSITY OF VICTORIA DISTRICT ENERGY PLANT

A LEED® GOLD CERTIFIED PROJECT

MARCH 12, 2021

PART 1
PROJECT DESCRIPTION

Use for all categories. Projects are judged based on criteria of sustainable design, architectural merit and innovation.

2021
CANADIAN GREEN BUILDING AWARDS
THE NATIONAL PROGRAM OF SUSTAINABLE ARCHITECTURE & BUILDING MAGAZINE SABMag

Project categories

Identify which Award category you are entering

[ ] **1. Residential [small]**
Open to new or renovated buildings less than 600m² in area, of which a minimum of 75% is dedicated to single-family or multi-family residential uses.

[ ] **2. Residential [large]**
Open to new or renovated buildings [typically multi-unit buildings or groups of related buildings] greater than 600m² in area, of which at least 75% is dedicated to residential uses.

[ ] **3. Commercial/Industrial [small]**
Open to new or renovated buildings up to 2,000m² in area, of which more than 75% is dedicated to commercial or industrial uses.

[ ] **4. Commercial/industrial [large]**
Open to new or renovated buildings [or groups of related buildings] greater than 2,000m² in area, of which at least 75% of the floor area is dedicated to commercial or industrial uses.

[X] **5. Institutional [small]**
Open to new or renovated buildings up to 2,000m² in area, of which more than 75% is dedicated to institutional uses.

[ ] **6. Institutional [large]**
Open to new or renovated buildings [or groups of buildings] greater than 2,000m² in area, of which at least 75% of the floor area is dedicated to institutional uses.

[ ] **7. Mixed Use**
Open to new or renovated buildings [or groups of related buildings] of any size, in which no individual use exceeds 75% of the overall floor area.

[ ] **8. Existing Building Upgrade**
Open to buildings of any size or type in which the primary focus of the work has been to enhance the performance or extend the life of an existing structure. Entries in this category are required to respond only to the submission criteria appropriate to the project.

[ ] **9. Interior Design**
Open to interior design projects of any size or type. Entries in this category are required to respond only to the submission criteria appropriate to the project.

An award will be given in each category at the discretion of the jury.

PROJECT DETAILS

Project name: University of Victoria District Energy Plant

Address: 3800 Finnerty Road, Victoria, BC, V8W 2Y2

Year completed: 2019

PROGRAM AND CONTEXT

Project type: [Identify all uses occupying 10% or more of gross floor area]

Industrial - District Energy Plant

Project site: [Check all that apply]

- [ ] Previously undeveloped land
- [x] Urban
- [ ] Rural
- [x] Previously developed land
- [ ] Suburban

Other Building description: [Check only one]

- [x] New
- [ ] Renovation
- [ ] Both [If both, list __% new and __% renovation]

STATISTICS* Provide the following metrics as applicable to your project.

- Site Area: 2100 m^2
- Building gross floor area: 710 m^2
- Energy Intensity: 135 KWhr/m^2/year [Include both base building and process energy]

[optional: report energy intensity separately as follows:

  - Energy Intensity, base building: ________ KWhr/m^2/year
  - Energy Intensity, process energy: ________ KWhr/m^2/year

- Reduction in energy intensity: 72 %.
- State the reference standard on which the % reduction is based: MNECB, NECB or ASHRAE 90.1 [include version]: ASHRAE 90.1 2007
- Recycled materials content: 16 % by value
- Water consumption from municipal source: 40,970 litres/occupant/year [Include both base building and process consumption]
- Reduction in water consumption: 33 %
- State the reference on which the % reduction is based: LEED [x] or other [ ]
- Construction materials diverted from landfill: 95.8 %
- Regional materials by value: N/A %

***NOTE FOR PART 9 RESIDENTIAL PROJECTS: PROVIDE THE STATISTICS ABOVE IF AVAILABLE.** Include in the Executive Summary [see next page] the EnerGuide or the Home Energy Rating System [HERS] ratings if available, and the WalkScore rating [see www.walkscore.com]. Also, a qualitative assessment of project performance should be included in the appropriate sections of the narrative.

PROJECT SUMMARY

The new University of Victoria district energy plant (DEP) replaces and centralizes three outdated boilers and the supporting infrastructure, which were scattered across campus. It provides increased capacity to the campus heating system, and services 32 buildings. The plant has a full output potential of 27.5 MW of thermal heat – enough for 2,000 single-family homes. The plant and network provide 10% energy savings annually, and greenhouse gas (GHG) reductions of 6,500 tonnes / year.

The 710 m² post-disaster building employs leading-edge sustainable design and passive energy strategies, including using residual heat from the boilers to heat the space and boost natural ventilation when cooling is required. The extensive use of BC wood products promotes biophilia for both operations staff and visitors. Ultra-clean boilers are fitted with low nitrous oxide (NOx) burners to further reduce toxic particulate emissions created during combustion. The ability to connect additional buildings and switch to low-carbon fuels at a later date have effectively future proofed the plant.

Community education was a pivotal component of the project's design intent. Extensive glazing allows the public to easily view plant operations, while piping and equipment are colour-coded based on function; interpretive signage provides an overview of plant operations and digital dashboards offer real-time plant data. The DEP was designed to meet LEED® Gold certification standards and has since been certified to that level.

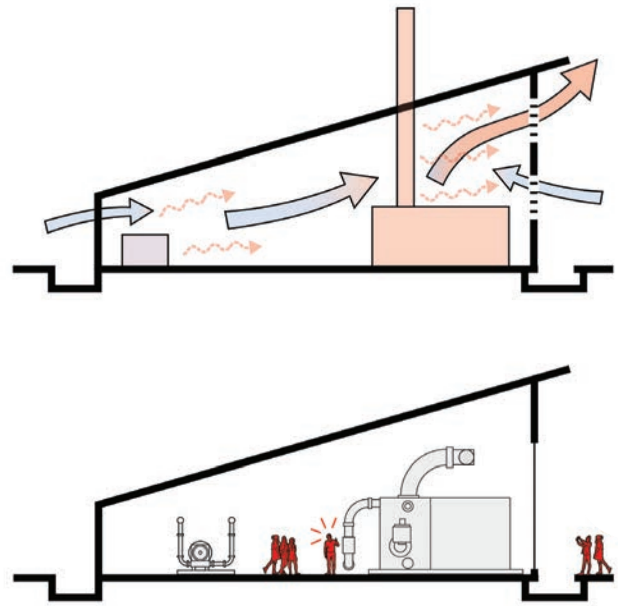
1. STRATEGIC DECISIONS

The DEP was built on an existing parking lot in the southwest corner of the campus, adjacent to a forest, publicly-accessible botanical gardens, and an interfaith chapel.

This site was selected for several reasons:

- it was identified as the most appropriate location in a new campus plan (which was completed by the design firm responsible for the DEP)
- it minimized the plant's impact on sensitive campus ecosystems
- there is adequate space for future expansion if the university decides to increase the DEP's capacity
- connections to nearby buildings not initially part of the district energy loop are easy to facilitate
- it is directly linked to municipal streets, which allows service vehicles to avoid circumnavigation of the campus ring road
- its proximity to facilities used by the community makes it possible for the university to showcase its infrastructure investments to the broader public

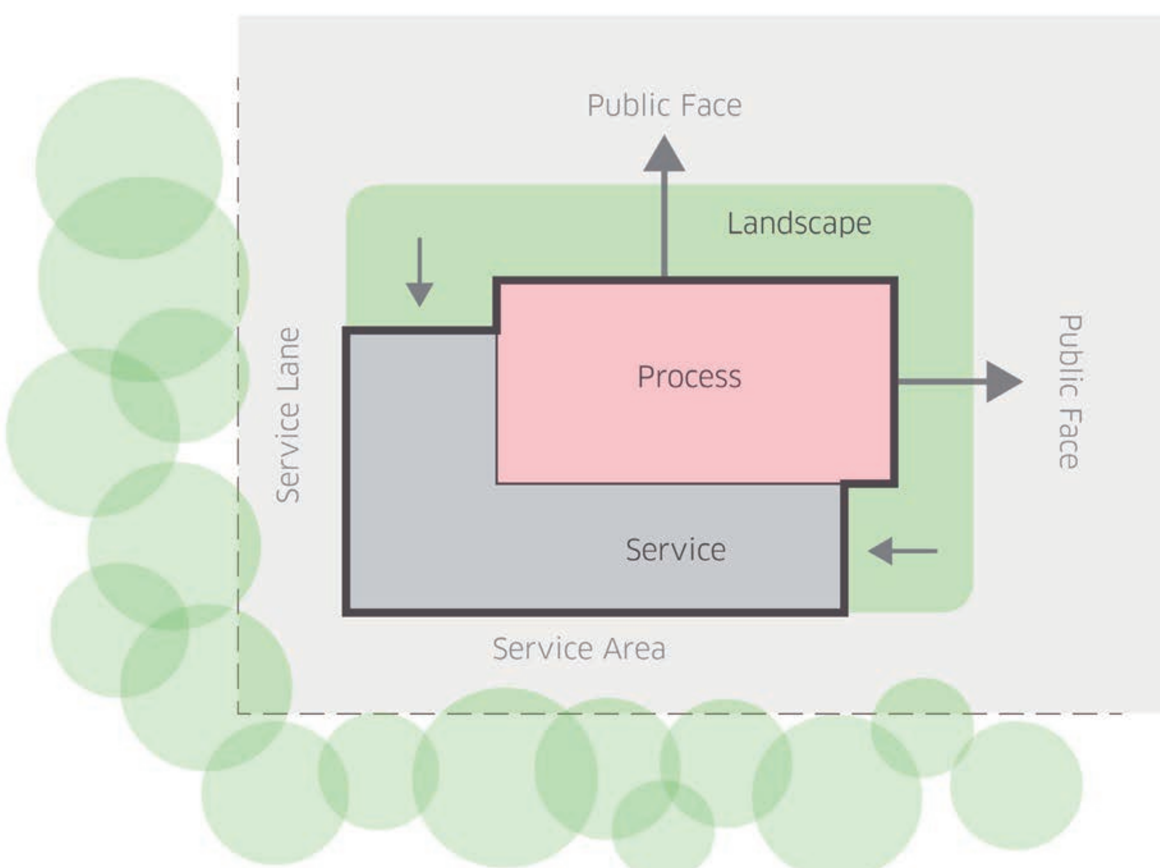
Massing for the building was driven by a combination of required equipment height clearances (which in turn enhance cross-ventilation and natural ventilation) and a desire to increase visibility of the plant's inner workings for the public.



TOP: *Recoverable heat will be used to enable natural ventilation.*

MIDDLE: *The plant's location, plus a strong educational component, will encourage people to visit and learn about its role on campus.*

BOTTOM: *The building has been laid out very intentionally on the site, in order to put its most engaging face forward to the public.*



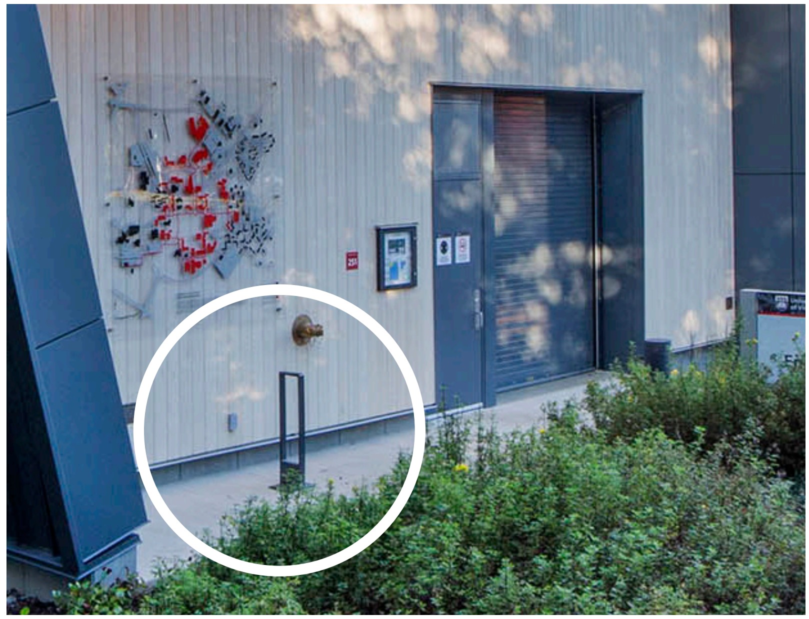
2. COMMUNITY

The DEP was built on an existing parking lot, consciously eliminating more than 30 stalls of parking as part of the University's strategy to favour pedestrian and cycling over car-oriented infrastructure.

It is also located near a transit stop, and the campus is well connected to public transportation.

The building includes an electric vehicle charger and stall that accommodates EVs from the new UVic operations fleet.

Bike racks and a shower were installed for operators who use the extensive bike infrastructure of the campus to cycle to work.



ABOVE: *A simple bicycle rack for the small operations team encourages them to commute to and from work, or use bicycles to access other parts of the DEP network on campus.*

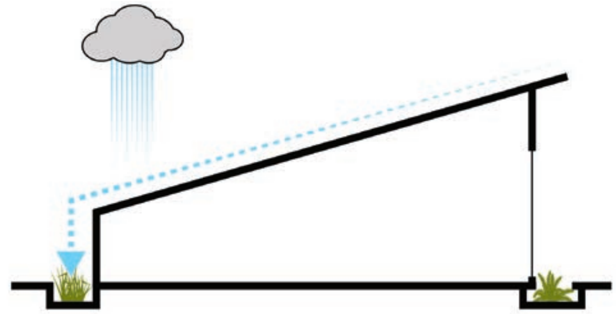
LEFT: *There is an en electric vehicle charging station on the west side of the DEP. It is intended to be used by University operations vehicles.*

3. SITE ECOLOGY

As the majority of the site area that was designated for the DEP previously existed as a parking lot, the landscape design efforts predominately focused on preserving and enhancing the adjacent forest and shrub ecosystems to the south and west of the building.

Major design elements included a bioswale for stormwater conveyance into an associated rain garden, new native plants and shrubs along the north and east facades, as well as three new birch trees near the east entrance.

The impact was a net increase in vegetated area that supports a variety of native plant and animal species. The University has a 3-to-1 tree replacement policy, and the project also planted 12 new native species trees in an ecosystem restoration site on another area of the campus beyond the site boundary.



TOP: *The roof was designed to direct rainwater into the bioswale on the south side of the building.*

INSET: *The bioswale on the south side of the DEP helps manage stormwater on site. New plantings will also fill in the space and promote connectivity to the adjacent forest.*

BOTTOM: *The rainfall garden, complete with signage explaining its significance and role in site ecology.*

4. LIGHT AND AIR

The main occupied space is the plant's control room, which is 100% daylit by operable windows that also provide a beautiful view of the forest to the shift engineers that are present 24 hours a day. All spaces are within 5m of these windows. The space undergoes 26.7 air changes / hour.

The main plant space has large north-facing glazing that allows views into the plant and brings in daylight, with a smaller curtain wall strip at the south.

Louvers along the sides of the plant have dampers that dynamically open and close to maximize natural ventilation of the spaces.

All lights are LED fixtures and work with daylight and occupancy sensors to achieve an overall projected consumption of 26.7 KWhr / m^2.

TOP: *South-facing windows in the operations control room provide access to natural light.*

MIDDLE: *The south side of the DEP has large windows to provide daylight to the facility.*

BOTTOM: *There is extensive glazing on the north facade, ensuring there is plenty of natural light entering the building.*

5. WELLNESS

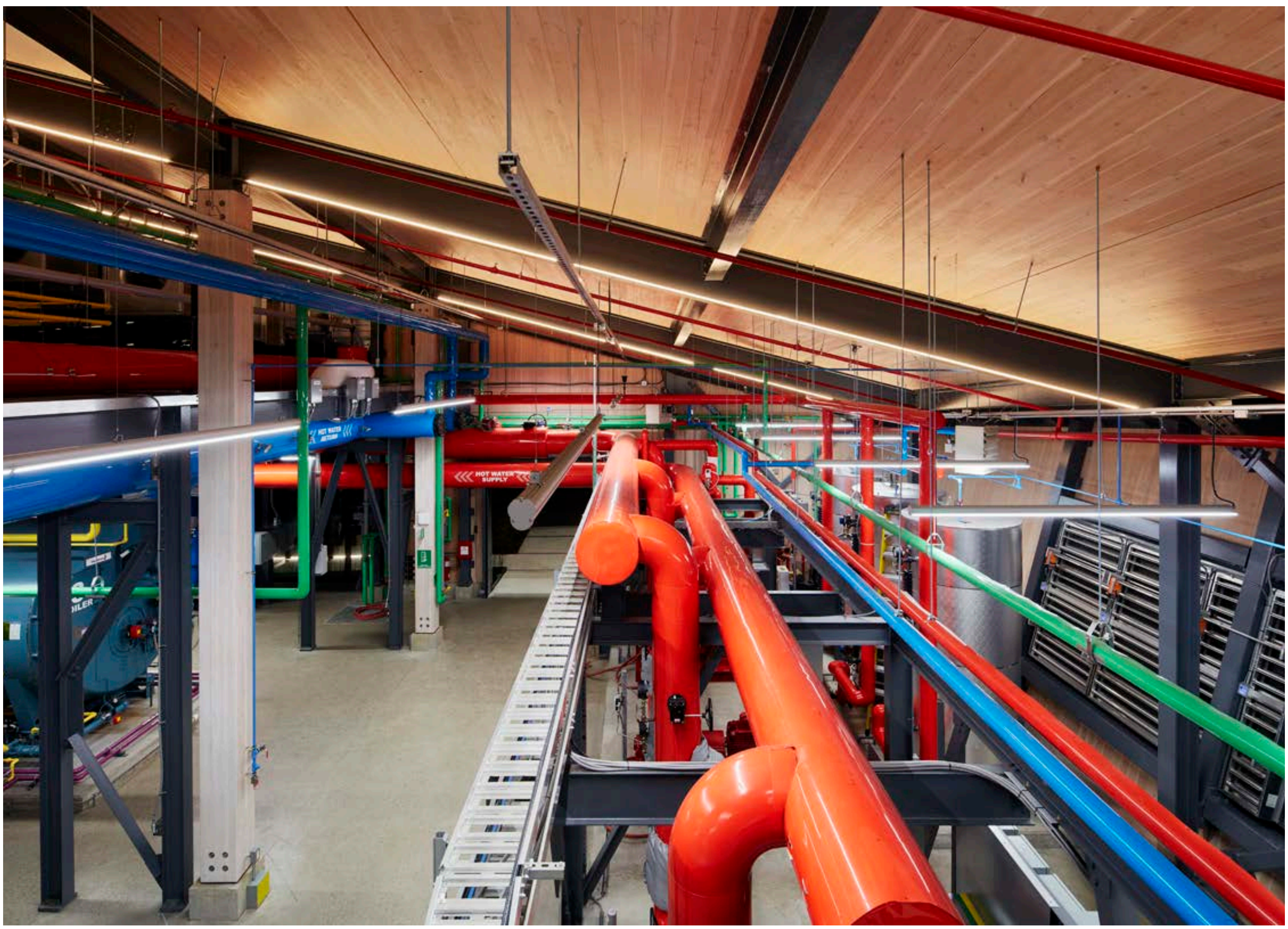
The new DEP provides a unique work experience for the UVic operations team, which positively contributes to workplace health and wellbeing.

The old heating plants were scattered across campus in dark, noisy, and cramped boiler rooms, whereas operations are now consolidated into one bright and open location.

Operators are able to work in a spacious, naturally daylit facility that has a warm, biophilic ambiance thanks to exposed cross-laminated timber panels throughout the plant.

They also have direct views towards the surrounding forest and landscaping from both the operations room and main plant space.

In terms of amenities, the operations team has direct access to covered bicycle parking, on-site showers, and personal lockers as well as a filtered drinking fountain.



TOP: *The operations room for the DEP is well situated in the plant, and has windows on three sides; windows on the south side face out to the forest behind the building.*

BOTTOM: *The CLT roof structure adds to the biophilic ambiance of the plant.*

6. WATER CONSERVATION

On the exterior of the DEP, water runoff from the roof and the surrounding landscape is conveyed into a newly established rain garden via a bioswale that runs behind the building.

During normal rainfall events, hydrophilic plants use the stormwater and release moisture back into the atmosphere through evapotranspiration. Water is held and filtered by the garden soil, and the remaining water infiltrates into the surrounding native sub-soil.

There is also a waterflow management strategy for heavy rainfall scenarios when the garden is saturated. Water is held in the upper tier of the garden until it builds up, then spills over a weir and flows into the garden's lower tier, where it is absorbed into the sub-soil. This system slows the entry of stormwater into the municipal system after a major rain event, when the system is under the most pressure.

Within the building, a 33% water use reduction was achieved through the deployment of low-flow fixtures (compared to a baseline reference building as per LEED 2009).

Projected potable water consumption for this facility is 19.23L / m^2 per occupant per year.

TOP: *One of the educational signs on site, explaining the water conservation benefits associated with the rain garden.*

BOTTOM: *The rain garden, located on the west side of the DEP, adds to the natural beauty of the site while also serving as an important resource conservation measure.*

7. ENERGY, PRESENT AND FUTURE

This new DEP provides a number of operational and environmental benefits over the previous heating system.

The plant itself is considerably more efficient than similar building types. The project team calculated a baseline EUI for this building typology at 376 kWh / m². Anticipated EUI for the new DEP is 135 kWh / m², representing a 64% reduction.

The strategy for energy efficiency for this unique building typology started with organizing the height clearance of all equipment to create a building form that slants from the northeast towards the southwest.

There are intake louvers placed low on the north and east facades and exhaust louver bands at the highest points of the south and west elevations.

The boilers, equipment, and piping create significant residual heat inside the building, and the design utilizes this heat to promote natural ventilation that eliminates the need for cooling or mechanical fan use.

Wall assemblies and glazing are designed to have a high performance value that is appropriate for the milder Victoria weather and the challenge of having to eliminate heat from the inside the plant.

The district energy system as a whole will result in an overall reduction in energy use by the University of approximately 10%, thanks to efficiencies created by consolidating heating facilities, improved equipment and infrastructure, and reduced losses in the system.

The high-efficiency burners in the plant are expected to result in a 6,500-tonne reduction in GHG produced each year.

There are also future opportunities for the DEP to be retrofitted as a low-carbon fuel plant through the use of electric boilers or expanding the plant to accommodate biomass fuel, which would further reduce GHG emissions.

TOP: *Intake louvers are visible on the north facade of the plant. The three stacks are tied to the three boilers inside.*

BOTTOM: *Additional exhaust louvers just below the roofline on the east facade of the building.*

8. MATERIALS AND RESOURCES

The main structural material of the building is mass timber. This includes cross laminated timber (CLT) roof and wall panels, and glulam columns.

As this is a post-disaster building, additional steel structure was added for lateral forces associated with the high seismic zone in Victoria.

Most facilities of this type would be constructed entirely out of steel or concrete, and utilizing so much wood in the structure was a key factor in reducing the embodied energy of the building.

Additionally, the mass timber elements are left exposed inside, providing a warm and comfortable environment for the operations team.

A higher-quality metal standing seam roof was chosen to provide extended durability and moisture performance.

The building also utilized 16% recycled materials; 95.8% of waste materials were recycled during construction

TOP: *CLT roof and wall structures have been left exposed, as are glulam columns and steel supports through the structure.*

BOTTOM: *CLT walls add to the aesthetic appeal and biophilic ambiance of the plant for both the operations team and visitors.*

9. BUILDING LIFE CYCLE CONSIDERATIONS

In addition to the mass timber structure being selected to reduce greenhouse gas emissions associated with the embodied energy of the building, the structure is also designed to post-disaster standards.

As this building houses a key piece of campus infrastructure, it has been designed to last at least 50 years and survive a major seismic event.

The building configuration and siting allows for future expansion and interconnection to a future low-carbon extension, as well as also enabling a conversion to electric boilers.

ABOVE: *Glulam columns, CLT panelling, and extensive structural steel bracing ensure that this post-disaster facility will survive a major seismic event, and last for at least 50 years.*

10. EDUCATION AND INFORMATION SHARING

One of the most innovative aspects of the DEP is the educational component of the project. It was a priority for the university to showcase its investment in sustainable infrastructure while also educating students and the broader public about energy usage on campus.

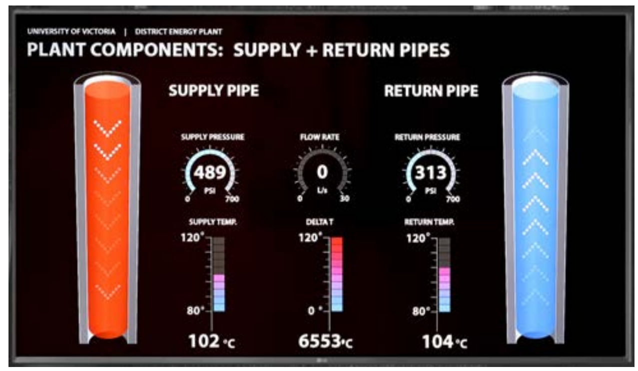
The design team has been able to deliver a unique set of strategies to respond to this mandate.

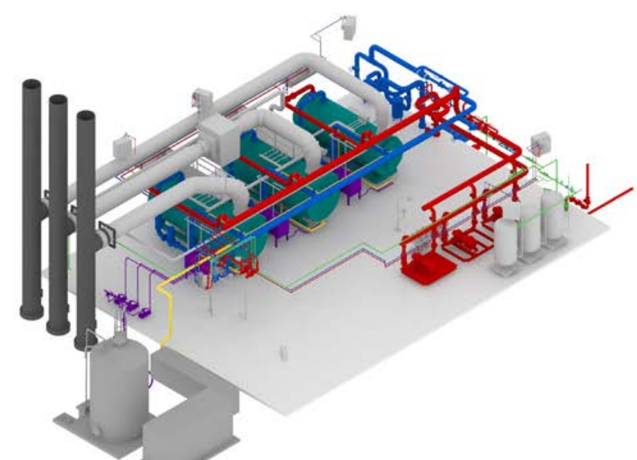
This started with the architectural concept – a glazed box that is open on the north and east sides to allow people to look inside.

From there, eight signboards around the exterior of the building, as well as several more inside, provide explanations of the equipment in the plant, as well as the process for converting raw fuel into heat for campus buildings.

Colour-coded pipe jacketing and custom labels make it easy for visitors to understand the function of the network of pipes.

Two digital dashboards (one outside, one inside) offer real-time visual representations of plant operations, including the amount of energy being produced.





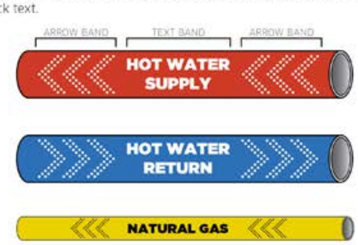
PIPE JACKETING CONCEPT

PIPE JACKET INTENT, DESIGN AND CONTENT

	ITEM / LOCATION	MATERIAL	FINISH/COLOUR: BASE
PAINTED PIPE	Natural Gas	Painted Metal	RAL 1018
	Fuel Oil Piping	Painted Metal	RAL 4008
	Fire Protection Water	Painted Metal	RAL 3031
	Sprinkler Lines	Painted Metal	RAL 3031
INSULATED PIPE JACKETING	DE Hot Water: Supply	PVC Jacket	RAL 3028
	DE Hot Water: Return	PVC Jacket	RAL 5005
	DE Hot Water: Decoupler	PVC Jacket	RAL 9003
	Domestic Hot Water: Supply + Recirc	PVC Jacket	RAL 3017
	Domestic Cold Water + Make-up	PVC Jacket	RAL 6037

PIPE LABELS

A variety of labels will be used on pipes to explain the material they transport and the flow directoin. Some will be used for safety while others are designed to emphasize the educational value of the plant. The labels are designed as transparant stick-on bands with white or black text.



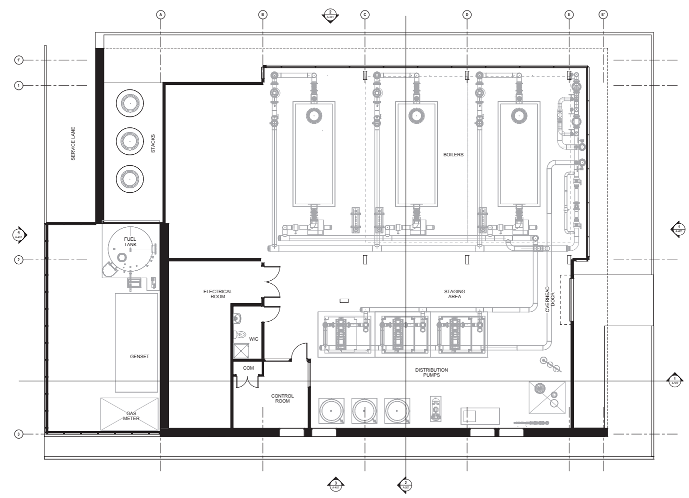
TOP LEFT: *Brightly coloured pipe jacketing shows visitors to the plant exactly what each piece of the puzzle is responsible for, and how it fits into the overall plant operations.*

TOP RIGHT: *This digital signboard provides visitors with real-time data on plant operations and energy being produced.*

BOTTOM LEFT & RIGHT: *The graphic shows how the pipe jacketing ties in with the plant layout; this information is explained in detail on various signboards around the facility.*

SUPPLEMENTAL IMAGES



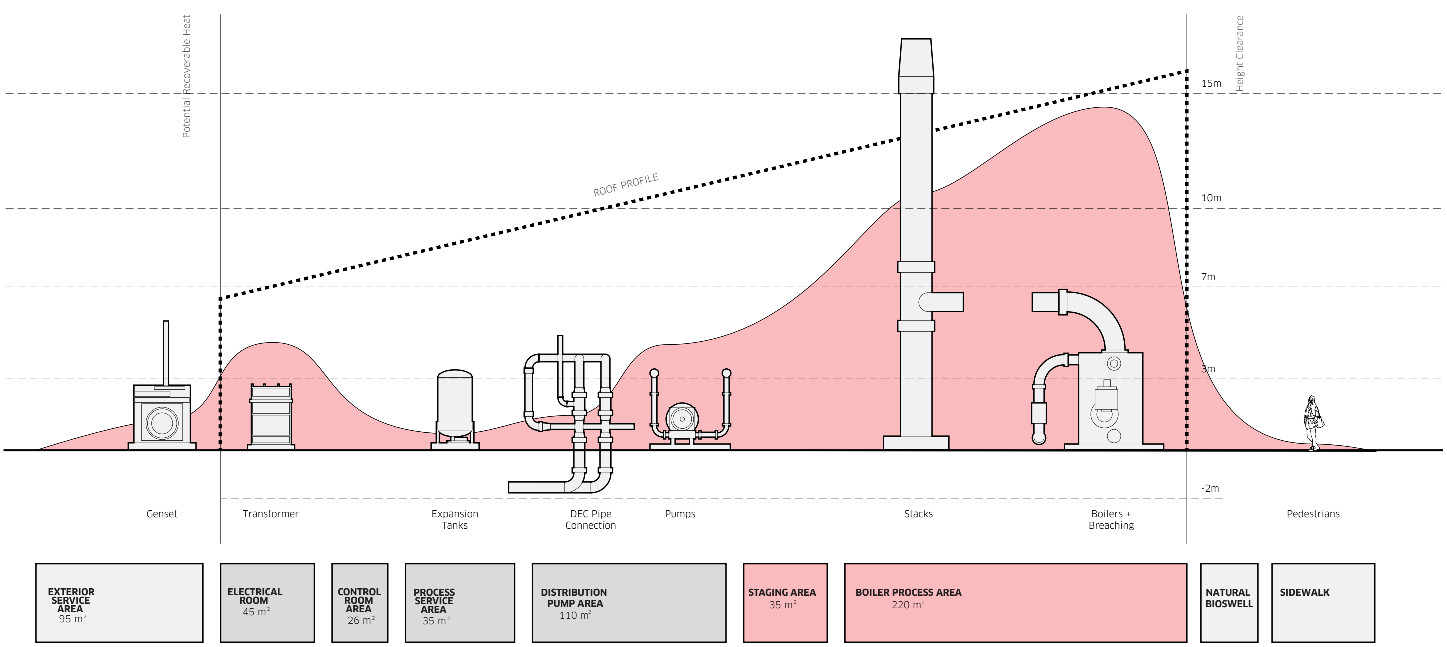


TOP THREE: *Rendering showing the three main views of the building, as well as illustrating the slope of the roof structure.*

MIDDLE LEFT: *Visitors look at a map showing the buildings serviced by the DEP.*

MIDDLE RIGHT: *Drawing showing the floorplan of the plant.*

BOTTOM: *Diagram showing potential removeable heat graphed against the height of the building.*



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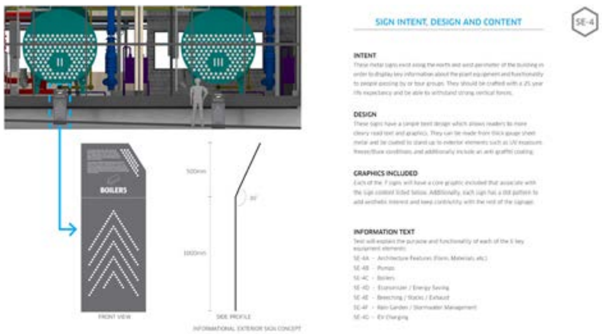
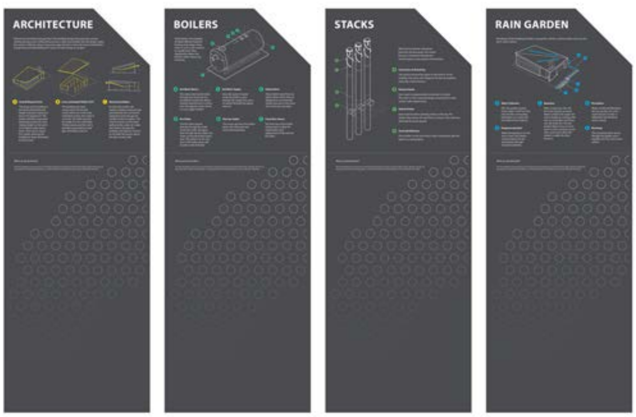
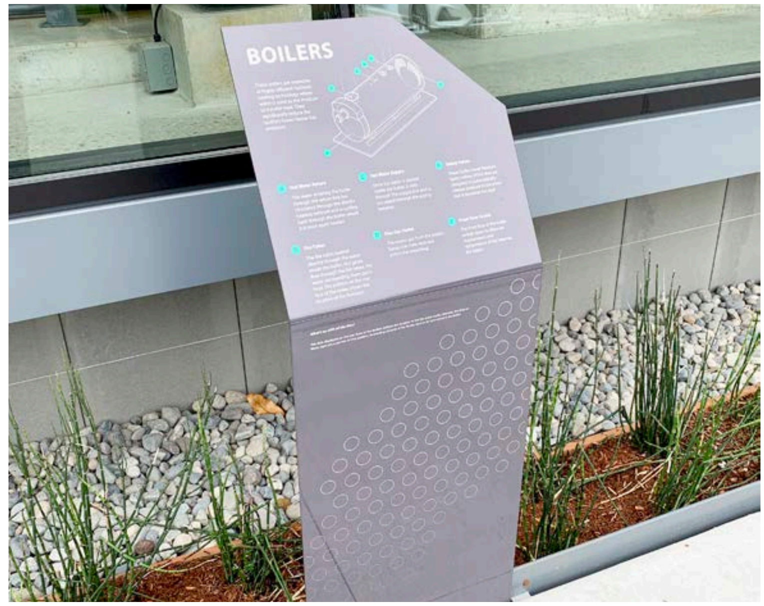






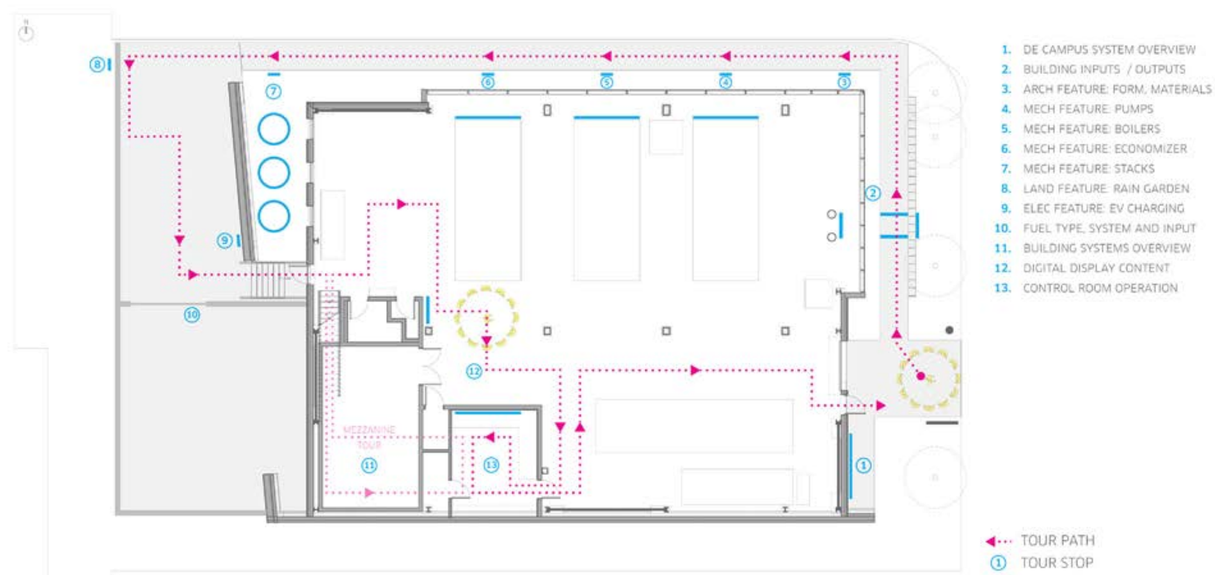
TOP LEFT: *Explanation of the intent of educational signage.*

TOP RIGHT: *Example of signage in place on site.*

MIDDLE LEFT: *Graphics showing the colouring for selected signs.*

MIDDLE RIGHT: *Additional outdoor bench signage that is also part of the DEP educational initiative.*

BOTTOM: *Routing for educational tours of the plant, as well as locations for signage both inside and outside the plant.*




HOT WATER
RETURN