

Manitoba Energy Code for Buildings

Part 8 – Building Energy Performance Compliance Path

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Manitoba Energy Code for Buildings (MECB) Training Day



Overview

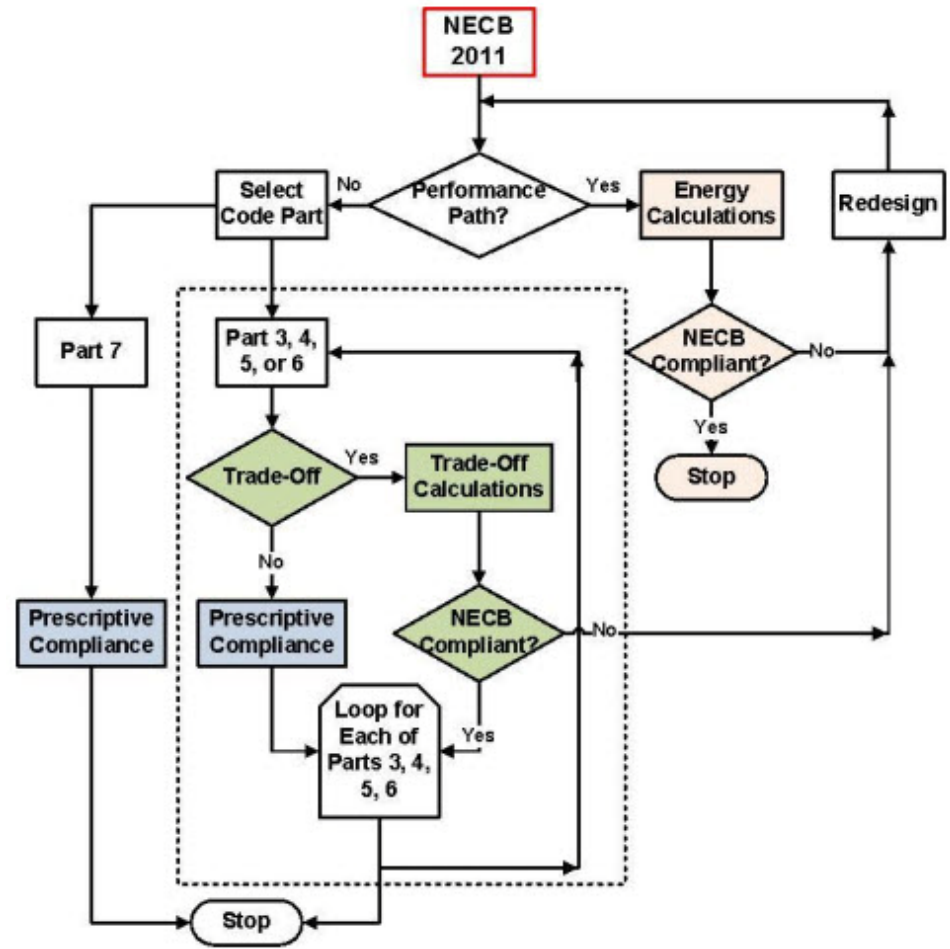
- Scope, application, and limitations
- Calculation method
- Calculation rules
 - General
 - Building envelope (Part 3)
 - Lighting (Part 4)
 - Heating, ventilating, air conditioning (Part 5) and service water heating (Part 6)
- Modeling resources
- Summary

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Scope

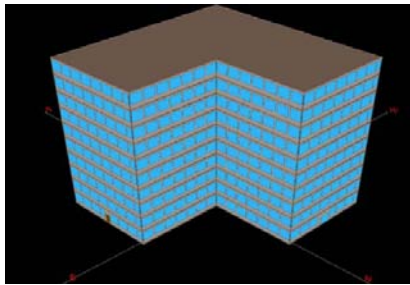
Part 8 provides an alternative to using the **Prescriptive** and **Trade-off Paths** requirements of NECB Parts 3 to 7.



Scope

Whole building approach

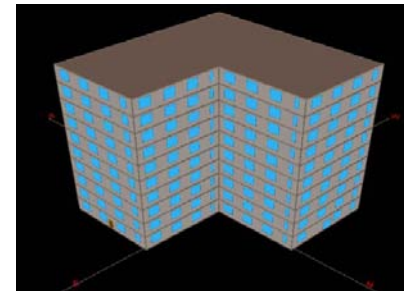
Compliance is based on the annual energy consumption



Proposed

“Annual Energy Consumption”

≤



Reference

“Building Energy Target”

Limitations

Sufficient information must be known on

- Building occupancy type(s)
- Location
- Components, materials, and assemblies



Limitations

Building envelope

- Thermally active element above-grade requires insulation
- Slab-on-grade permitted flexibility
- Designed to avoid air leakage, wetting or moisture by-pass

HVAC and service water heating

- All appliances and equipment performance efficiencies cannot be less than required by the applicable energy efficiency act

Lighting and Electrical systems

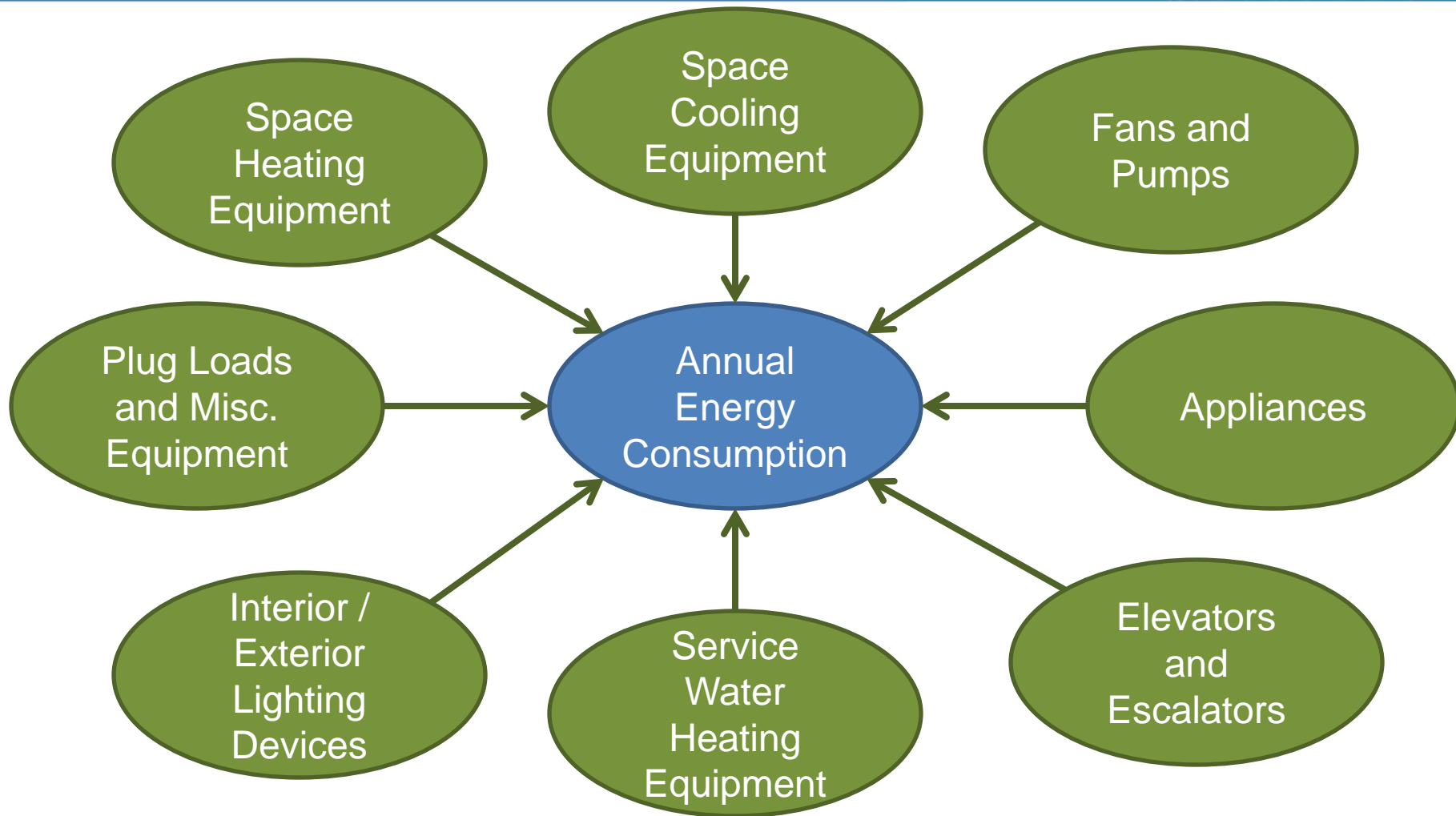
- None



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Calculation method



Calculation method

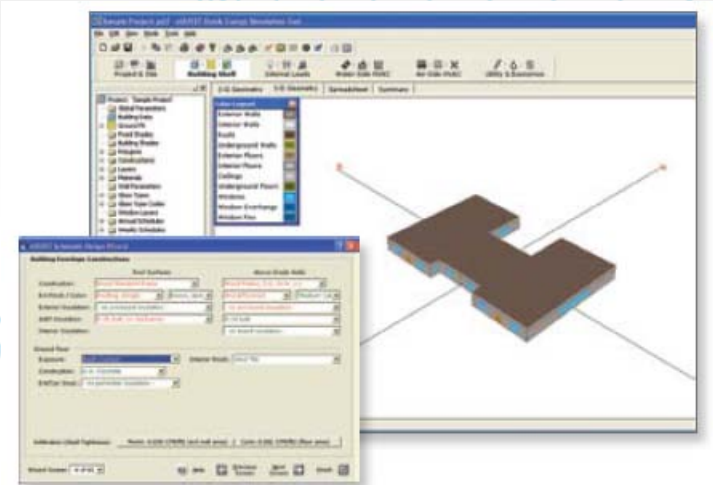
Required detail

- Hourly time step during one year (8760)
- Climatic data files based on at least 10 years of real data
- Energy calculations must account for
 - Effects of thermal mass
 - Dynamic calculations of space temperatures
 - Cross effects of the building systems and internal loads
- Envelope assembly covering $< 5\%$ total assembly area need not be modeled separately

Calculation method

Framework for compliance calculation provided in Part 8

- No software specified
- Flexible to allow use of various tools
- ANSI/ASHRAE 140 “Evaluation of Building Energy Analysis Computer Programs” or equivalent test method



Calculation method

Some examples of tool options...



Building Energy Software Tools Directory – US DOE
http://apps.eere.energy.gov/buildings/tools_directory/subjects_sub.cfm

Calculation method

CAN-QUEST

- Canadian adaption of eQUEST
- Includes Canadian weather
- Supports metric and imperial measurements
- English and French interface

- Automatically generates NECB 2011 reference model
- **Warning!** MECB 2013 reference model not generated

Available for free from NRCan

Email info.services@nrcan.gc.ca to request a copy

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Calculation rules - general

General building criteria held constant...

- Floor area and shape
- Thermal blocks
- Building types or space functions
- Building orientation
- Location of fenestration elements
- Occupancy density
- Service water heating loads
- Internal loads and schedules
- Supply, return and exhaust fan schedules

Calculation rules - general

Renewable and process energy

- Flexibility by silence on process load and energy from renewable sources
 - Guidance provided in Appendix for inclusion
 - Industrial processes
 - Medical imaging equipment
 - Computer servers
 - Cooking appliances in commercial kitchen or restaurant
- No credit for efficiency of purchased energy



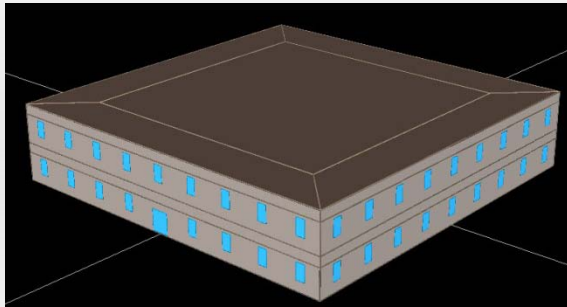
Calculation rules - building envelope

Thermal characteristics

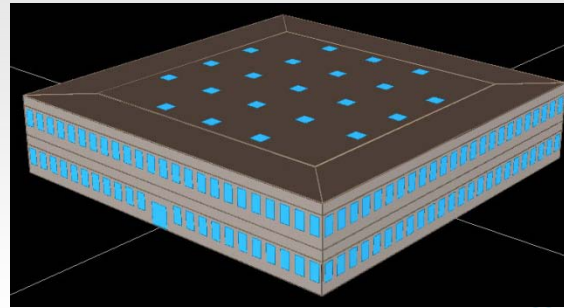
- - reference set to prescriptive
 - Opaque building assemblies (walls, roofs and floors)
 - Fenestration **including spandrels (MECB 2013)**
 - Requirement for vestibules
 - Continuity of insulation
- Proposed building as per specification
- Credit or energy penalty depending on where design falls with respect to prescriptive requirements

Calculation rules - building envelope

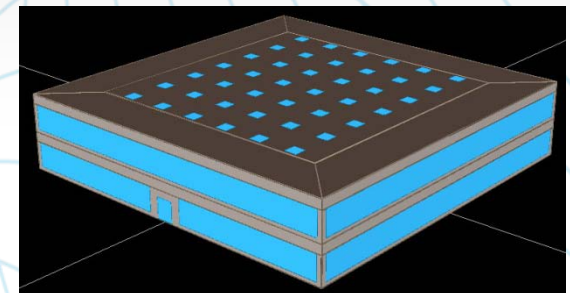
Impact of the fenestration and door area allowances (FDWR)



Credits



Reference

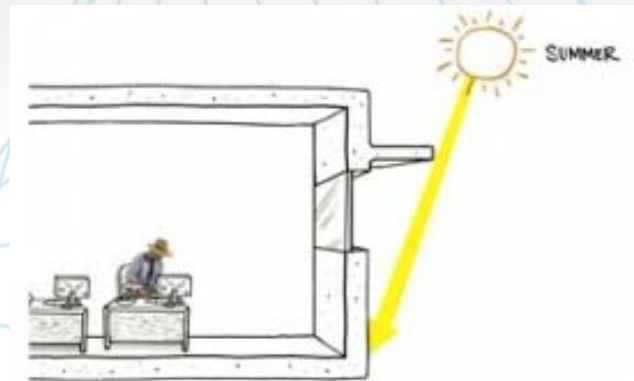
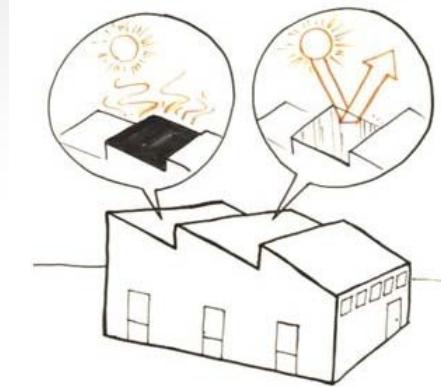
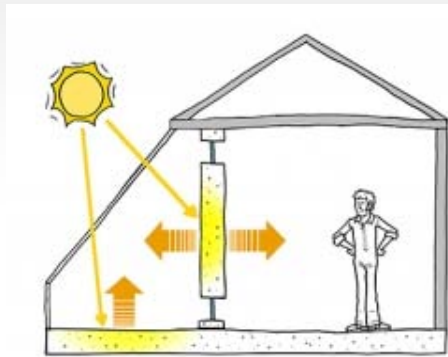


Energy Penalty

Calculation rules - building envelope

Credits

- Thermal mass (reference set to lightweight construction)
- Roof solar absorptance improvements (reference set to 0.7)
- External permanent shading devices

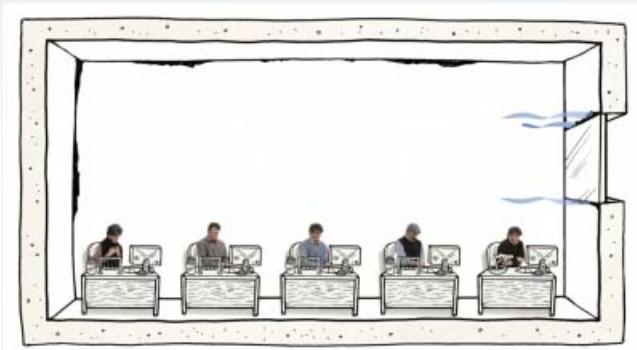


Graphics: <http://sustainabilitywokshop.autodesk.com/>

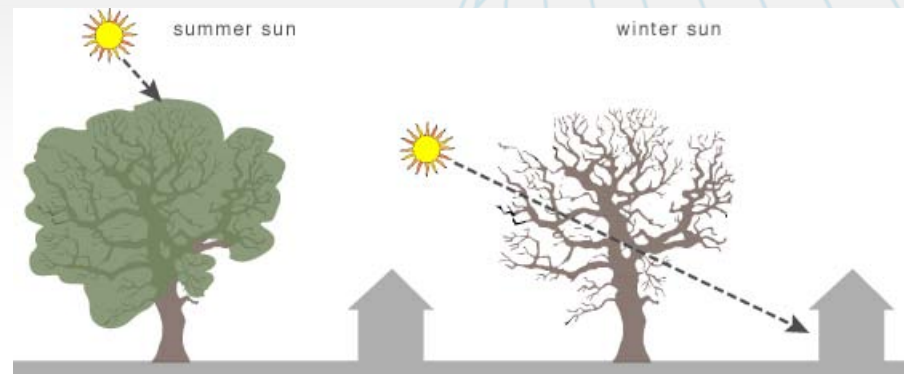
Calculation rules - building envelope

No credits

- Whole building air leakage rate of $0.25 \text{ (l/s} \cdot \text{m}^2)$ same in both models
- Exterior shading by tree or other structure



Graphic: <http://sustainabilityworkshop.autodesk.com/>



Graphic: <http://www.greenspec.co.uk/building-design/solar-siting-orientation/>

Calculation rules - lighting

Credits

- Interior, site and exterior lighting power density
 - Reference as per prescriptive requirement
 - Proposed as specified
- Occupancy sensors
 - 10% credit
- Daylighting
 - Use trade-off if none in software used



Calculation rules - lighting

No credits

- Lighting power density allowances in dwelling units not mandated in Part 4
 - 5 W/m² used in reference and proposed buildings



Calculation rules - HVAC

HVAC system selection for reference case

- Based on space function or building type
- System selection table

Building or Space Type of the Proposed Building	Size of Building or Space	Type of HVAC System Required
<u>General Area</u> : office, banking, health care clinic, library, retail/mall concourse, gymnasium, athletic play area, swimming pool, exercise centre, dressing room, lighting control room, atrium	Maximum 2 storeys	System 3
	More than 2 storeys	System 6
<u>Indoor Arena</u> : ice rinks, curling rinks	All sizes	System 7

Calculation rules - HVAC

HVAC system types

- Seven system types to represent reference, based on current practice
- ‘Fuel neutral’ means same as proposed building

System #	System type	Fan control	Cooling type	Heating type
System 3	Single zone packaged rooftop with baseboard heating	Constant volume	Air-cooled direct expansion	Fuel-fired or electric resistance furnace for rooftop; hot water with fuel-fired boiler, or electric resistance for baseboards
System 6	Multi-zone built-up system with baseboard heating	Variable volume	Water-cooled water chiller	Baseboards: electric resistance or hydronic with <i>fuel</i> -fired boiler
System 7	Four-pipe fan coil	Constant volume	Water-cooled water chiller	Hydronic with electric resistance or <i>fuel</i> -fired boiler

Calculation rules - HVAC

- Heat recovery credit
 - Central exhaust > 150 kW, above 50% efficiency
- Ventilation
 - Reference constant volume, except office type > 2 storeys
- Cooling with outside air above Part 5 requirements



Calculation rules - HVAC

Radiant systems - credit provided

- In-floor, in-ceiling or in-wall radiant systems modeled with 2°C difference in temperature set-point (e.g. heating to 21°C versus 19°C)



Calculation rules - HVAC

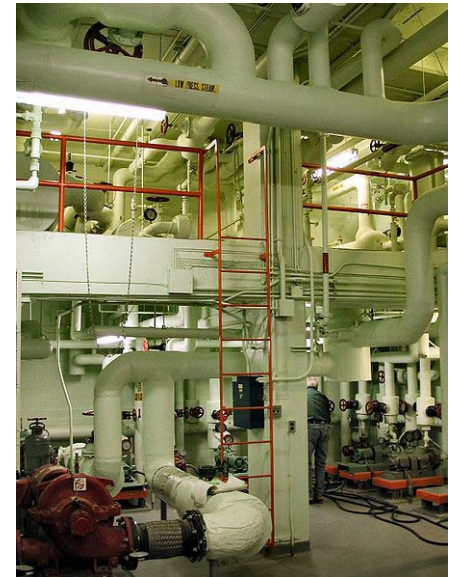
Other – credit optional

- Heating system
 - Constant speed pumping
 - Hot water supply temperature reset
- Cooling system
 - For hydronic, number of chillers based on plant size
 - For direct expansion, number of stages based on size
 - For cooling tower, number of cells based on size
 - Temperature drops
- Fan part load performance characteristics

Calculation rules - HVAC

Credits optional

- Equipment oversizing addressed
 - Reference heating equipment not oversized by $> 30\%$
 - Reference cooling equipment not oversized by $> 10\%$
- Part load performance characteristics
 - Reference defaults provided
 - Proposed as specified can be used



Calculation rules - HVAC and SWH

No credit

- Outdoor air rate same
 - Except for displacement ventilation
 - Demand control ventilation for heated parking garages
- Space temperature throttling of 1 °C
- Equipment operation
 - Supply and storage tank temperature
 - Number of water heaters
- Priority order for use of equipment with multiple energy type systems provided

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Modeling Resources

Red River College – two-day CanQUEST training (October and November)

<http://rrc.ca/files/file/techsolutions/mbenergycode.pdf>

The American Institute of Architects – The AIA Energy Modeling Guide

<http://info.aia.org/aia/energymodeling.cfm>

Rocky Mountain Institute – Building Energy Modeling for Owners and Managers

<http://www.rmi.org/EnergyModelingWorkstream>

IBPSA USA – BEMBook (Building Energy Modeling Body of Knowledge)

<http://www.bembook.ibpsa.us/>

Summary

- Reference building linked to prescriptive requirements
- More consistent reference
 - Introduction of FDWR based on HDD
 - HVAC selection based on building type
- Most flexibility and detail of all compliance paths in acceptable solutions

Questions?

Thank you

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