**Background**

**Client:** The Scottsville Group  
**Building:** Car dealership and repair shop  
**TFA:** 1,500m² (16,000 ft²)  
**Location:** Red Deer, Alberta  
**Design Temp:** -29°C (-20°F)

**Scott Subaru**  
PH aligns with Subaru environmental strategy  
Inspired by Subaru’s zero-landfill factory in the U.S.  
Owner saw PH as a better way - Legacy project  
Virtually no cost to heat and cool the building  
“Important statement to the industry and the country [flowing from the land of oil and gas]”  
– Garrett Scott

**Cold Climate Overview**

**Cold temperatures**  
Every decision matters more  
Airtightness has huge impact  
Frost protection, (low) humidity become problematic  
Design temps influence functionality of equipment

**Product Availability**  
No local manufacturer of cold climate products  
Very few on EU market - Some won’t export

**Design**  
We walked a fine line to meet the targets
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Building Design
- 2 storeys
- Corporate image guidelines
- Compact Form

Southwest Facade
- Highly glazed front façade
- Two different occupancies

Ground Floor
- Showroom
- Circulation/Reception
- Sales/Office
- Service
- Dropoff Area

Second Floor
- Double Height
- Circulation/Reception
- Sales/Office
- Service/Dialogue Hall

Assemblies
- Roof U value: 0.08
- Wall U Value: 0.05
- U Value: 0.13
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West Glazing

Highly glazed, no permitted overhangs
50% more West radiation than Germany
Low amount natural shading
Trees reduced SHG too much
Too windy and tall for external blinds
Electrochromatic Glazing too expensive

West Glazing Shading Solution

Automated operable internal blinds (with manual override)
Insulated Spandrel panels in top row
Deal with additional peak cooling load

Windows

Comfort Requirement: $U_{w,\text{installed}} \leq 0.61 \text{ W/m}^2\text{K} (0.11 \text{ BTU})$

Only one certified cold climate window available
No certified cold climate curtain wall
Relied on window heating
Wicona series
- C/W: Wicline 50HI
- Windows: WL/WS 75 Evo
- Doors: Wicline 95
Internal Heat Gains

Estimated Equipment Usage early: 55% of IHGs in Shop
Repair Shop and Dropoff: 18°C, Showroom: 20°C (68°F)
Some losses between different zones
Cars brought in warm and cold → Heat flows balance out
Cars engines produce 14% of IHGs

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<th>Quantity</th>
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Ventilation Systems and Heat recovery

Direct vent car exhaust system required: (400 CFM/service bay x 6 bays)
Convinced engineer to run each bay on separate fan
No viable options for heat recovery from exhaust
Considered earth tube or ground loop
2400 CFM – large capacity would be required
Average ground temperature = 4°C (39°F)
**Heating & Cooling**

VRF system
Heads suspended ceiling, ducted to each room
Considered residential model
Concern over longevity
Does not operate at winter design temperature
Requires electric backup

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**Heating System Capacity**

**Heating**
3x more than conservative estimate of heating load (no gains)

**Cooling**
West facing glazing problematic

**Method** | **Heating Load (kW)**
--- | ---
PHPP | 13
PHPP w/o gains | 21
Engineer | 64

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**Element** | **PHPP** | **Peak Day - Reasonable gains** | **Peak Day - worst gains** | **Peak 3 hours - worst gains**
--- | --- | --- | --- | ---
Solar radiation - West (W/m²) | 235 | 235 | 235 | 909
Interior shading % | 60% | 60% | 100% | 100%
Net IHGs | 1911 | 4859 | 9215 | 9215

**Peak Cooling Load (kW)**
10.7 | 15.4 | 24.3 | 52.3

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**DHW**

**Showroom**
Low demand – handwashing
Supplied by Sanden CO2 heat pump

**Repair Shop**
Each car is washed after maintenance work
2020 L/day @ 60°C equiv. (530 gal/day @ 140°F)
On-demand gas heater was only option
Large PER impact
34 kWh/m²/yr (11 kBTU/ft²/yr)

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**DHW heat recovery**

Car wash load was good candidate for heat recovery
High volume
High temperature (76°C)
Frequent use

**Initially identified horizontal shower-type unit**
Company stopped manufacturing (trade issues)
Was willing to create custom unit, but eventually abandoned it
Settled on vertical unit installed horizontally 10 ft long
Summary

Cold Climates demand everything you’ve got
  Simplified approach is critical
  Find engineers who are willing to explore options
  Cold climate product innovation required

Think through the details early
  Estimate equipment & occupant loads
  Identify all energy flows
  Not everything is predictable → add some buffer

If you like a challenge, design a Passive House car dealership in a cold climate

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