

# Roadmap to Resilient, Ultra-Low Energy Buildings

June 20, 2023

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# Agenda for Today's Presentation

1. Introduction
2. Proposed Policy Principles
3. Draft Roadmap for Engineers – call to action



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# Roadmap Introduction



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# What is the Roadmap?

- Guidance for the engineering profession and policy makers
- A compelling and achievable Vision for the Canadian building stock
- Goals and metrics aligned with the vision
- Case studies of buildings that align with the vision
- Proposed Policy Principles to support government activities
- A call to action for the engineering profession and Roadmap to catalyze transformation
- Project website:

<https://www.cae-acg.ca/resilient-building/>



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# Sponsors

- [Pacific Northwest Economic Region](#) (PNWER)
  - Matt Morrison, Brandon Hardenbrook, Nate Weigel
- [Canadian Academy of Engineering](#)
  - Dr. Robert Crawhall | P.Eng, FCAE, ICD.D



*Pacific NorthWest  
Economic Region*



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# Roadmap History

- 2014 PNWER Summit (Whistler) – Roadmap Established
- 2019 Workshop (Montréal) and Communiqué
- 2020 Symposium (Montréal) and Communiqué
  - Example paper: *Jurisdictional Responsibility for Improving the Resilience of Buildings to Climate-related Power Outages*
- 2021 online Workshop – Low-carbon, Positive Energy Resilient Communities
- 2022 PNWER Summit (Calgary) – Bridging Silos to Catalyze Decarbonization and Resilience of Buildings
- 2023 Webinar
- 2023 Draft Roadmap for comment by Advisory Committee and CAE Fellowship inductees

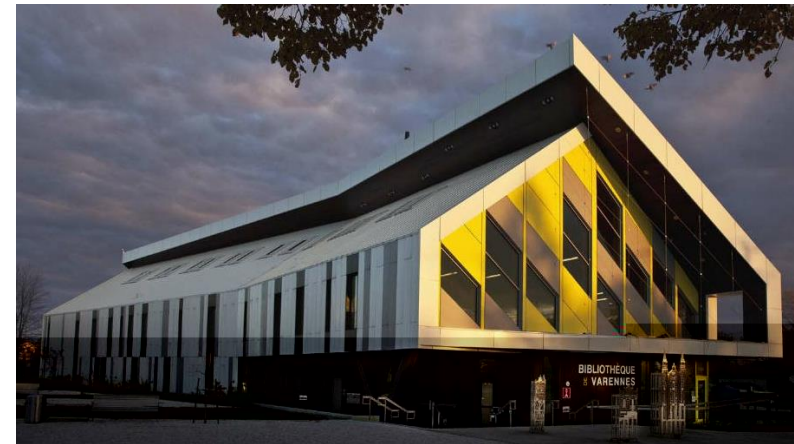


# Vision

Climate change mitigation and energy affordability necessitates a transformation of Canadian buildings

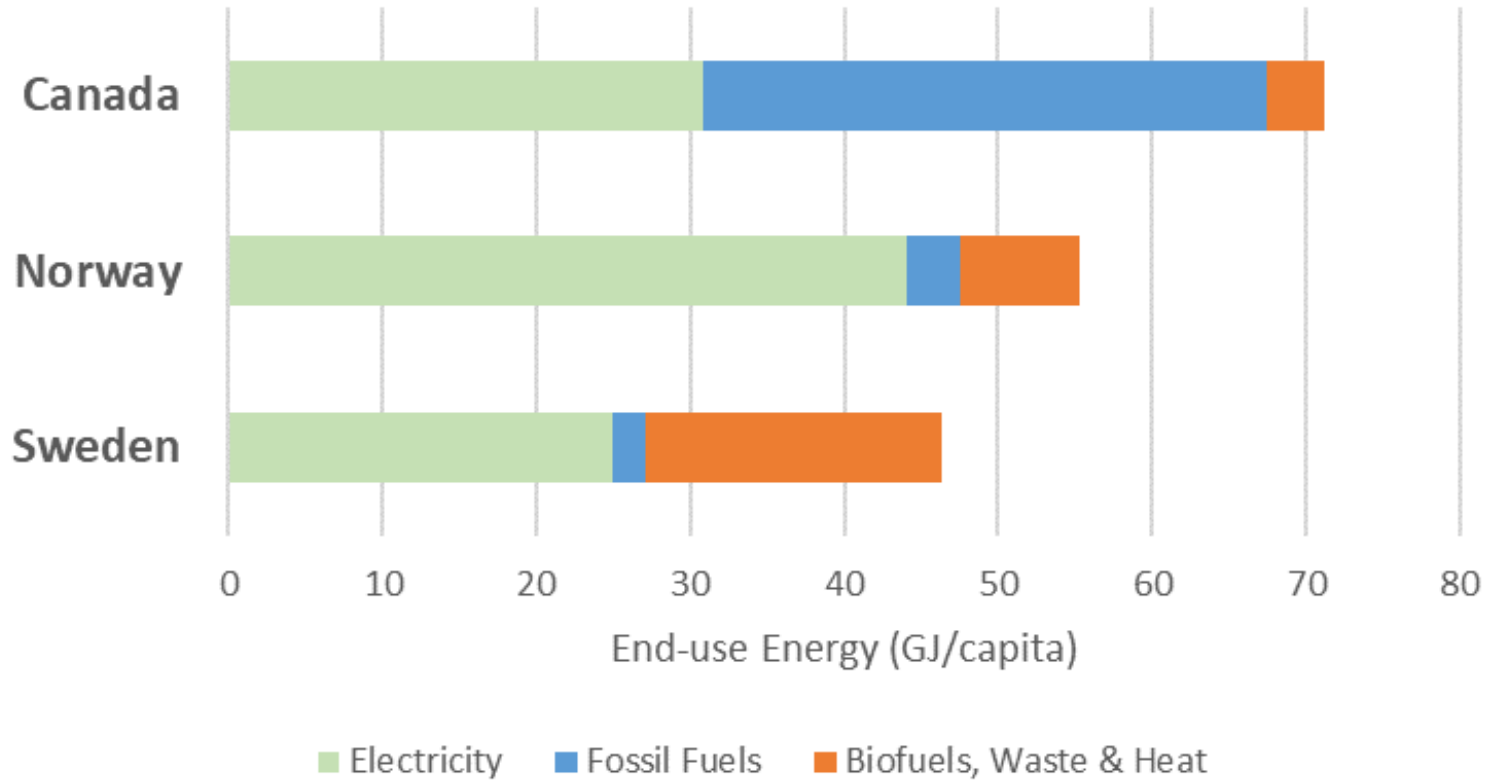
The design of buildings, transportation systems and industry must change, with an additional emphasis on:

- Increasing energy efficiency
- Exclusive use of zero- and net-zero carbon fuels
- Bolstering resilience





# Supply- and Demand-side Decarbonization



Comparison of per capita building energy use by source (2019)





# The Resilience Imperative

**Requirement:** efficient and responsive use; diversity of carbon-free energy sources; including building & community-scale generation, storage, control



# Proposed Policy Principles



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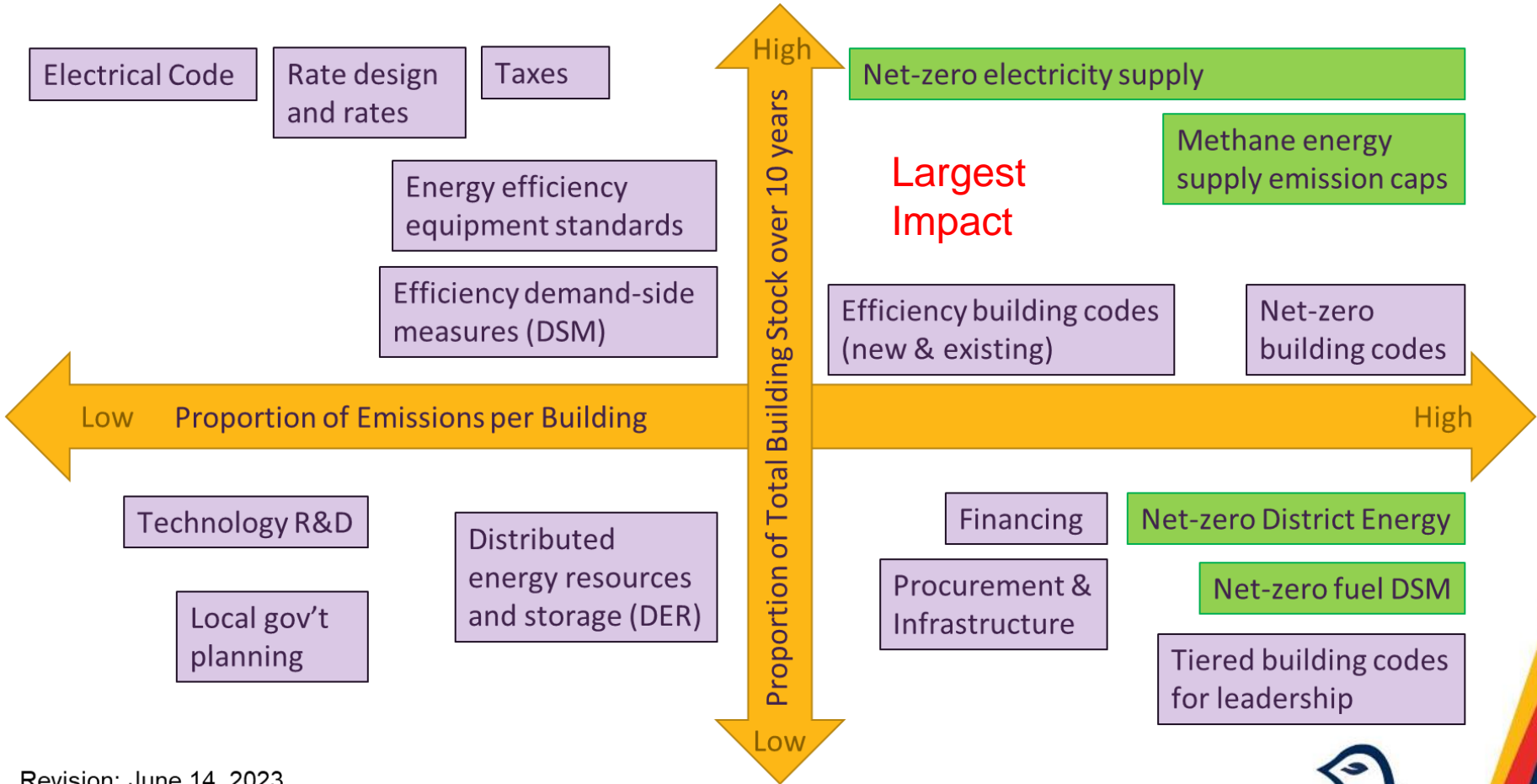


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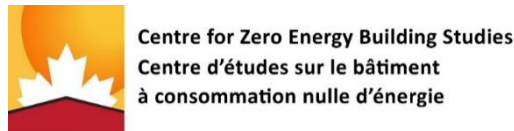


# Measures to Decarbonize Buildings

Demand-side Measures (purple)  
Supply-side Measures (green)



Revision: June 14, 2023

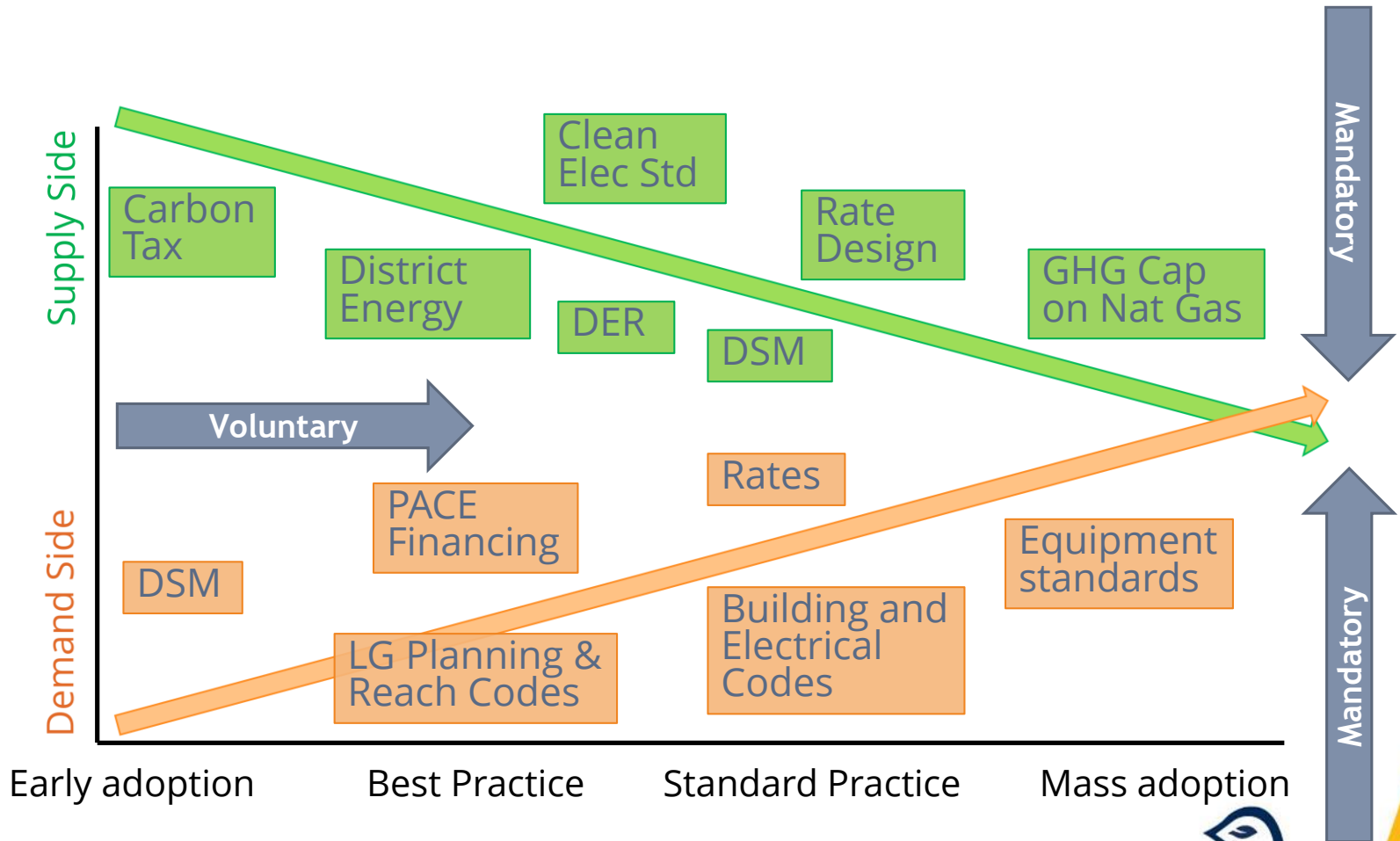


# Proposed Principles for Policy Makers

1. Facilitate Integrated Demand- and Supply-side Resource Planning
2. Focus on Performance Outcomes that Foster Competition and Enable Innovation
3. Allocate Jurisdictional and Institutional Responsibility
4. Leverage Building Lifecycle Investment Triggers
5. Facilitate Data-driven, Outcome-based Policymaking



# 1. Facilitate Integrated Demand/Supply Planning



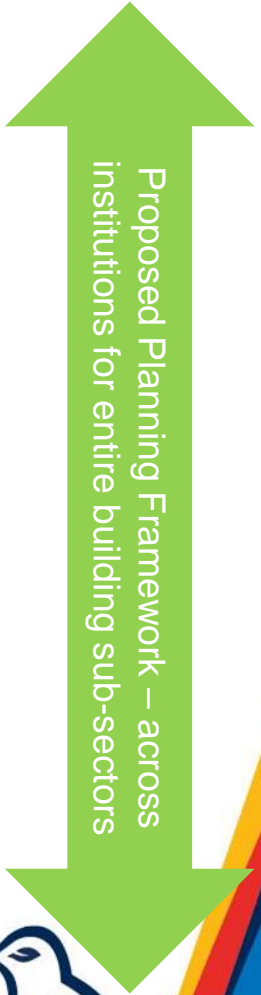
## 2. Focus on Performance Outcomes that Foster Competition and Enable Innovation

- Establish common performance metrics and standards across markets
- Empower professionals to co-optimize design across goals
- Maximize flexibility to achieve goals, enhancing innovation, competition and cost reduction
- Develop adaptative design solutions to avoid dead ends
- Focus on risk identification, vulnerability assessment and mitigation versus exposure to recovery and damage costs
- Communicate extensively with governments on policy adjustments to enhance performance, innovation and resilience, as opposed to a “compliance mindset”
- We are calling on establishing an “innovation ecosystem” for buildings

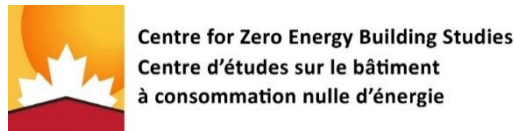




# 3. Optimize Allocation of Responsibility

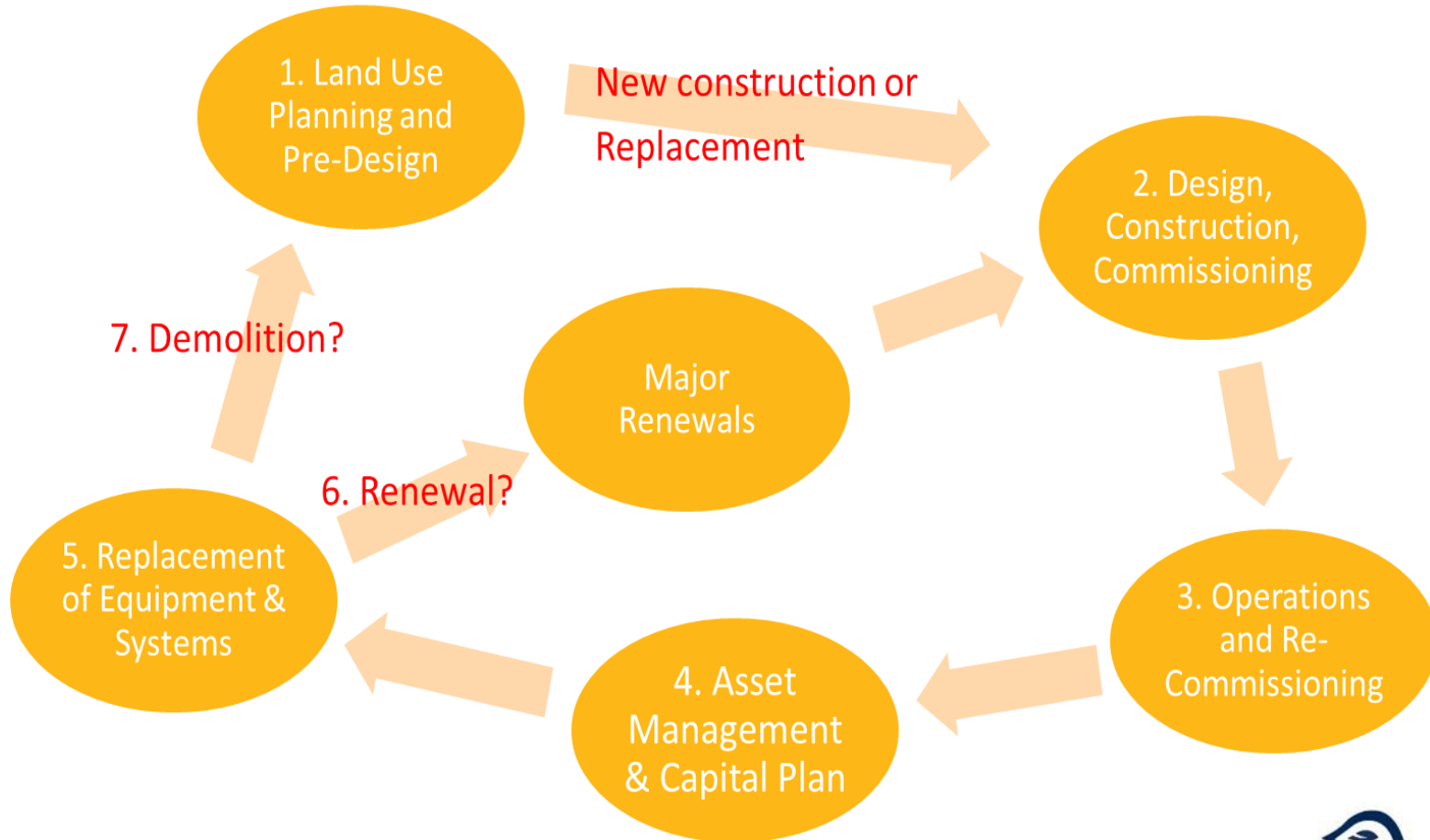


Regulatory Frameworks for Buildings	Residential	Commercial	Institutional	Rental & Social Housing
Land Use Planning	Local / Regional / Indigenous Government Planning			[P/T Emerging]
New Construction	Building Codes, Advanced Energy Efficiency Standards, Energy Efficiency Programs			
Equipment	Federal and Provincial Energy Efficiency Act, Energy Efficiency Programs			
Asset Management	Mandatory Depreciation Report	N/A	Capital Asset Management Framework	
Building Renewal	Building Codes, Energy Efficiency, Tax credits			+ Design guidelines, Rent control, Government funds
Real Estate	Real estate labelling	Benchmarking	Greening government buildings	Tenant protection
Electricity Supply	Public Utility Commission (planning, projects, supply, rates), clean electricity standard			
Fossil fuel and other methane and H2	Public Utility Commission (planning, projects, supply, rates), emerging carbon cap			
Distributed and District Energy	Public Utility Commission (planning, projects, supply, rates), net metering, government ownership, connection bylaws.			

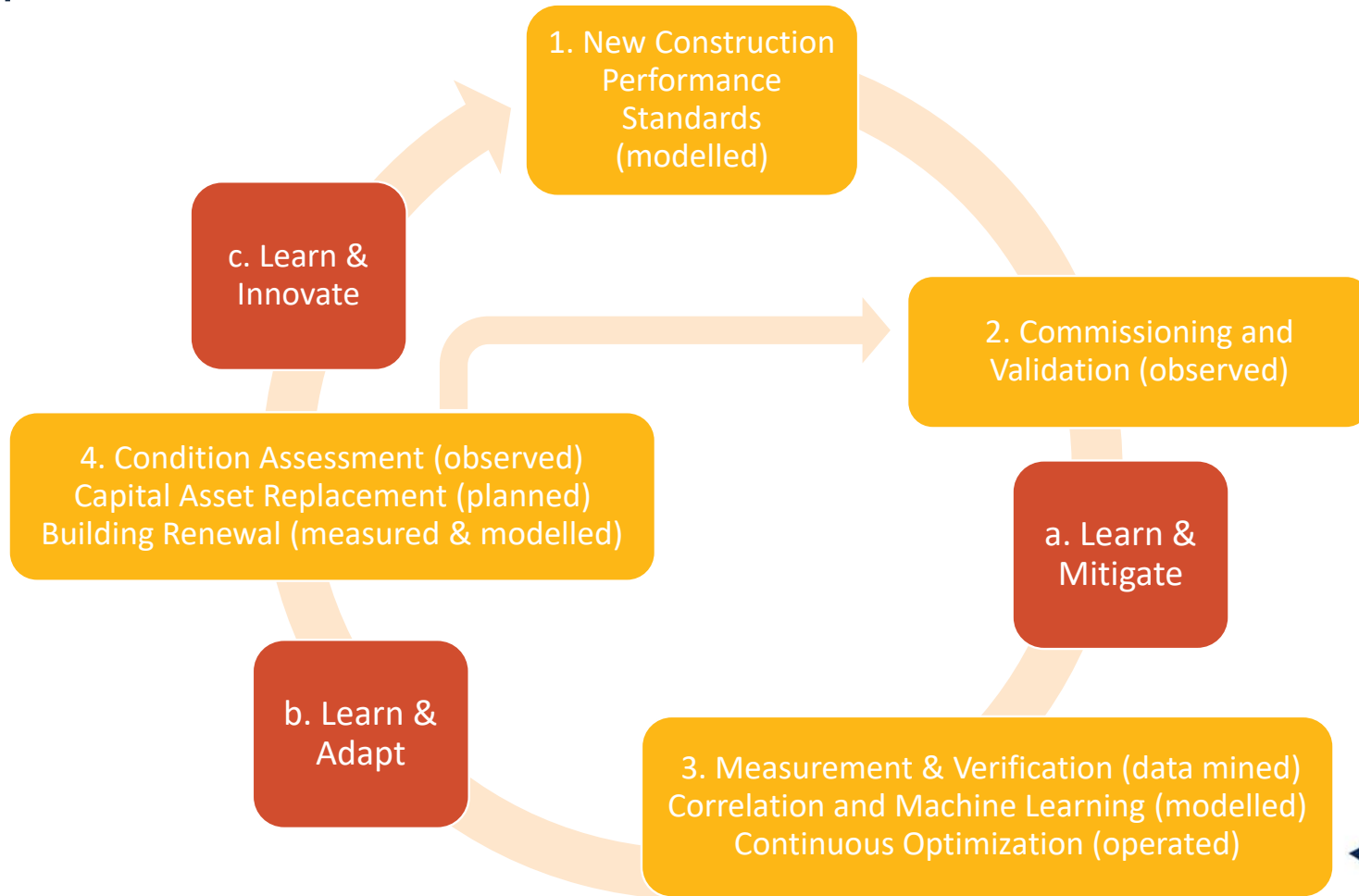




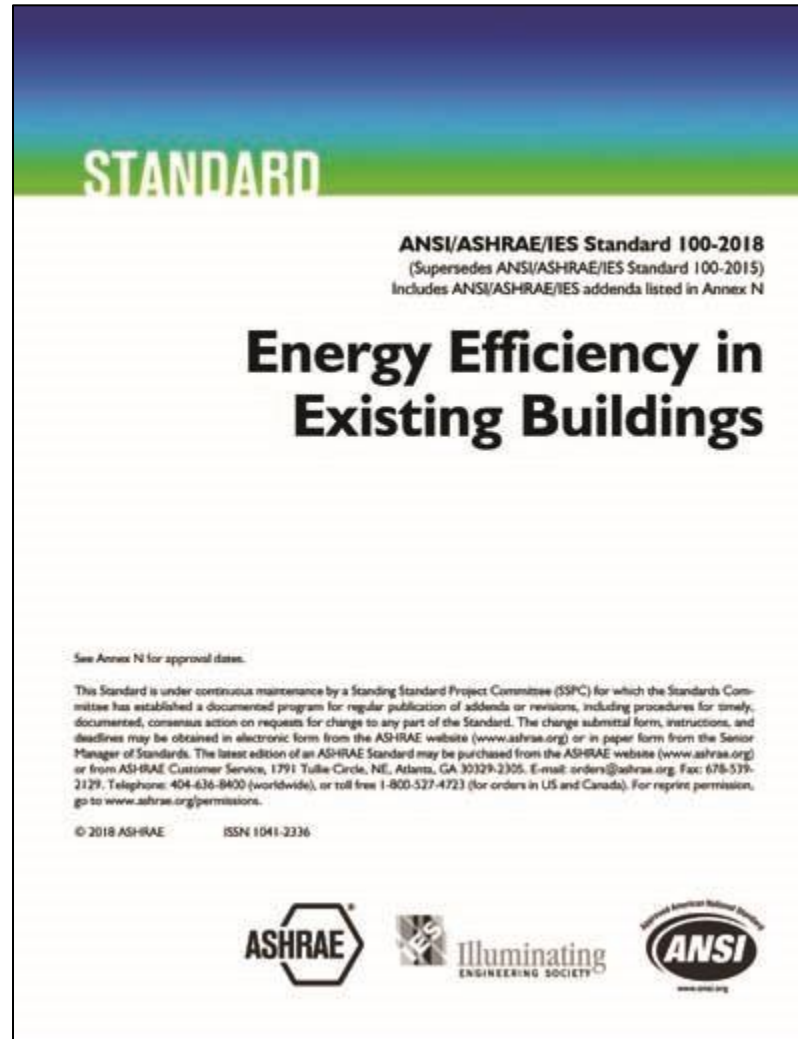
# 4. Leverage Lifecycle Investment Triggers



# 5. Facilitate Data-driven Policymaking



# Example



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# Call to Action for Engineers and Roadmap



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# Empowering Engineers

Expanded role needed for engineers because the profession:

- Serves multiple Buildings sector stakeholders
- Bridges across government, institutional and sectoral silos
- Aligns with codes of ethics including “hold paramount the safety, health, and welfare of the public, including the protection of the environment...”

Engineers are in a unique position to catalyze meaningful action on policy goals while highlighting limitations of design solutions in the context of management practices, local context and a changing climate.



# Call to action for Engineers

- Establish a vision for future-proofing buildings
- Individually evaluate risk factors and mitigation measures
- If involved in building operation: measure building performance and use data to optimize operation
- Contribute to policy development including codes
- Collaborate with academe on demonstration projects
- Collaborate with CAE on innovation ecosystem



# Roadmap for Engineers, Professional Reliance and Practice

Support resilient, ultra-low energy design and operation

Learning loop

Design and Operate Buildings

Urban planning: prioritize resilience, efficiency and renewable energy

Forecast: climate change and natural hazards

Financial: integrated budget strategy (capital and O&M)

Use measured performance data to inform design

Codes: define ultimate goals and interim steps/tiers; require modelling that incorporates forecast normal and extreme conditions, informed by historic conditions

Education: Credentials for sub-disciplines

Electricity: smart grids for resilient and responsive buildings, integrated demand- and supply-side resource planning for decarbonization

Community resilience planning: go beyond site scale to model broader response to disruptions

Operation: Performance continuity strategy

Share building performance data

Share projections of buildings' grid load and interactions

Share building's contribution to community resilience

New buildings and major retrofits designed to decarbonize and be resilient to climate and seismic risks, by using the full potential of energy conservation, energy efficiency, on-site renewable generation, purchased energy from zero-carbon fuels and energy storage in normal and disrupted operation while providing EV charging capacity



# Closing Remarks



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# Roadmap Next Steps

- First draft of Roadmap: Completed November 2022
- Advisory Committee input: December-March
- Draft Roadmap for CAE Members: June 2023
  - Adding existing buildings case studies
- Final Roadmap Options
  - Current format – integrated with vision and case studies
  - Separate “Roadmaps” for engineers and governments
- Dissemination to F/P/T Ministers of Buildings and Energy: Fall 2023



# Summary

- Guidance offered from CAE to engineering profession and policy makers at all levels
- Proposed Policy Principles to support government activities
  - Integrated planning for each buildings sub-sector, crossing legislative and institutional boundaries
  - Focus on data, innovation, performance
  - Clear allocation of responsibility to governments
  - Engineers co-optimizing multiple goals, maximizing affordability
- A call to action for the engineering profession to facilitate resilient, ultra-low energy buildings

