

**ENERGY, ENVIRONMENT, & ECONOMY
IN MASSACHUSETTS: LESSONS FROM H.4744**

by
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Abstract

This paper explores planning and decision-making on issues linking energy, environment, and economy – i.e., “triple-E” issues. Massachusetts is the geographic focus but this exploration has wider relevance. A draft bill – i.e., H.4744 – considered by the Commonwealth of Massachusetts’ legislature was chosen as a point of entry for this exploration. That choice reveals unexpected deficiencies in leadership and strategy in the Commonwealth regarding triple-E issues. Evidence of these deficiencies includes ill-advised proposals in two important issue areas – i.e., climate action, and nuclear power.

These deficiencies could prevent the Commonwealth from achieving goals including our commitment since 2008 to eliminate emissions of greenhouse gases. Thus, these deficiencies require immediate attention. Fortunately, there are opportunities for rapid, corrective actions. This paper describes some corrective actions that could put us on a better pathway. It also identifies related opportunities that the Commonwealth could find or create in the triple-E space. The paper ends with a warning and a call for action.

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1. Introduction

This working paper seeks to assist public dialogue on technical and policy issues related to energy, environment, and economy. Massachusetts is the geographic focus, but many of the issues discussed have wider relevance. Constructive comments on the paper will be welcome.

Energy, environment, economy: Choosing our pathway

The future prosperity of the Commonwealth of Massachusetts will depend upon the quality of our planning and decision-making today. This paper discusses planning and decision-making in a particular context – i.e., issues linking the fields of energy, environment, and economy. These issues can be termed “triple-E” issues. The quality of our planning and decision-making on triple-E issues will have far-reaching implications. It will determine the future quality of our health and well-being. It will determine if the Commonwealth responds effectively to the global climate emergency.

Across coming decades, a range of triple-E pathways will be available. The Commonwealth will face challenges and opportunities, whatever pathway we choose. If we choose wisely, however, and act with determination, we could meet the challenges while seizing the opportunities. For example, we could fulfill our duty to eliminate emissions of greenhouse gases (GHGs) while developing related goods and services that strengthen our local economies and find worldwide markets.

The act of choosing our pathway could be liberating and empowering. It could be a practical expression of a vision articulated by Martin Luther King in his acceptance speech for the Nobel Peace Prize in 1964. King’s speech includes the statements:¹

“I accept this award today with an abiding faith in America and an audacious faith in the future of mankind.”

“I refuse to accept the idea that man [humanity] is mere flotsam and jetsam in the river of life, unable to influence the unfolding events which surround him.”

We could make King’s vision real in Massachusetts, in the triple-E space and more broadly. Necessary ingredients would include leadership that engages all of us in visioning and working collaboratively toward a shared future.

¹ King, M.L. Jr. 1964. Nobel Peace Prize Acceptance Speech, Oslo, 10 December 1964. Nobel Prize website, accessed on 25 January 2026 at: <https://www.nobelprize.org/prizes/peace/1964/king/acceptance-speech/>

Roles of this paper

This paper is envisioned as the first of a series discussing triple-E challenges and opportunities in Massachusetts. While Massachusetts will be the geographic focus, these papers will provide information that could be useful elsewhere. This initial paper was originally envisioned as serving a limited role – i.e., framing ongoing inquiry.

The exploration conducted here has identified unexpected, internal challenges – i.e., deficiencies in leadership and strategy in the Commonwealth regarding triple-E issues. Evidence of these deficiencies includes ill-advised proposals in two issue areas – i.e., climate action, and nuclear power. These deficiencies are hindering our efforts in the triple-E space and could prevent the Commonwealth from achieving its climate goals. Thus, they require immediate attention.

Fortunately, there are opportunities for rapid, corrective actions. Goals would include the adoption of collaborative, empowering leadership and participatory decision-making. Taking corrective actions promptly could position the Commonwealth to overcome the challenges and seize the opportunities that await us.

In light of these needs, this paper now has an additional role – i.e., providing a warning and a call for action.

2. Unexpected, Internal Challenges: Deficiencies in Leadership and Strategy

A specific point of entry to the triple-E space was chosen for the exploration conducted here. This point of entry reveals unexpected, internal challenges – i.e., deficiencies in leadership and strategy. Specific deficiencies identified in this paper include:

- Failure to protect and use two of the Commonwealth’s most valuable assets – i.e., healthy democracy, and an empowered citizenry.
- Lack of long-term, integrated strategies to guide climate action and other triple-E programs.
- Lack of inclusive, open, coherent processes for planning and decision-making.
- Poorly developed capacity to critically assess technology options.
- Failure to engage stakeholders in visioning and working collaboratively toward a shared future.

These deficiencies are dangerous. Fortunately, further exploration shows that they are fixable.

H.4744 as a point of entry to the triple-E space

A draft bill considered by the Massachusetts legislature is the chosen point of entry here. The draft bill was titled “An Act relative to energy affordability, clean power and economic competitiveness”. The version discussed here was issued on 13 November 2025 by the Joint Committee on Telecommunications, Utilities, and Energy, and was designated as H.4744.²

Discussion here regarding H.4744 focuses on two of its proposed outcomes. One is weakening of the Commonwealth’s commitment to reducing emissions of GHGs. The other is repeal of a law established by a statewide referendum in 1982, whereby a large majority of voters demanded that specific conditions must be met before a new nuclear power plant could be built in Massachusetts. Further information on these proposals is provided below.

These two proposals are problematic in themselves. Sadly, a closer look at them reveals larger problems. It reveals deficiencies in leadership in the Commonwealth’s legislative and executive branches. There could be associated leadership deficiencies in business, academia, and civil society. Further exploration reveals weaknesses in the formulation and implementation of strategy.

Thus, choosing H.4744 as a point of entry obliges one to address unexpected, internal challenges facing the Commonwealth – i.e., deficiencies in leadership and strategy. Fortunately, however, examination of these challenges reveals opportunities for rapid, corrective actions. Seizing these opportunities now could help Massachusetts to address larger challenges and opportunities across the coming decades.

² H.4744 can be accessed, as of 29 January 2026, at: <https://malegislature.gov/Bills/194/H4744>

H.4744 as the marker for a needed turning point

In this paper, H.4744 is proposed as a marker for a needed turning point in the Commonwealth's approach to planning and decision-making. Accordingly, attention is focused here on the original version of H.4744 that was created in November 2025.

The H.4744 in question is not law. It was an intermediate product of legislative consideration. It provides a picture, at a particular moment in time, of attitudes and practices in the Massachusetts legislature regarding planning and decision-making on triple-E issues. Sadly, that picture is disturbing.

Going forward, H.4744 might be re-introduced in its present form or in a modified form. It might be replaced with another bill using a different designation. In some version, it might become law. This paper will not attempt to track such outcomes. Attention here is focused on the original H.4744.

Leadership and strategy deficiencies: A serious but fixable problem

Deficiencies in leadership handicap the Commonwealth's ability to think and act strategically in the triple-E context. Without that ability, we will struggle to meet challenges and pursue opportunities. This weakness is especially significant at a historical moment when the Trump administration is threatening the values and interests of Massachusetts.

Fortunately, however, this problem is fixable, relatively quickly. A few years of determined effort could suffice. Moreover, that effort could create durable capabilities that are useful in Massachusetts and around the world.

Note that strengthening leadership is not primarily about replacing individuals. Instead, it is about enhancing capabilities across society. Aspects of the enhancement include skill-building, institutional reform, creation of new tools, public education, and cultural shifts.

Interestingly, broad-based strengthening of leadership would involve societal actions in three "E" categories – i.e., engagement, education, and empowerment. These actions could be essential to our capturing of triple-E opportunities.

Good leadership could build the societal cohesion and trust necessary to develop sound strategy. Thus, at least initially, leadership might be a precondition for strategy. Over time, however, leadership and strategy could develop symbiotically, each strengthening the other.

3. Global Challenges

Massachusetts, like communities around the world, faces a variety of global challenges. Some are likely to become more severe across the coming decades. A notable example is the global climate emergency.

H.4744 and the global climate emergency

H.4744 compels us to consider the global climate emergency because it proposes to weaken the Commonwealth's prior commitment to address this emergency. The Commonwealth embedded that commitment in law in 2008. H.4744 proposes that we retreat from our commitment, without acknowledging the historic significance of a retreat.

The climate emergency in context

The global climate emergency, viewed in isolation, is a daunting challenge. Yet, that picture is incomplete. The climate emergency is part of a broader polycrisis that is largely human-created and, therefore, unnecessary. Aspects of the polycrisis include abuse of Earth's life-support systems, pandemics, disparities in wealth and power, technological hubris, authoritarian politics, and rejection of science.³

Michael Lawrence and colleagues explain, in a 2024 paper, how a polycrisis viewpoint on global challenges could help us to respond effectively. They say:⁴

“Governments tend to focus on individual and immediate threats, which often renders their management of systemic risks ineffective. Because today's crises are causally entangled, they can be neither fully understood nor addressed in isolation from one another. A comprehensive approach is necessary – an ‘integrated assessment’ of the full range of interlinked crises involved – especially when policies that address one crisis might worsen or undermine efforts to resolve others.”

Lawrence et al's argument deserves further exploration. Such an exploration could, for example, identify ways in which our economies could be restructured to transform challenges into opportunities.⁵ This author hopes to pursue that matter in later papers.

³ For background see, for example: World Economic Forum. 2026. *The Global Risks Report 2026*. World Economic Forum, Geneva, Switzerland.

⁴ Lawrence, M., and five other authors. 2024. Global polycrisis: the causal mechanisms of crisis entanglement. *Global Sustainability*, Volume 7, paper e6. Quoted text from Conclusion.

⁵ See, for example: Intergovernmental Platform on Biodiversity and Ecosystem Services. 2026. *Summary for Policymakers of the Methodological Assessment Report on the Impact and Dependence of Business on Biodiversity and Nature's Contributions to People*. IPBES secretariat, Bonn, Germany. February 2026.

An overview of the climate emergency

The climate emergency is extensively documented. William Ripple and colleagues have drawn upon this documentation to publish a series of scientists' warnings that are intended to be guides for action. The October 2025 version begins with this statement by Ripple et al:⁶

“We are hurtling toward climate chaos. The planet's vital signs are flashing red. The consequences of human-driven alterations of the climate are no longer future threats but are here now. This unfolding emergency stems from failed foresight, political inaction, unsustainable economic systems, and misinformation. Almost every corner of the biosphere is reeling from intensifying heat, storms, floods, droughts, or fires. The window to prevent the worst outcomes is rapidly closing.”

Ripple et al mention the role of misinformation in exacerbating the climate crisis.⁷ Sadly, misinformation can be effective in creating misperceptions. In illustration, Gregg Sparkman and colleagues describe, in a 2022 paper, widespread misperception in the United States regarding public support for climate action, as follows:⁸

“Using a representative sample of Americans ($N = 6119$), we examine whether Americans accurately perceive national concern about climate change and support for mitigating policies. We find a form of pluralistic ignorance that we describe as a *false social reality*: a near universal perception of public opinion that is the opposite of true public sentiment. Specifically, 80–90% of Americans underestimate the prevalence of support for major climate change mitigation policies and climate concern. While 66–80% [of] Americans support these policies, Americans estimate the prevalence to only be between 37–43% on average. Thus, supporters of climate policies outnumber opponents two to one, while Americans falsely perceive nearly the opposite to be true.”

Figure 3-1, published by Ripple et al, places the climate emergency in the context of human history. The unprecedented stresses we are placing on Earth's climate system are clearly evident.

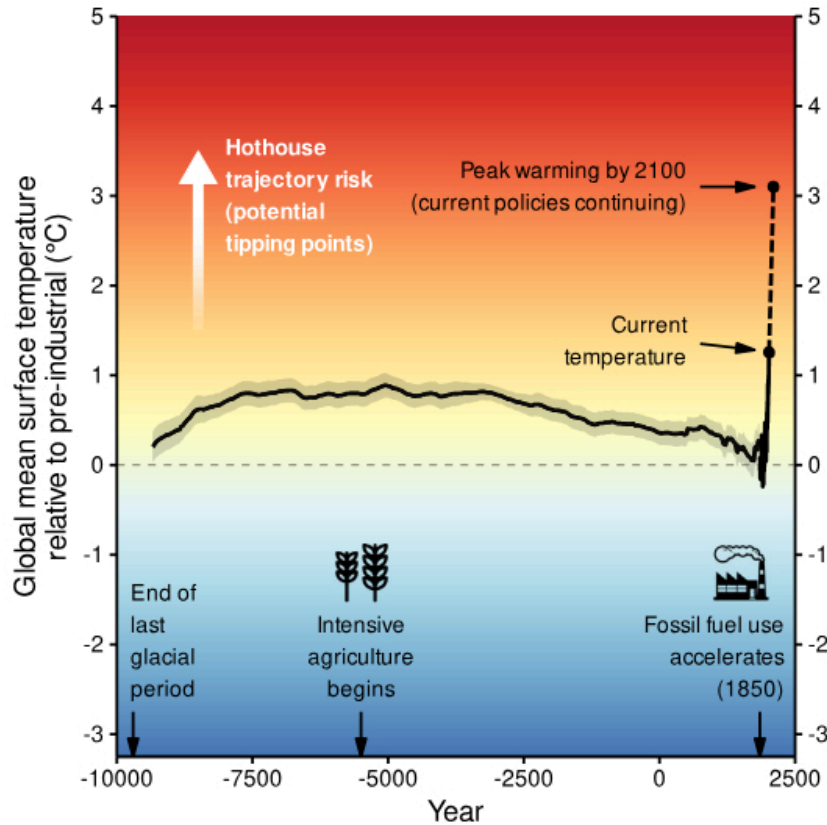
⁶ Ripple, W.J., and other authors. 2025. The 2025 state of the climate report: a planet on the brink. *BioScience*, 29 October 2025.

⁷ Apropos of climate misinformation, see, for example: YCC Staff. 2025. Eight of the top 10 online shows are spreading climate misinformation. *Yale Climate Connections*, 21 April 2025.

⁸ Sparkman, G., and two other authors. 2022. Americans experience a false social reality by underestimating popular climate policy support by nearly half. *Nature Communications*, Volume 13, Article number 4779, 23 August 2022. Quoted text from Abstract.

Figure 3-1

Average Surface Temperature of Earth: Measured/Estimated from 9340 BCE to 2020 CE, and Projected from 2020 CE to 2100 CE, per Ripple et al⁹



An insurance perspective on the climate emergency

In a statement quoted above, Ripple et al warn us about emerging, climate-related threats. Our direct experience of these threats will often involve the rapid breakdown of societal and economic systems. Prevailing economic models cannot predict the onset and unfolding of such breakdowns, because they will occur non-linearly.¹⁰ Thus, contingency planning for these breakdowns is difficult.

The insurance industry has learned, over centuries, to take a long-term view, to practice situational awareness, and to develop qualitative understanding of threats, system vulnerabilities, and risks. Gunther Thallinger, an executive at the international insurer Allianz, draws from this experience in a March 2025 essay that brings an insurance perspective to the climate emergency.

⁹ Ripple, W.J., and other authors. 2025. The 2025 state of the climate report: a planet on the brink. *BioScience*, 29 October 2025. Figure reproduced from Figure 3.

¹⁰ See, for example: Abrams, J.F., and two other authors. 2026. *Recalibrating Climate Risk: Aligning Damage Functions with Scientific Understanding*. University of Exeter and Carbon Tracker.

Thallinger's essay begins by warning us about emerging threats, just as Ripple et al have done. Then, Thallinger says:¹¹

“The insurance industry has historically managed these risks. But we are fast approaching temperature levels – 1.5°C, 2°C, 3°C – where insurers will no longer be able to offer coverage for many of these risks. The math breaks down: the premiums required exceed what people or companies can pay. This is already happening. Entire regions are becoming uninsurable. (See: State Farm and Allstate exiting California's home insurance market due to wildfire risk, 2023).”

“This is not a one-off market adjustment. This is a systemic risk that threatens the very foundation of the financial sector. If insurance is no longer available, other financial services become unavailable too. A house that cannot be insured cannot be mortgaged. No bank will issue loans for uninsurable property. Credit markets freeze. This is a climate-induced credit crunch.”

“This applies not only to housing, but to infrastructure, transportation, agriculture, and industry. The economic value of entire regions – coastal, arid, wildfire-prone – will begin to vanish from financial ledgers. Markets will reprice, rapidly and brutally. This is what a climate-driven market failure looks like.”

The world acknowledged the climate emergency in 1992: The UNFCCC

The nations of the world formally acknowledged the climate emergency at the Earth Summit in Brazil in 1992, by becoming parties to the UN Framework Convention on Climate Change (UNFCCC). They accepted commitments under the UNFCCC including the following:¹²

“The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities.”

One sign of support for such commitments was a speech at the Earth Summit by US President George H.W. Bush, delivered just after he signed the UNFCCC. In the speech, according to a later report, Bush said:¹³

“We must leave this Earth in better condition than we found it, and today this old truth must be applied to new threats facing the resources which sustain us all, the atmosphere and the ocean, the stratosphere and the biosphere. Our village is truly global.”

¹¹ Thallinger, G. 2025. Climate, Risk, Insurance: The Future of Capitalism. *LinkedIn*, 25 March 2025.

¹² UNFCCC Secretariat. 2025. Website: Convention documents. Accessed on 26 March 2025 at: <https://unfccc.int/process-and-meetings/the-convention/history-of-the-convention/convention-documents> Quoted text from Article 3 of the UNFCCC.

¹³ Laporte, A. 2018. *Remembering George H.W. Bush, the “Environmental President”*. Environmental and Energy Study Institute, Washington, DC.

Negotiations to implement commitments in the UNFCCC have continued since 1992. These negotiations have failed in the sense that the amount of anthropogenic carbon dioxide in the atmosphere has doubled. Yet, some progress has been made.¹⁴ Also, the principles of stewardship set forth in the UNFCCC remain unchallenged.

COP30

Since 1992, a conference of the UNFCCC parties (COP) has been held thirty times. COP30 was held in Brazil 10-21 November 2025. The Trump administration did not send a delegation. Also, the Trump administration is seeking to withdraw from the UNFCCC. In that context, note that the US Senate ratified the UNFCCC in 1992 by a vote of 92 to 0.

Delegates at COP30 were offered a diverse array of information. One piece of information was a scientists' statement by Carlos Nobre and colleagues. That statement includes the following call for action on GHG emissions:¹⁵

“We need to be as close as possible to absolute zero fossil fuel emissions by 2040, the latest by 2045. This means globally no new fossil fuel investments, removing all subsidies from fossil fuels and a global plan on how to phase in renewable and low-carbon energy sources in a just way, and phase out fossil fuels quickly. Finance from rich countries to developing countries is imperative.”

This call is notable because many public and private entities around the world – e.g., the Commonwealth of Massachusetts – have declared an intent to reduce their emissions to net zero by 2050. Nobre et al say that we should be more ambitious, aiming for absolute zero by 2040.

¹⁴ For background, see: Maslin, M.A., and two other authors. 2023. A short history of the successes and failures of the international climate change negotiations. *UCL Open Environment*, Volume 5.

¹⁵ Nobre, C., and other authors. 2025. *Scientists statement on state of COP30 Negotiations, November 19, 2025*. Planetary Science Pavilion at COP30.

Opportunities to address the climate emergency

The trends described above are disturbing. Fortunately, however, there are numerous opportunities to address the climate emergency. Societies that vigorously pursue these opportunities could benefit humanity while developing related goods and services that find worldwide markets. Opportunities at the triple-E nexus include:

- Renewable-energy sources with declining costs and increasing capabilities.
- Improvement of energy efficiency via electrification and other measures.
- Reduction of materials requirements via circular economy and other measures.¹⁶
- Agroecology practices that reduce farming impacts and sequester carbon.
- Processes for stakeholder engagement and participatory decision-making.

Massachusetts' role in the climate emergency

Warning signals about the deepening climate emergency are increasingly apparent in our region. For example, Stephen Young and Joshua Young, in a December 2025 paper, describe temperature trends in New England as follows:¹⁷

“This research shows that outside the Polar and Arctic regions, New England is one of the world’s fastest warming areas, warming more than 2.5°C since 1900, with 75% of this warming occurring since the late 1980s. Winters are warming almost twice as fast as the other seasons, with New England’s winters warming more than 4°C since 1900, and winters for the states of CT, MA, ME and VT have warmed more than 5°C.”

These temperature trends are causing a variety of adverse impacts. Consider two examples. First, warming is causing increases in tick-borne illnesses.¹⁸ Second, climate-related risks are becoming increasingly difficult to insure in New England. In the home-insurance market, coverage is becoming harder to obtain and premiums are rising.¹⁹ In a November 2025 news story, Kate Selig says:²⁰

¹⁶ Apropos of circular economy, see, for example: Klinger, J.M. 2026. America’s Rare-Earths Solution Is Hiding in Plain Sight. *The New York Times*, 6 February 2026.

¹⁷ Young, S.S., and Young, J.S. 2025. Decreasing Snow Cover and Increasing Temperatures Are Accelerating in New England, USA, with Long-Term Implications. *Climate*, Volume 13, Issue 12, December 2025. Quoted text from Conclusions.

¹⁸ Apropos of tick-borne illnesses, see: Bouchard, C., and five other authors. 2019. Increased risk of tick-borne diseases with climate and environmental changes. *Canada communicable disease report*, Volume 45-4, 4 April 2019, pages 81-89.

¹⁹ For background see: US Department of the Treasury. 2025. Press Release, 16 January 2025: U.S. Department of the Treasury Report: Homeowners Insurance Costs Rising, Availability Declining as Climate-Related Events Take Their Toll.

²⁰ Selig, K. 2025. Your New England home insurance could vanish. Climate change explains why. *The Boston Globe*, 25 November 2025.

“New England is not often thought to be on the front lines of the climate-driven insurance crisis. Yet from Connecticut to Maine, coastal communities are flashing warning signs: premiums climbing at dizzying rates and scores of policies abruptly dropped.”

“Climate change has fueled an unprecedented rise in costly disasters, making it one of the biggest financial threats to insurers. Over the last five years alone, New England has suffered more than 40 disasters with losses exceeding a billion dollars each, the majority of which were winter storms or severe storms.”

Despite these early-warning signals, the severity of the climate emergency is not always recognized in our region. H.4744 illustrates this problem. The Commonwealth should consider advice offered by Dianne Plummer in a January 2026 essay as follows:²¹

“Climate risk is now a planning variable, rather than a forecast uncertainty. The countries, companies and institutions that endure the coming decade will be those that stop treating climate change as a long-term scenario and start managing it as a present-day operational reality.”

The Global Warming Solutions Act (i.e., Chapter 21N)

The UNFCCC did not directly oblige Massachusetts to take climate action. Eventually, however, the Commonwealth accepted such an obligation by passing the Global Warming Solutions Act (GWSA) in 2008. Notably, the GWSA obliged Massachusetts to reduce its GHG emissions in 2050 by at least 80 percent compared to a 1990 baseline.

The GWSA was incorporated into the General Laws as Chapter 21N. That chapter has subsequently been amended while retaining the same basic structure.

²¹ Plummer, D. 2026. In 2026, Climate Change is no Longer a Theoretical Risk. *Forbes*, 12 January 2026.

4. Standards for Leadership and Strategy

Massachusetts faces both global and local challenges. Some challenges – e.g., destructive actions by the Trump administration – have increased recently. Overall, challenges seem likely to increase across coming decades. Thus, we should promptly fix our present deficiencies in leadership and strategy, and we should further strengthen these capabilities going forward. Otherwise, we will be increasingly vulnerable.

If we are to strengthen our capabilities for leadership and strategy, we will need standards to guide us. These standards are needed across government, civil society, academia, and business. Some initial observations are offered here, with a focus on the triple-E space in Massachusetts. Broad-based public dialogue on standards for leadership and strategy would be helpful.

Good leadership and strategy: Citizen empowerment

Good leadership will strive to involve all of us in visioning and working collaboratively toward a shared future. By empowering citizens, that mode of leadership can yield decisions with two important attributes. First, the decisions reflect widely-felt needs. Second, they are durable over time. Both attributes are essential to the success of a long-term project. A good strategy can then transform these decisions into action plans that are widely understood and supported. To that end, the strategy should be stated clearly and concisely.

Good leadership and strategy: A long-term perspective

Almost any challenge or opportunity that the Commonwealth faces in the triple-E space will require a long-term perspective, often extending across decades. While some challenges are sudden and brief – e.g., major storms – effective responses to them will require long-term planning. Other challenges – e.g., the climate emergency – unfold over decades. Changing our infrastructure to accommodate such challenges – e.g., by decarbonizing our energy systems – must also occur over decades.

Thus, leadership and strategy in the Commonwealth must involve a long-term perspective. That need must be met, somehow, in a democratic system operating on short cycles.²² A Massachusetts Governor serves for a 4-year term while a Senator or Representative serves for 2 years. This is a fundamental problem facing any democracy, but it has been solved in many jurisdictions across a range of societal functions – e.g., water and sewer systems.

Good leadership and strategy: Adaptive management

Any large project – e.g., decarbonizing our energy systems – will require comprehensive planning. Yet, experience tells us that large projects never unfold exactly as planned. Thus, the

²² For background, see, for example: Shankman, S. 2026. Adapting to climate change could cost eight Big Digs, according to a recent state report: So why isn't the governor talking about it? *The Boston Globe*, 14 February 2026.

strategy underlying a large project must achieve a difficult balance. On the one hand, it must have specific, measurable goals. On the other hand, it must have sufficient flexibility to accommodate changing reality. A systematic process of adaptive management could provide the needed balance.

Will Allen provides a useful description of adaptive management, including the following statement:²³

“Adaptive management is a structured, iterative approach to managing complex environmental and social systems. It emphasizes learning through action, integrating science, management, and policy at an ecosystem level. Because it supports shared learning and flexible decision making, adaptive management also plays an important role in strengthening resilience across multi-actor settings. At its core, adaptive management is a search for effective ways to:

- Experiment and innovate through management-based approaches.
- Address natural resource challenges at scales beyond individual enterprises and communities.
- Build capacity for action among multiple agencies and stakeholders, often with differing perspectives and interests.
- Strengthen the social processes and organizational capacity required to implement sustainable management practices.”

In this statement, Allen notes that adaptive management can support citizen empowerment and stakeholder engagement. That point can be generalized. The several attributes of good leadership and strategy that are discussed here are complementary and should be integrated.

Note that a well-designed process of adaptive management can generally function without statute change. That feature is important because statutes, like strategies, should be stable sources of guidance. To accommodate changing reality, they should contain built-in mechanisms for course correction – i.e., provisions for adaptive management.

Good leadership and strategy: Stakeholder engagement

Stakeholder engagement has some aspects in common with citizen empowerment. Both seek to involve diverse parties in visioning and working collaboratively toward a shared future. Stakeholder engagement, as discussed here, pursues this task at the level of group entities. The Commonwealth hosts a diverse array of such entities – e.g., municipalities, businesses, universities, public agencies, hospitals, civil-society organizations, unions, and many others. Many of them have independent projects in the triple-E space – e.g., municipalities have climate-action plans.

²³ Learning for Sustainability. 2026. Learning for Sustainability website: Adaptive management – “learning by doing”. Accessed on 30 January 2026 at: <https://learningforsustainability.net/adaptive-management/>

These diverse stakeholders in Massachusetts are, collectively, a massive societal asset that is not yet fully mobilized. If they could be engaged in visioning, planning, and implementing a shared future, the Commonwealth would be better positioned to address coming challenges and opportunities. New capabilities would be needed to achieve this outcome – e.g., new information systems. These capabilities could, however, find worldwide application.

Good leadership and strategy: Contingency planning

A process of adaptive management should be designed to accommodate changing reality across a range of scales. Clearly, however, larger changes are harder to accommodate. At the upper end of the range, we encounter an additional category of potential changes that can be termed “contingencies”. Here, that term refers to a substantial hazard that is foreseeable and involves a substantial shift in prevailing trends and expectations. These hazards require special preparations – i.e., contingency planning. Contingencies affecting the triple-E space could include:

- War, revolution, political instability, civil unrest.
- Financial crisis.
- Accident or attack affecting critical infrastructure.
- An Earth-system “tipping point” – e.g., collapse of Atlantic meridional overturning circulation (AMOC).
- Pandemic.

Good leadership and strategy: Partnerships

The Commonwealth’s pursuit of triple-E projects could benefit from partnerships domestically and internationally. Partners could include states, national governments, and a range of non-government entities. In a typical partnership of this kind, a key feature would be the pooling of resources – e.g., scientific talent, political influence, natural assets, investment capital. The partnership would be mutually advantageous if each partner gained, via the pooling of resources, a substantial net benefit.

Massachusetts has a variety of current partnerships. For example, our electricity systems are tied into a regional transmission grid. Going forward, we will need to adapt current partnerships and create new ones. Leaders should pursue new partnerships proactively, to prepare for coming challenges and opportunities. The Commonwealth did this in February 2026 by launching a partnership with Nova Scotia to advance the harnessing of offshore wind.²⁴

²⁴ Commonwealth of Massachusetts. 2026. Press Release: Massachusetts and Nova Scotia Launch Collaboration to Advance Offshore Wind. 5 February 2026.

Good leadership and strategy: Information systems

The aspects of good leadership and strategy that are discussed above have at least one common feature. Each of them would depend upon a rich supply of reliable information. Sadly, none of the existing information channels – e.g., commercial media – could meet that need.

Thus, we should create new, non-proprietary information systems spanning all phases and components of each major project in the triple-E space – e.g., decarbonizing our energy systems. These systems should be designed from the outset to complement each other. They should include an array of data bases together with decision-support tools including simulation models.

A major foreseeable hazard: The Trump administration

As discussed above, a sound strategy for climate action by Massachusetts would include contingency planning for foreseeable hazards. Sadly, at this historical moment we face a major hazard that has been foreseeable for a decade. This hazard is the hostility of the Trump administration and its allies, especially in its second period, to the principles of modern civilization. Manifestations include:

- Undermining of democracy and the rule of law.
- Normalizing of kleptocracy.²⁵
- Attacks on science and the institutions and culture that sustain it.²⁶
- Destabilization of the international order.²⁷
- Attacks on renewable energy and related measures.²⁸
- Potential economic disruption – e.g., ending the role of the US\$ as reserve currency.²⁹

The resulting damage to the US republic will not be easily repaired. One group of well-informed scholars – i.e., Steven Levitsky, Lucan Way, Daniel Ziblatt – predicts, as an optimistic outcome, ongoing political instability through the coming decade. They say:³⁰

²⁵ See, for example: Cooley, A., and Nexon, D. 2026. The Age of Kleptocracy. *Foreign Affairs*, Volume 105, Number 2, March/April 2026, pages 24-37.

²⁶ See, for example: Mervis, J. 2026. Damage Assessment. *Science*, Volume 391, Issue 6783, 22 January 2026, pages 339-341.

²⁷ See, for example: Bunde, T., and Eisentraut, S. (Editors). 2026. *Munich Security Report 2026: Under Destruction*. Munich Security Conference. February 2026.

²⁸ See, for example: Plumer, B., and Elliott, R.F. 2026. A Trump ‘Blockade’ Is Stalling Hundreds of Wind and Solar Projects Nationwide. *The New York Times*, 4 February 2026.

²⁹ See, for example: Brainard, L. 2025. Exorbitant Pillage: Can the US Dollar Survive the US Government? *Foreign Affairs*, Volume 104, Number 6, November/December 2025, pages 155-160.

³⁰ Levitsky, S., and two other authors. 2026. The Price of American Authoritarianism: What Can Reverse Democratic Decline? *Foreign Affairs*, Volume 105, Number 1, January/February 2026. Quoted text from page 43.

“The most likely medium-term outcome in the United States is neither entrenched authoritarianism nor a return to stable democracy. Rather, it is regime instability: a protracted struggle between authoritarian impulses and democratic solidarity. In the absence of a radical transformation of the Republican Party, the most optimistic scenario for the coming decade is probably a slide back and forth between dysfunctional democracy and unstable competitive authoritarianism, depending on which party holds national power.”

That outcome would pose challenges to triple-E planning in Massachusetts. Related challenges would occur in other sectors. For example, repeated attacks on science could severely damage research programs that contribute significantly to the Massachusetts economy.

Ongoing political instability at the national level would have major implications for strategy at the state level. Massachusetts and similar states would interact with the federal government in a reactive, defensive mode. They would struggle to retain federal benefits such as funding for science. They would struggle to resist destructive federal actions such as unregulated promotion of artificial intelligence (AI). They would be obliged to defer any vision of a new federal initiative, in any sector of society, that operates responsibly and benefits humanity. The Trump administration is incapable of operating such an initiative, even if it wanted to.

In that environment, any well-run state seeking to pursue a new, constructive initiative would do so independently, or via partnerships with sub-national entities in the United States and similar entities and national governments worldwide. The Commonwealth of Massachusetts is fortunate that, for now, it retains the constitutional authority to pursue partnerships domestically and internationally.

By establishing diverse partnerships, the Commonwealth could position itself as a leader in a recovering US republic. Lydia Polgreen contends that this future republic would be obliged to find a new role in the world. Polgreen says:³¹

“For all Trump’s grandstanding efforts to fashion the world in his dark image of power, the world clearly has other ideas. The coming world order, whatever it may be, will be shaped by others – and America will need to negotiate its place in it.”

³¹ Polgreen, L. 2026. This Week Has Revealed 3 Types of Americans. *The New York Times*, 30 January 2026.

5. Climate Action in Massachusetts: A Test of Leadership and Strategy

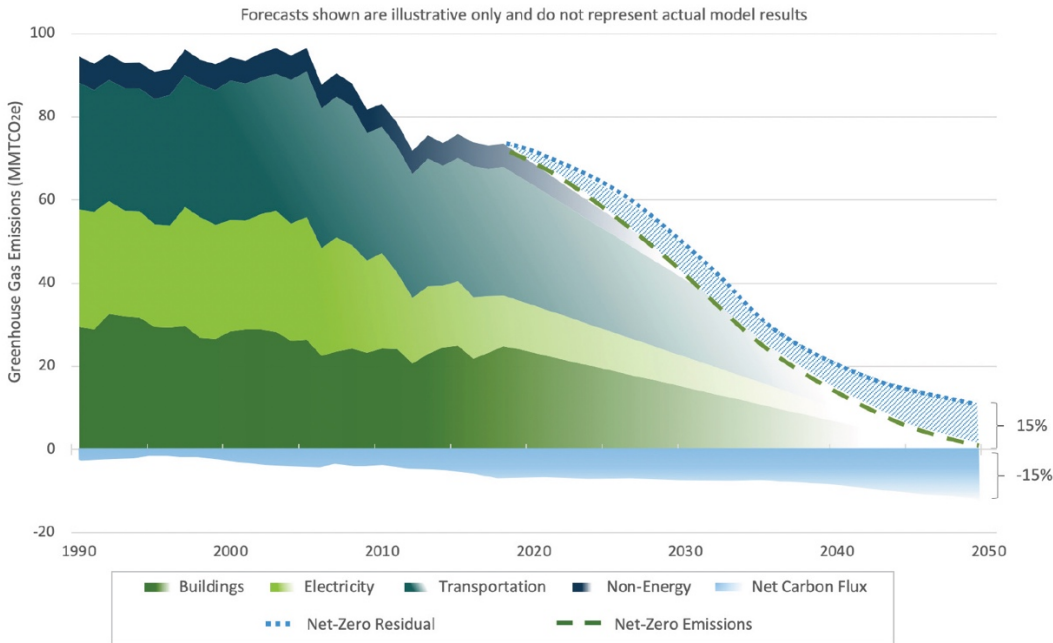
The preceding discussion sketches some standards for leadership and strategy. The Commonwealth's actions over recent decades regarding the climate emergency provide a record of experience that can be compared with these standards. Sadly, the comparison yields disappointing results.

Implementation of the Global Warming Solutions Act

Passage of the GWSA in 2008 committed the Commonwealth to achieving a measurable outcome – i.e., substantial reduction of GHG emissions. Since 2008 the Commonwealth has taken a variety of actions toward fulfilling its commitment, as documented in various web-accessible documents.

Figure 5-1 is reproduced from a “roadmap study” done by the Commonwealth's executive branch. This figure shows Massachusetts GHG emissions across the six-decade period 1990-2050. Across the first half of that period, the figure shows actual data. For the second half, it shows a projection that culminates in net-zero emissions in 2050. Note that a net-zero outcome modifies the 2050 goal set forth in the GWSA.

Figure 5-1
Massachusetts GHG Emissions: Data 1990-2020 and Projection from 2020 toward a Net-Zero Outcome in 2050, per Roadmap Study³²



One sees that statewide GHG emissions began to decline around 2005 and have been on a generally declining trajectory since. The factors causing, or intended to cause, emissions reductions can be placed into two categories:

- *GWSA Factors*: These factors reflect actions by the Commonwealth pursuant to passage of the GWSA in 2008.
- *Other Factors*: These factors reflect a diverse array of actions, events, and trends.

It is difficult to determine, from available documents, the respective extents to which GWSA Factors and Other Factors have caused our GHG emissions to decline. We know that Other Factors include some substantial influences – e.g., a market-driven shift from coal to natural gas for electricity generation.

Going forward, if the Commonwealth is serious about implementing the GWSA it should carefully assess the effects of GWSA Factors and Other Factors on emissions trends. The findings should be thoroughly documented and promptly published. These steps would be vital parts of a process of adaptive management.

³² Mass. Executive Office of Energy and Environmental Affairs. 2020. *Massachusetts 2050 Decarbonization Roadmap*. Mass. Executive Office of Energy and Environmental Affairs. December 2020. Figure reproduced from Figure 1.

In the first years after passage of the GWSA, some stakeholders concluded that the Commonwealth's executive branch was too timid in implementing the Act. That behavior prompted the Conservation Law Foundation to sue the executive branch in 2014, leading to a decision by the state's Supreme Judicial Court in May 2016. A news story by David Abel about that decision includes the statements:³³

“In a decision environmental advocates hailed as a landmark, the state's highest court ruled Tuesday that Massachusetts regulators must set specific limits on various sources of greenhouse gases to comply with the legal obligation to reduce emissions linked to climate change. For years, environmental groups have argued that both the Patrick and Baker administrations have not done enough to meet the mandates of the state's 2008 Global Warming Solutions Act, which requires the state to cut its greenhouse gases 25 percent below 1990 levels by 2020.”

“State officials have countered that the law only requires the state Department of Environmental Protection to set emissions targets, not hard caps, and that it gives the agency broad discretion over how to reach them. In a rebuff to the state, the Supreme Judicial Court sided with the environmental groups and in a unanimous decision ordered the Baker administration to enact specific policies to carry out the required emissions cuts.”

One interpretation of this record is that the Commonwealth did not take serious action to implement the GWSA until 2016. That interpretation could be unfair. An accounting of Commonwealth action across recent decades could shed light on this matter.

Inferring the Commonwealth's strategy for climate action

The importance of sound strategy is discussed above. Sadly, however, the Commonwealth does not seem to have articulated a comprehensive strategy for climate action. Thus, its strategy must be inferred from relevant statutes and executive actions.

A process of inference is conducted here, beginning with statutes and then proceeding to executive actions. That process identifies two, partially compatible strategies that can be compared with standards as discussed above.

Inferring strategy from statutes

Examination of statutes to infer strategy focuses here on Chapter 21N – i.e., the GWSA – in its December 2025 version.³⁴ Discussion here focusses on Sections 3, 4, 5, and 3B of the chapter. Note that Sections 3 and 3B are distinct. Chapter 21N is awkwardly constructed and written.

³³ Abel, D. 2016. SJC rules Mass. failed to issue proper regulations to cut emissions. *The Boston Globe*, 18 May 2016.

³⁴ Commonwealth of Massachusetts. 2025. Mass.gov website: Chapter 21N. Accessed on 5 December 2025 at: <https://malegislature.gov/Laws/GeneralLaws/PartI/TitleII/Chapter21N>

Nevertheless, careful review of its text reveals features that could enable an upgrade of the Commonwealth's climate efforts.

Section 3 calls for reduction of the Commonwealth's GHG emissions along a declining trajectory that features "interim" limits for 2025, 2030, 2035, 2040, and 2045. For 2050, it calls for: "a 2050 statewide emissions limit that achieves at least net zero statewide greenhouse gas emissions; provided, however, that in no event shall the level of emissions in 2050 be higher than a level 85 per cent below the 1990 level." Section 3 further says that: "Each limit shall be accompanied by publication of a comprehensive, clear and specific roadmap plan to realize said limit."

Section 5 sets forth specifications for the "roadmap plans" required in Section 3. These specifications include:

"To the extent practicable, the roadmap plans required by subsection (b) of section 3 for 2025, 2030, 2035, 2040 and 2045 shall be consistent with each other, cumulative in effect and constructed to realize the 2050 statewide greenhouse gas emissions limit imposed by said subsection (b) of said section 3."

Section 4 specifies numerical values for interim limits on GHG emissions in 2030 ("at least 50 per cent below the 1990 level") and 2040 ("at least 75 per cent below the 1990 level"). Numerical values are not specified for the other interim limits.

Section 4 paragraph (g) calls for a learning process. The paragraph's complete text is as follows:

"Not more than 18 months after the last day of 2020, 2025, 2030, 2035, 2040, 2045, 2050 and any other calendar year for which a statewide greenhouse gas emissions limit is adopted pursuant to statute or regulation, the secretary shall issue a statement in writing to the clerks of the house of representatives and the senate, the house and senate committees on ways and means, the joint committee on telecommunications, utilities and energy and the joint committee on environment, natural resources and agriculture."

"The statement shall indicate, drawing upon the best available data and measurements, the degree of compliance achieved by the commonwealth with the statewide greenhouse gas emissions limit. The statement shall reasonably quantify the extent to which emissions exceeded or did not exceed the limit and shall consider the lessons to be learned from any success or failure to comply with said limit. If emissions exceeded the limit, the statement shall describe remedial steps that might be taken to offset the excess emissions and ensure compliance with the next upcoming limit adopted pursuant to statute or regulation."

The above-mentioned portions of Sections 3,4, and 5, taken together, could enable the Commonwealth to establish an effective process of adaptive management. Some creative interpretation of statutes might be required, and some statute adjustments might be needed over

time. The intent of Chapter 21N is, however, clear. The Commonwealth wants to learn by doing.

As mentioned above, Section 5 sets forth specifications for the roadmap plans required in Section 3. These specifications include:

“Each [roadmap] plan, including the 2050 plan, shall.....(xiv) include the results of quantitative modeling and analysis of the commonwealth's energy economy and greenhouse gas emissions in their state and regional context, including, but not limited to, the regional electric distribution and transmission grid; provided, however, that said modeling and analysis may be conducted in conjunction with other states or regional entities as part of an analysis of reducing regional emissions to a level consistent with this chapter; provided further, that the secretary is authorized to utilize back-cast methodology; (xv) publish the results of any modeling and analysis performed pursuant to this section and, to the maximum extent permitted by law, make available for public inspection and use the model, all model assumptions, and all input and output data; provided, that the secretary may protect from public disclosure, trade secrets, confidential, competitively sensitive or other proprietary information”.

Deconstruction of this verbiage suggests that the framers of Chapter 21N were struggling to address an important need and opportunity – i.e., the Commonwealth’s creation of electronic, non-proprietary information systems spanning all phases and components of the climate-stabilization project. These systems would be designed from the outset to complement each other. They would include an array of data bases together with decision-support tools including simulation models.

The hypothesized information systems could support a process of adaptive management. They could, at the same time, support a process of stakeholder engagement. Moreover, they could help to integrate the two processes. With some creative interpretation, the quoted text from Section 5 could enable the Commonwealth to create these information systems.

Section 3B of Chapter 21N opens a window into a different arena of planning and decision-making. Section 3B’s complete text is:

“Not later than March 1 of **every third year** [emphasis added] of each plan approved under section 21 of chapter 25, the secretary shall set a goal, expressed in tons of carbon dioxide equivalent, for the succeeding plan's necessary contribution to meeting each statewide greenhouse gas emissions limit and sublimit adopted pursuant to this chapter.”

In that text, Section 3B takes us to a different statute – i.e., Chapter 25, which focusses on the Department of Public Utilities (DPU).³⁵ Within Chapter 25 we are taken to Section 21, which addresses efficiency-enhancement and demand-reduction programs conducted by electricity and

³⁵ Commonwealth of Massachusetts. 2025. Mass.gov website: Chapter 25. Accessed on 5 December 2025 at: <https://malegislature.gov/Laws/GeneralLaws/PartI/TitleII/Chapter25>

natural-gas utility companies. These programs are regulated by the Commonwealth via the DPU. They play central roles in the Commonwealth's effort to reduce GHG emissions.

From a strategic perspective, splitting of planning and decision-making across two different arenas raises red flags. The two arenas could differ in their cultures, practices, and legal constraints. We see that they operate on differing time cycles – i.e., five years versus three years. Thus, there seems to be a substantial potential for friction and confusion, and some potential for overall program failure. The Commonwealth does not offer any strategic argument to allay these concerns.

Review of these statutes did not identify any provision, either explicit or implicit, for contingency planning related to climate action. The author would welcome correction on that point.

Strategy inferred from statutes: Summary

The preceding discussion indicates that statutes imply a Commonwealth strategy for climate action as follows:

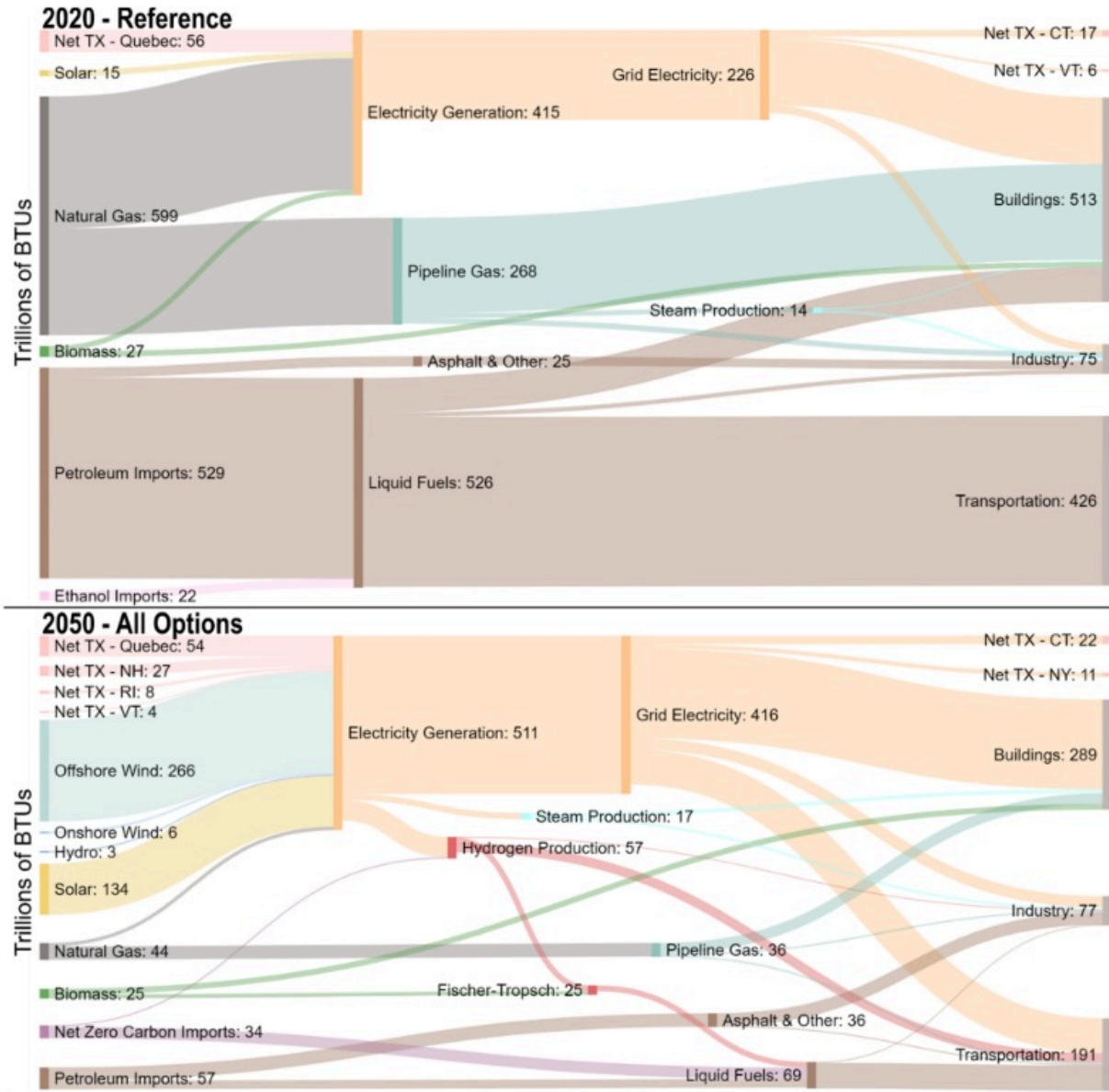
- Relevant statutes call, in effect, for a process of adaptive management, and provide an enabling framework for that process.
- Statutes also call for, and enable, a process of stakeholder engagement.
- Statutes also call for, and enable, creation of climate-action information systems.
- Statutes split planning and decision-making across two different arenas operating on differing time cycles, creating potentials for friction, confusion, and program failure.
- Statutes do not call for, or enable, contingency planning.

*Inferring strategy from executive actions:
Identifying potential pathways*

Examination of climate actions by the Commonwealth's executive branch, in order to infer strategy, reveals a mixed picture. Here, discussion begins by focusing on the executive's conduct of technical analysis to identify future pathways for the Massachusetts economy that are consistent with our GWSA obligations.

Figure 5-2 illustrates a body of technical analysis by the executive and its contractors that has identified pathways leading, ultimately, to full decarbonization of Massachusetts energy systems. Figure 5-2 is reproduced from the Commonwealth's Decarbonization Roadmap Study for 2050, published in December 2020. This figure shows energy flows in Massachusetts for two cases – i.e., actual flows in 2020, and a scenario for 2050. Unfortunately, energy flows are shown in obsolete units – i.e., British Thermal Units (BTUs). Metric units would be better.

Figure 5-2
Massachusetts Energy Flows, Actual for 2020 and a Scenario for 2050, per Roadmap Study³⁶



³⁶ Evolved Energy Research (for the Commonwealth of Massachusetts). 2020. *Energy Pathways to Deep Decarbonization: A Technical Report of the Massachusetts 2050 Decarbonization Roadmap Study*. Massachusetts Executive Office of Energy and Environmental Affairs. December 2020. Figure reproduced from page 35.

The scenario for 2050 that is shown in Figure 5-2 seems reasonable. It is consistent with present and expected technical capabilities, and with Massachusetts' geographic situation. A notable feature is that offshore wind becomes the largest single source of energy. Various issues deserve further investigation. An example is the ability of fossil-fuel systems to operate at low levels of demand.³⁷

The Commonwealth has performed a valuable service by developing the 2050 scenario shown in Figure 5-2. Note, however, that the three-decade energy shift portrayed in Figure 5-2 would be a massive socio-technical transition. It would pose major challenges while offering major opportunities. It would demand high-caliber leadership and strategy. Thus, present deficiencies in these attributes in the Commonwealth are concerning.

Figure 5-2 is drawn from the Commonwealth's Decarbonization Roadmap Study for 2050, published in December 2020. In June 2022 the Commonwealth published a Clean Energy and Climate Plan (CECP) for 2025/2030, and in December 2022 it published a CECP for 2050. Each of these CECP documents mentions the Decarbonization Roadmap Study for 2050 as one input among others. Thus, it seems that there was a discontinuity in the Commonwealth's analytic work, somewhere between 2020 and 2022. That discontinuity requires an explanation.

The two CECP documents provide some valuable findings. For example, the CECP for 2025/2030 says³⁸

“Economic analysis conducted as part of this 2025/2030 CECP estimates that the strategies and policies designed to achieve our emissions limits and sublimits will help grow the Massachusetts economy.”

“Overall modeling indicates that the 2025/2030 CECP will result in a net gain of over 22,000 jobs by 2030, most of which will be in installing electric vehicle chargers, solar photovoltaic projects, energy efficiency retrofits in buildings, offshore wind projects, and transmission lines to connect the clean energy that powers the economy. Ninety-five percent of new jobs will be middle to high wage, paying over \$26 per hour.”

“Reduced consumer spending on imported oil and gas will lead to an average household savings of approximately \$400 per year, making the local economy more resilient to swings in global fossil fuel prices. Improved air quality will result in public health benefits valued at over \$400 million per year.”

³⁷ See: Lappen, J., and Grubert, E. 2026. Fossil energy minimum viable scale. *Science*, Volume 391, Issue 6784, 29 January 2026, pages 449-452.

³⁸ Mass. Executive Office of Energy and Environmental Affairs. 2022. *Massachusetts Clean Energy and Climate Plan for 2025 and 2030*. Mass. Executive Office of Energy and Environmental Affairs. 30 June 2022. Quoted text from page xi.

Similarly, the CECP for 2050 says:³⁹

“The Commonwealth can achieve its 2050 emission limits with technologies that are already known and largely commercialized. Massachusetts in 2050 will look different from today, but it will not be entirely foreign. The Commonwealth’s electric power supply will be both bigger and cleaner as it accommodates the electrification of buildings and vehicles while also meeting increasingly stringent emissions standards.”

“Offshore wind will be a cornerstone of the Commonwealth’s electricity generation alongside solar PV and energy storage, with a portfolio of additional clean energy technologies to balance variable resources on the grid. Several high-voltage transmission lines throughout the Northeast will allow the sharing of low-cost, clean energy among Massachusetts and its neighbors.”

*Inferring strategy from executive actions:
Pursuit of selected pathways*

Here, inference of strategy focuses on the executive’s pursuit of selected pathways. The term “pursuit” encompasses the planning of practical actions, their implementation, tracking of their outcomes, compilation of data about each part of this process, and publication of data.

As mentioned above, management and publication of data could occur via electronic, non-proprietary information systems that span all phases and components of the climate-stabilization project. These systems could provide a dynamic, frequently-refreshed picture of the Commonwealth’s pursuit of pathways. Stakeholders could receive instant answers to a wide range of questions. To illustrate, consider some data that the hypothesized information systems could instantly provide regarding heat pumps in Massachusetts:

- Past and projected trends in heat-pump deployment and use.
- Effects on use of fossil fuels and electricity, and implications for GHG emissions.
- Implementation, outcomes, benefits, and costs of Commonwealth programs to promote heat pumps.
- Stakeholder perspectives regarding present and projected use of heat pumps.

The hypothesized information systems do not yet exist. They could, however, be developed relatively quickly, integrated with new processes for adaptive management and stakeholder engagement. Note that the overall architecture of these systems could be applied worldwide.

Massachusetts has accumulated a rich body of experience that could be captured in these information systems. Observable manifestations of climate action in recent years include growing numbers of heat pumps, solar arrays, EV charging stations, electric buses, and housing

³⁹ Mass. Executive Office of Energy and Environmental Affairs. 2022. *Clean Energy and Climate Plan for 2050*. Mass. Executive Office of Energy and Environmental Affairs. December 2022. Quoted text from page 7.

retrofits. Related developments include municipal composting and conversion of roads to mixed use. Larger projects include offshore wind farms and construction of the nation's largest underground electricity substation, in Cambridge.

Thus, the Commonwealth has an interesting story to tell about climate action. The vehicle the Commonwealth has chosen to tell this story is the Climate Report Card. This is a web-accessible, static document. A 2024 version was published in January 2025, and a 2023 version was published in December 2023.

The 2024 Climate Report Card says, in its Overview:⁴⁰

“Massachusetts has advanced some of the strongest climate policies nationwide and has made significant progress in the past year, including securing unprecedented federal funds, advancing clean energy infrastructure siting and permitting reforms, significantly increasing the pace of heat pump installations and building weatherization, and expanding state and local investments in climate resilience.”

“Nevertheless, the most challenging period for climate action through 2050 remains 2025-2030, when the sharpest emissions reductions are expected and climate change impacts become more intense.”

At the time of publication of that statement – i.e., January 2025 – the Commonwealth knew that the United States would experience a second Trump administration. The incoming administration's hostility to climate action was readily foreseeable. Yet, the 2024 Climate Report Card did not invoke any contingency plan to address the coming hostility.

The Climate Report Cards represent a good-faith effort by the Commonwealth personnel involved. Sadly, however, these Cards are pale imitations of the information systems that we need and could have. Fortunately, this problem could be fixed by assigning greater priority and resources to the information arena.

Compatibility of strategies inferred from statutes and executive behavior

The preceding discussion shows that the executive branch has been taking actions to fulfill the Commonwealth's obligations under the GWSA. Some actions have focused on identifying future pathways for the Massachusetts economy. Others have focused on the pursuit of selected pathways.

These actions have yielded valuable outcomes. Their effectiveness could, however, be significantly enhanced by the Commonwealth's development of information systems as discussed above. With that caveat, we can say that these actions by the executive branch have been compatible with statutes.

⁴⁰ Mass. Executive Office of Energy and Environmental Affairs. 2025. *2024 Massachusetts Climate Report Card*. Mass. Executive Office of Energy and Environmental Affairs. 17 January 2025. Quoted text from Overview.

In other respects, however, the executive's apparent strategy has deviated from the apparent strategy set forth in statutes. Some notable deviations are discussed here.

The executive has not responded to the statutes' call for a process of adaptive management. In illustration, the executive has not responded to the statutes' call for roadmaps, covering five-year intervals from 2025 to 2045, that are "consistent with each other, cumulative in effect and constructed to realize the 2050 statewide greenhouse gas emissions".

Similarly, the executive has not responded to the statutes' call for a process of stakeholder engagement, nor to their call for creation of climate-action information systems.

Sadly, a point of convergence between the strategies apparent from statutes and from executive-branch behavior is that neither one makes any clearly-evident provision for contingency planning.

Correcting deficiencies in strategy: An urgent imperative

The preceding discussion shows that the Commonwealth's climate-action effort is handicapped by deficiencies in strategy. There are related deficiencies in leadership. The deficiencies in strategy require urgent correction, for two reasons. First, climate action is entering a period of rising technical challenges. Second, climate action faces hostility from the Trump administration.

Apropos of rising technical challenges, the Commonwealth warns us, in a passage quoted above, that "the most challenging period for climate action through 2050 remains 2025-2030". It is likely, however, that the challenging period will be longer, perhaps extending until 2050. The Commonwealth's analyses of decarbonization show that, across the period 2025-2050, a deliberate shift from old to new energy systems must occur faster, and at greater scale, than was required to achieve the GHG emissions reductions observed from 2005 to 2025. Figure 5-2 illustrates this finding.

This finding need not imply that the energy shift would be uneconomic or otherwise infeasible. It does imply that the Commonwealth's future efforts must be disciplined, consistent, and well managed.

Apropos of the Trump administration's hostility to climate action, this has been evident since early 2025 and was foreseeable much earlier.

The Trump administration's blitzkrieg approach

The Trump administration boasts about its use of psychological-operations techniques, many developed in the military context of blitzkrieg, to throw its opponents off balance and encourage weak responses such as preemptive surrender.

Luke Broadwater, in a January 2025 news story, discusses this behavior, saying:⁴¹

“A deliberate effort by the president and his team to roll out an unceasing flow of initiatives has knocked his rivals off balance in the first days of the new administration. The strategy has existed since at least 2018, when the former Trump administration strategist Stephen K. Bannon boasted of the ability to overwhelm Democrats and any media opposition through a determined effort to “flood the zone” with initiatives.”

“This time [i.e., January 2025], the flood is bigger, wider and more brutally efficient. As President Trump begins his second term, he has enacted his agenda at breakneck speed as part of an intentional plan to knock his opponents off balance and dilute their response.”

To support its “flood the zone” approach, the Trump administration also engages in related behaviors including performative cruelty, deceit, creation of uncertainty, and blatant lawbreaking.

As mentioned by Luke Broadwater, this threat has been evident for a decade. It could, therefore, have been addressed in contingency planning by potentially targeted entities. There are known techniques for resisting this threat.

Although this threat was foreseeable, it enjoyed initial success. Various law firms, universities, and businesses across the United States engaged in preemptive surrender. Other targeted entities have learned how to resist, but the threat remains serious.

H.4744 and preemptive surrender

In November 2025 the Massachusetts legislature was considering a bill addressing energy affordability and related matters. Without warning or public debate, legislators proposed a new version of the bill, designated as H.4744, that would weaken the Commonwealth's commitment to climate action. That outcome would be achieved, in part, by amending Chapter 21N.

⁴¹ Broadwater, L. 2025. Trump's 'Flood the Zone' Strategy Leaves Opponents Gasping in Outrage. *The New York Times*, 28 January 2025.

A group of civil-society leaders⁴² criticize H.4744 in a November 2025 policy essay that begins as follows:⁴³

“Massachusetts is known as a leader in clean energy and climate action. Our policies have lowered emissions, created jobs, and helped families save money on energy. But a bill currently under consideration in the House of Representatives on Beacon Hill threatens to undo that progress and would be a damaging mistake for our state.”

“This bill, proposed by Rep. Mark Cusack, the co-chair of the Legislature’s Joint Committee on Telecommunications, Utilities, and Energy, is essentially a fossil fuel industry wish list. It rolls back the Commonwealth’s enforceable 2030 climate targets, weakens the Mass Save energy efficiency program, eliminates efforts designed to make energy efficiency more affordable for working families, and even resurrects the disastrous “pipeline tax” that would allow utilities to charge residents for unnecessary gas infrastructure. In short, it hands fossil fuel companies a gift while leaving Massachusetts households to foot the bill.”

“At a moment when President Trump is dismantling federal climate policy, this bill would do the work for him. It would abandon our 2030 emissions targets, gut our most effective programs, and lock Massachusetts into the very fossil fuel dependence that has driven today’s affordability crisis. It would cede our hard-earned reputation as a clean energy innovator and put our economy, our health, and our climate at risk.”

H.4744 begins by listing actions, by the Trump administration and its allies, that hinder the Commonwealth’s ability to implement its climate commitment. While these actions are real and disturbing, they were foreseeable and are consistent with the Trump administration’s blitzkrieg approach. H.4744’s response is, in effect, to engage in preemptive surrender.

To add to the embarrassment of this surrender, it occurred while COP30 was being held in Brazil, where delegates struggled to keep the world on track toward a sustainable civilization.

Moreover, reporting indicates that industry lobbyists played a substantial role in creating H.4744.⁴⁴ Also, it was created within a body – i.e., the Massachusetts legislature – that has been described by Jeanne Kempthorne as “one of the least effective, least efficient, and least transparent legislatures in the nation”.⁴⁵ This legislature has declined to submit to an audit

⁴² Members of the group are: Cindy Luppi (Clean Water Action), Kyle Murray (Acadia Center), Caitlin Peale Sloan (Conservation Law Foundation), and John Walkey (GreenRoots).

⁴³ Luppi, C., and three other authors. 2025. House climate bill is a big step backward: Abandoning 2030 emissions goal would be defeatist concession to Trump, fossil fuel industry. *Commonwealth Beacon*, 15 November 2025.

⁴⁴ See, for example: Gross, S.J. 2025. ‘It just seems like amateur hour’: As climate bill worked through Beacon Hill, industry donations poured in. *The Boston Globe*, 16 December 2025.

⁴⁵ Kempthorne, J. 2024. Why can’t the Legislature do its job? *Commonwealth Beacon*, 7 September 2024.

despite a call for such an audit by a large majority of voters in a statewide referendum in November 2024.⁴⁶

H.4744 as a marker for a societal turning point

In this paper, discussion of H.4744 focuses on the original version that was created in November 2025. Going forward, H.4744 might be re-introduced in its present form or in a modified form. It might be replaced with another bill using a different designation. In some version, it might become law. This paper will not attempt to track such outcomes.

This paper shows that H.4744 offers ill-advised policy proposals in two issue areas – i.e., climate action, and nuclear power. Moreover, examination of these proposals reveals larger deficiencies in leadership and strategy. At the same time, however, examination of H.4744 reveals that it contains some potentially valuable proposals.

At first sight, this situation might seem to pose a dilemma. Do we scrap H.4744 entirely or do we attempt to rescue it? Fortunately, however, there is another way forward. We could use H.4744 as a marker for a societal turning point – i.e., a necessary course correction that puts us on a better pathway of planning and decision-making. One feature of that pathway would be that the Commonwealth would cease tinkering with valuable statutes.

⁴⁶ See, for example: Connaughton, M., and Enrich, P. 2025. Why does Beacon Hill continue to dodge an audit? *The Boston Globe*, 5 December 2025.

6. Another Test of Leadership and Strategy: Nuclear Power

The preceding discussion focuses on one ill-advised policy proposal in H.4744 – i.e., weaken our commitment to climate action. That proposal creates a test of the Commonwealth’s capabilities in leadership and strategy. If we turn the proposal into law, we fail the test. If we decisively reject the proposal, we pass.

Now, consider a second ill-advised policy proposal in H.4744 – i.e., repeal a law established by a statewide referendum in 1982. That proposal creates another test of the Commonwealth’s capabilities in leadership and strategy. We could fail or pass the test as discussed above.

H.4744 and Chapter 503 of the Acts of 1982

H.4744’s proposal to overturn the statewide referendum of 1982 is stated in its Section 80 as follows:

“Chapter 503 of the acts of 1982 is hereby repealed.”

There is no accompanying explanation. We are not told what Chapter 503 says or why it should be repealed. H.4744 conveys the impression, perhaps intentionally, that Chapter 503 is insignificant and can be arbitrarily swept aside.

Closer examination reveals, however, that Chapter 503 is valuable in itself and represents two of the Commonwealth’s most precious assets – i.e., a healthy democracy, and an empowered citizenry. H.4744 casually attacks these assets.

In a statewide referendum held in 1982, a large majority of voters demanded that specific conditions must be met before a new nuclear power plant could be built in Massachusetts. That demand was embodied in law via Chapter 503 of the Acts of 1982.⁴⁷ Chapter 503 has nine sections. For the purposes of discussion here, Section 3 is most pertinent. It states:⁴⁸

“Section 3. No new nuclear power plant shall be constructed or operated within the Commonwealth unless:

(a) construction and operation of the proposed nuclear power plant have been approved by a majority of the voters voting thereon in a state-wide general election; and

(b) the General Court has found, and has so certified by resolution duly adopted by majority vote of the members of each House:

⁴⁷ The formal title of Chapter 503 is “The Nuclear Power and Waste Disposal Voter Approval and Legislative Certification Act”.

⁴⁸ Commonwealth of Massachusetts. 2026. State Library of Massachusetts Digital Collections website. Accessed on 13 February 2026 at: <https://archives.lib.state.ma.us/entities/archivalmaterial/4d804842-fdcc-4399-94ea-cd86238ac1b1>

- (i) that there exists an operating, federally-licensed facility for the timely and economical permanent disposal of high-level radioactive wastes generated by the proposed nuclear power plant;
- (ii) that an adequate emergency preparedness plan for the proposed nuclear power plant has been developed, approved, and implemented by the Commonwealth;
- (iii) that effective emission standards applicable to the proposed nuclear power plant have been promulgated by the Commonwealth to protect the public against health and safety hazards of radioactive air pollutants traceable to nuclear power plants within the Commonwealth;
- (iv) that there exists a demonstrated, federally-approved technology or means for the timely and economical decommissioning, dismantling, and disposal of the proposed nuclear power plant; and
- (v) that the proposed nuclear power plant offers the optimal means of meeting energy needs from the combined standpoints of overall cost, reliability, safety, environmental impact, land-use planning, and avoiding potential social and economic dislocation.”

Section 3 sets forth several conditions for the construction of a new nuclear power plant. Attention here is focused on three conditions that can be summarized as follows:

- Section 3(a) gives voters the right of final approval.
- Section 3(b)(i) requires the functioning of a radioactive-waste repository.
- Section 3(b)(v) requires the legislature to certify that the nuclear plant “offers the optimal means of meeting energy needs”.

These conditions are not onerous. A nuclear industry that is well run, socially responsible, and properly regulated, offering a product that is truly “optimal”, should be able to satisfy these conditions easily. Sadly, however, the actual nuclear industry of today has none of these characteristics.

Thus, the voters in 1982 had a grasp of nuclear-power issues that remains valid today. They did not fully trust the nuclear industry or its regulators to serve the public interest, and they sought to protect the public by embodying a reasonable set of conditions – i.e., Chapter 503 – in state law. Experience since 1982 shows that the voters acted prudently. They were notably prescient on some key points.

How the proposed repeal of Chapter 503 came to be in H.4744

H.4744’s proposed weakening of the Commonwealth’s climate commitment, as discussed above, was a legislative initiative. By contrast, its proposed repeal of Chapter 503 was an executive-branch initiative. This aspect of H.4744 was included in a precursor bill submitted to the

legislature by the Healey administration in May 2025. The administration’s justification for this aspect consists of a paragraph in Governor Healey’s cover letter, as follows:⁴⁹

“In Massachusetts, in addition to requiring rigorous federal, state, and local approvals through formal siting and licensing processes that require public input, any proposed new nuclear fission facility must also secure approval via a statewide ballot initiative with a majority vote. No other generation source in the state requires this statewide ballot initiative approval. This Act would repeal a 1982 law that mandates that any new nuclear facility receive approval through a statewide ballot initiative, eliminating a major barrier to the consideration of new small modular reactors [SMRs] that could improve reliability, stabilize prices, and decarbonize the region’s power grid. Since 2020, eight of the 14 states with a nuclear moratorium or similar provisions have either fully or partially lifted limitations on building new nuclear and three more states are exploring it.”

Assessing the Healey administration’s justification statement

The paragraph quoted above can be termed the Healey administration’s “justification statement” in support of the proposed repeal of Chapter 503. This paragraph can best be understood in a larger context, encompassing the Commonwealth’s recent statements and actions related to nuclear power, and a well-funded effort by the nuclear industry to promote SMRs.

The justification statement, viewed in its larger context, deserves thorough assessment by diverse, independent experts. Here, a partial assessment is offered, with three foci. First, attention is given to an unspoken assumption underlying the justification statement – i.e., nuclear power is a “normal business” that does not require any special consideration or regulation. Second, the significance of radioactive waste is discussed. Third, nuclear power is discussed from a political-economy perspective.

An independent analyst embarking on an assessment of the justification statement will immediately encounter a red flag, warning of danger ahead. Strangely, it seems that the Healey administration does not see this flag, although it is evident in the justification statement itself.

We encounter the red flag as follows. On the one hand, we are told that SMRs could bestow great benefits upon us. Part of the subtext is that SMRs represent “advanced” technology. On the other hand, we are told that SMRs face a “major barrier” that prevents them from bestowing their benefits. What is this barrier? It emerges that the barrier has two levels, represented by Chapter 503.

One level of the barrier is a set of conditions embodied in Chapter 503. As discussed above, these conditions are not onerous. A nuclear industry that is fit for purpose should be able to satisfy these conditions easily. The promoters of SMRs do not believe, however, that they can satisfy these conditions. Thus, they insist, the conditions must be swept aside. This position

⁴⁹ Healey, M.T. 2025. Letter from Governor Healey to the Massachusetts legislature, covering the submission of a proposed Act relative to energy affordability, independence and innovation. 13 May 2025.

invites skepticism about the ethics and technical credibility of the SMR promoters. Moreover, incorporation of this position in H.4744 casts doubt on the Commonwealth's ability to critically assess technologies.

The second level of the barrier is the will of the people. The existence of Chapter 503 reflects the functioning of two of the Commonwealth's most precious assets – i.e., a healthy democracy, and an empowered citizenry. The SMR promoters tell us that these assets create a barrier preventing their bestowal of benefits upon us. Thus, we are told, we must accept the degradation of these valuable assets.

These considerations warn us that repeal of Section 503 could be a strategic folly. This folly would be compounded if we subsequently discovered that the SMR promoters had been purveyors of snake oil. The opportunity costs of that outcome could be massive.

Why nuclear power is not a normal business: Overview

The Healey administration's justification statement complains that "no other [electricity] generation source in the state" is required to satisfy the conditions set forth in Chapter 503. That complaint is, in effect, an assertion that nuclear power is a "normal business", requiring no special consideration or regulation.

Actually, fundamental features of nuclear power prevent it from being a normal business. In the United States and elsewhere, commercial nuclear power was created by, and depends upon, the national government. Private entities have taken on roles such as equipment vendors and plant owners, while accepting that they must work closely with national government.

Local governments have almost no influence on the industry. State governments have limited influence via mechanisms such as electricity market regulation. Regulation of safety and security is entirely in the hands of national government.

The non-normal aspects of nuclear power affect society in a variety of ways. For example, US federal law prevents insurers in normal markets from covering the offsite impacts of nuclear-plant incidents, and limits the liability of plant owners.⁵⁰

Two non-normal aspects of nuclear power are discussed below – i.e., military connections, and government support.

⁵⁰ US Nuclear Regulatory Commission. 2025. *Backgrounder: Nuclear Insurance and Disaster Relief*. NRC Office of Public Affairs. July 2025.

Why nuclear power is not a normal business: Military connections

A major non-normal feature of nuclear power is its intimate relationship with the military. A 2019 report published by the Atlantic Council says:⁵¹

“Civilian nuclear power and the associated supply chain are interwoven with key US national security priorities, specifically US leadership in global nuclear nonproliferation norms, the support of the nuclear navy, and the nation’s nuclear deterrent.”

“The connectivity of the civilian and military nuclear value chain – including shared equipment, services, and human capital – has created a mutually reinforcing feedback loop, wherein a robust civilian nuclear industry supports the nuclear elements of the national security establishment, while underwriting the strategic value of civilian nuclear power to the United States and encouraging growth over the long term.”

In illustration of how these connections play out, each US nuclear weapon requires tritium to function, and the weapon’s inventory of tritium must be regularly refreshed. The current sole source of this tritium is a pair of nuclear power plants – i.e., Watts Bar Units 1&2 – operated by the Tennessee Valley Authority.⁵²

Why nuclear power is not a normal business: Government support

In the United States and elsewhere, commercial nuclear power was created by national government. The first generation of nuclear power plants became operational in the 1950s. Over the subsequent seven decades, the nuclear industry has evolved in various ways. For example, private entities have taken on greater roles. Nevertheless, the industry has continued to depend upon national government.

Robin Gaster explains, in a 2025 essay, how this dependency relates to the future of SMRs. Gaster is a supporter of SMRs. It is, therefore, noteworthy that Gaster’s essay opens with the statement:⁵³

“To reach their potential, SMRs will require effective support across the entire development cycle – and a sustained commitment based on bipartisan, long-term political backing.”

⁵¹ Ichord, R.F., and Oosterveld, B. 2019. *The Value of the US Nuclear Power Complex to US National Security*. Atlantic Council. October 2019. Quoted text from pages 2 and 3.

⁵² For background see: Laird, I. 2025. *The Weapons Engineering Tritium Facility*. Los Alamos National Laboratory. 5 June 2025.

⁵³ Gaster, R. 2025. Think small: Why America should bet on small modular reactors. *Utility Dive*, 4 June 2025.

Gaster's essay goes on to explain why government support for SMRs is needed, and how it could be provided. That discussion includes the statement:

“SMR investors face four core risks: [1] technological risks – new designs may not pan out, or competing energy sources could suddenly become better or cheaper (as solar and gas have done); [2] market risks – on the demand side, we don't know whether the projected boom in energy demand is going to last, or even occur at all, or whether nuclear's advantages will really matter; on the supply side, we don't know if fuel will be readily available or whether plants can be built on time and on budget; [3] regulatory risks – the pathway to approval for new nuclear designs is currently unpredictable, even though the NRC is working to improve it. International coordination, meanwhile, remains in its infancy; and [4] political risks – nuclear needs bipartisan support because builds take so long, and development depends heavily on government backing. Sudden shifts in strategy would be disastrous.”

The government support that Gaster calls for would be coordinated by the Trump administration. Yet, at this moment in our history the Trump administration and its allies are undermining the US republic. Outcomes could include ongoing political instability through the coming decade and beyond. Is it realistic, at this moment, for SMR advocates to expect close, sustained cooperation with the federal government?

Dependency of SMRs on government support also raises other questions. Consider two. First, is it prudent to pursue a technology that, after seven decades of development, cannot stand on its own feet? Second, is it prudent for a state – e.g., Massachusetts – to pursue a technology whose future is entangled with the Trump administration?

7. Significance of the Radioactive-Waste Condition in Chapter 503

Chapter 503 sets forth several conditions that must be met before a new nuclear power plant is built in Massachusetts. Section 3(b)(i) specifies one of those conditions – i.e., the existence of “an operating, federally-licensed facility for the timely and economical permanent disposal of high-level radioactive wastes”.

Since the 1980s, relevant parties in the United States have agreed that the concept of “permanent disposal” refers to the placement of containers of radioactive waste in a mined, underground facility – i.e., a “repository”.

The category “high-level radioactive wastes” covers a variety of waste forms. In the United States, now and for the foreseeable future, the dominant waste form, in terms of mass and toxicity, is spent nuclear fuel (SNF). A unit of SNF is a used, intact fuel assembly that has been removed from a nuclear reactor. It contains large inventories of radioactive and fissile materials, and generates heat from radioactive decay.

Thus, Section 3(b)(i) of Chapter 503 requires the functioning of a federally-licensed repository for SNF.

H.4744 and radioactive waste

H.4744 says nothing about radioactive waste. Similarly, the Healey administration’s justification statement says nothing about radioactive waste. In the latter case this omission creates a misleading picture of Chapter 503. The justification statement cultivates a false impression that the only condition set forth in Chapter 503 is a statewide ballot. One hopes that this outcome was not intentional.

By proposing the repeal of Chapter 503 without mentioning radioactive waste, the Commonwealth’s executive and legislative branches are telling us, intentionally or not, that management of radioactive waste is a matter of no significance. In their view, consideration of this matter is a “major barrier” to our receiving alleged benefits from SMRs. We are told, in effect, to ignore this matter.

Discussion here shows that, in reality, management of radioactive waste is a matter of considerable significance. Moreover, it shows that the Commonwealth itself, in the comparatively recent past, was concerned about hazards associated with SNF and sought to reduce them. The Commonwealth has, apparently, forgotten that history.

The US effort to dispose of high-level radioactive waste

Since the 1950s there has been a national effort in the United States to dispose of high-level radioactive waste. The characteristics of that effort have changed over time. To date, the effort has been unsuccessful.

In 2007, this author was invited to write a journal article reviewing the US effort. The article covers the 50-year period 1957 to 2007. It was published in 2008.⁵⁴ It informs the discussion here. Note that the US effort from 2008 to 2026 has proceeded at a relatively low level, without any significant new development.

During the initial decades of the US effort, various options for disposal of radioactive waste were considered – e.g., shooting the waste into space.⁵⁵ Since the 1980s, however, relevant parties have agreed that disposal should occur via placement in a repository.

In 1982 – i.e., the same year as the Massachusetts referendum underlying Chapter 503 – the US Congress passed the Nuclear Waste Policy Act (NWPA). The NWPA formalized a consensus that disposal should occur via a repository. The NWPA was intended to establish a national program to construct and operate repositories.

At an early point in its text – i.e., Section 111(a)(3) – the NWPA says:⁵⁶

“Federal efforts during the past 30 years [i.e., 1952 to 1982] to devise a permanent solution to the problems of civilian radioactive waste disposal have not been adequate”.

In this statement the federal government acknowledges two key points. First, the federal government has an obligation to dispose of radioactive waste. Second, as of 1982, the government has failed to fulfill its obligation. We can assume that the framers of the Massachusetts 1982 referendum were aware of these points. Thus, they were wise to include the repository condition that became Section 3(b)(i) of Chapter 503. Similarly, the voters were wise to demand this condition.

The NWPA was intended to put the federal government on track to fulfill its obligation. A specific target date was set. The NWPA committed the federal government to begin disposing of high-level radioactive waste from nuclear power plants by 1998. Thus, Massachusetts voters in 1982 could reasonably expect that the nuclear industry could meet the repository condition – i.e., Section 3(b)(i).

Failure of the NWPA and its implications

Sadly, the NWPA failed. Today, in 2026, there is no high-level waste repository in the United States and no plan to construct one. Projects for interim, surface storage of waste at remote locations have been proposed but, to date, none has succeeded. The waste created at nuclear

⁵⁴ Thompson, G.R. 2008. The US Effort to Dispose of High-Level Radioactive Waste. *Energy & Environment*, Volume 19, Numbers 3+4, pages 391-412.

⁵⁵ See, for example: Thompson, R.L., and two other authors. 1974. *Study of Extraterrestrial Disposal of Radioactive Wastes Part I: Space Transportation and Destination Considerations for Extraterrestrial Disposal of Radioactive Wastes*. NASA Technical Memorandum, NASA TM X-71557. May 1974.

⁵⁶ US Department of Energy. 2004. *Nuclear Waste Policy Act as Amended*. DOE Office of Civilian Radioactive Waste Management, Washington, DC. March 2004.

power plants remains there. The reasons for failure of the NWPA are discussed below. They are relevant to current debate about the future role of nuclear power.

As mentioned above, the dominant form of high-level radioactive waste in the United States today is SNF. When an SNF assembly is first discharged from a nuclear reactor, it is placed in a water-filled pool. When the present generation of nuclear power plants was designed, the nuclear industry expected that, after a few years of pool storage, the SNF would be taken away for reprocessing or disposal. Accordingly, the pools were equipped with low-density storage racks.

Beginning in the 1980s, it became clear that SNF would remain at power plants for a substantial period. In response, the nuclear industry re-equipped its pools with high-density racks. That shift created a massive, unnecessary radiological hazard that is discussed below.

Eventually, even with high-density racks, the pools became filled with SNF. In response, the nuclear industry transferred surplus SNF into a dry-storage mode – i.e., storage of SNF inside helium-filled, stainless-steel canisters placed within concrete structures. This mode is termed an independent spent fuel storage installation (ISFSI). At present, these ISFSIs are at nuclear power plant sites. In principle, they could be built elsewhere.

In 2014, the US Nuclear Regulatory Commission (NRC) published a generic environmental impact statement (EIS) for storage of SNF in the United States.⁵⁷ Note that storage implies the absence of a repository. In the EIS, NRC assumes that SNF will initially be stored at nuclear-plant sites, at first in pools and then in onsite ISFSIs. Subsequently, says NRC, some SNF might be transferred to offsite ISFSIs.

NRC identifies a range of time periods for continued storage of SNF. The shortest period is 60 years after reactor shutdown. The longest period is “indefinitely”. In the latter case NRC assumes that institutional controls will remain operative indefinitely and that each ISFSI will be rebuilt at intervals of about 100 years. NRC does not offer any objective basis for these assumptions.

Why did the NWPA fail?

The NWPA set in motion a complex socio-technical process that unfolded over several decades. A simplified, but broadly accurate, story is presented here, drawing from the author’s 2008 article.⁵⁸ This story explains why the NWPA failed.

The framers of the NWPA understood that almost any community could be reluctant to host a high-level radioactive waste repository. Accordingly, they sought to build trust by establishing three key principles. First, there would be one repository in western states and one in eastern

⁵⁷ US Nuclear Regulatory Commission. 2014. *Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel*. NRC report NUREG-2157. NRC, Washington, DC. September 2014.

⁵⁸ Thompson, G.R. 2008. The US Effort to Dispose of High-Level Radioactive Waste. *Energy & Environment*, Volume 19, Numbers 3+4, pages 391-412.

states, to share the national burden. Second, for each repository several sites would be characterized before one site was selected. Third, the repository-development program would be guided by the best available science.

Political leaders experienced pushback that soon led them to abandon the first two principles. Congress voted in 1987 to formalize this abandonment. That action confined repository development to one site – i.e., Yucca Mountain in Nevada. Note that the choice of Yucca Mountain was entirely political.

Investigations soon revealed that the Yucca Mountain site is technically unsuitable. The key point is that the Yucca Mountain repository would be located above the water table, in oxidizing conditions, while every other proposed repository in the world would be located below the water table, in reducing conditions. Given this choice, the Yucca Mountain repository could not meet performance standards if water is present as moisture or in liquid form. Investigations showed that water is now and will be present.

The third principle of NWPA – i.e., follow the best available science – called for rejection of the Yucca Mountain site. That step would have required professional integrity on the part of program managers. Instead, program managers sought, and compliant politicians provided, Congressional approval to weaken repository-performance standards and pursue questionable technical fixes – e.g., placing titanium drip shields over waste canisters. In other words, the third principle was abandoned.

Program managers were undoubtedly under pressure to “get the job done”. Exercising their professional integrity could have adversely affected their careers. Congress had decreed that a repository must be built at Yucca Mountain.

Abandonment of the three principles eventually led, as could have been foreseen, to effective termination of the repository program – i.e., failure of the NWPA. It also left a deep reservoir of distrust within affected communities and stakeholder groups. Any new program to develop a repository would be compelled to address that distrust.

Lessons from experience with the NWPA

It is appropriate to ask if the NWPA could have succeeded. Two missed opportunities are considered here.

First, the NWPA demanded principled behavior by political leaders, which was perhaps naïve given longstanding political dysfunction in the United States. If, however, the program had included a vigorous effort of stakeholder engagement, would stakeholders have called upon political leaders to behave better?

Second, the NWPA demanded professional integrity from program managers but these managers, when confronted with a technically-unsuitable site, surrendered their integrity. If, however, program managers had retained their professional integrity by rejecting the Yucca

Mountain site, would politicians have been obliged to return the repository program to the principled path specified in the NWPA?

Experience with the NWPA is relevant to current debate about the future role of nuclear power. Sadly, the history of the nuclear industry, in the United States and elsewhere, is rich in instances of unprincipled behavior and lack of professional integrity.⁵⁹ Advocates of a revived nuclear industry should be obliged to acknowledge this history and explain how its repetition could be avoided.

Hazards arising from failure of the NWPA: Overview

Via H.4744, the Commonwealth's executive and legislative branches tell us that failure of the NWPA, and the absence of a radioactive-waste repository, are matters of no significance. Accordingly, they tell us, we should surrender the limited protection that voters embodied in Chapter 503.

In reality, significant hazards have been created by failure of the NWPA. Two examples of such hazards are discussed here. The first is the potential for a fire in an SNF pool. The second is the potential for an ISFSI to become a toxic legacy.

*Hazards arising from failure of the NWPA:
Potential for an SNF pool fire*

As mentioned above, the nuclear industry, beginning in the 1980s, re-equipped the SNF storage pools at its reactors with high-density racks. The industry took this action because failure of the NWPA created growing onsite inventories of SNF. Use of high-density racks was the cheapest option for increasing onsite capacity to store SNF. A safer option – i.e., transferring SNF to an onsite ISFSI – was available at somewhat higher cost.

The shift to high-density racks created a massive radiological hazard. The hazard arose because the cladding and structure of today's nuclear fuel is made of a zirconium alloy that functions well under normal reactor operating conditions but reacts violently and exothermically with air or steam if overheated.⁶⁰ Partial or total loss of water from an SNF pool could lead to one or both reactions, creating a "pool fire" that could release a substantial amount of radioactive material to the atmosphere.

It should be noted that this hazard is unnecessary. In an SNF pool with low-density racks, loss of water would, in almost all cases, not lead to a reaction between zirconium alloy and air or steam. In other words, a pool fire would not occur. Thus, the pool-fire hazard could be avoided by retaining low-density racks and transferring surplus SNF to an onsite ISFSI. As mentioned

⁵⁹ See, for example: Loth, R. 2026. Dirty power, dark money: an Ohio cautionary tale for the country. *The Boston Globe*, 5 February 2026.

⁶⁰ Zirconium alloy was chosen for this role instead of stainless steel because it improves the neutron economy of a reactor, leading to lower cost per kWh of electricity produced. Stainless steel is, however, less chemically reactive.

above, the ISFSI option would be more costly than the high-density-rack option, but the cost difference would be comparatively modest.

There is a substantial literature on the potential for an SNF pool fire. This author has contributed to the field since the 1970s. A December 2013 declaration⁶¹ reviews relevant work by this author and others. The declaration is accompanied by 49 exhibits with diverse authors. Together, these documents provide evidence supporting the discussion here. Additional evidence is from a 2016 paper⁶² by Frank von Hippel and Michael Schoeppner, and from related papers by von Hippel et al.⁶³

To date, an SNF pool fire is a hypothetical event. During the 2011 accident at the Fukushima nuclear site, however, Japan came very close to experiencing an actual SNF pool fire in the Unit 4 pool. The fire was avoided by sheer luck, and the mechanisms involved were not fully understood at the time of the accident. If a fire had occurred, the radiological impacts of the Fukushima accident would have been much worse.

Figure 7-1 illustrates the radiological impacts of a potential SNF pool fire in the United States. The figure derives from modeling by von Hippel and Schoeppner. It shows land areas contaminated to different levels following an atmospheric release of 1,600 PBq of Cs-137 on four possible dates in 2015.⁶⁴ The release would occur at the Peach Bottom site, where two commercial reactors are currently operational.⁶⁵

⁶¹ Thompson, G.R. 2013. Declaration of 19 December 2013: Comments on the US Nuclear Regulatory Commission's Waste Confidence Generic Environmental Impact Statement, Draft Report for Comment (September 2013). IRSS, Cambridge, Massachusetts.

⁶² von Hippel, F.N., and Schoeppner, M. 2016. Reducing the Danger from Fires in Spent Fuel Pools. *Science and Global Security*, Volume 24, Number 3, pages 141-173.

⁶³ See: Kelly, B.R. 2017. *U.S. Nuclear Regulators Greatly Underestimate Potential for Nuclear Disaster*. School of Public and International Affairs, Princeton University. 25 May 2017. Accessed on 21 February 2026 at: <https://spia.princeton.edu/news/us-nuclear-regulators-greatly-underestimate-potential-nuclear-disaster>

⁶⁴ The modeling used actual weather data from 2015.

⁶⁵ In Figure 7-1 the small and large circles have radii of 80 km and 540 km respectively.

Figure 7-1
Areas Contaminated with Cs-137 Released by a Hypothetical SNF Pool Fire at the Peach Bottom Site in Pennsylvania, per von Hippel and Schoeppner⁶⁶

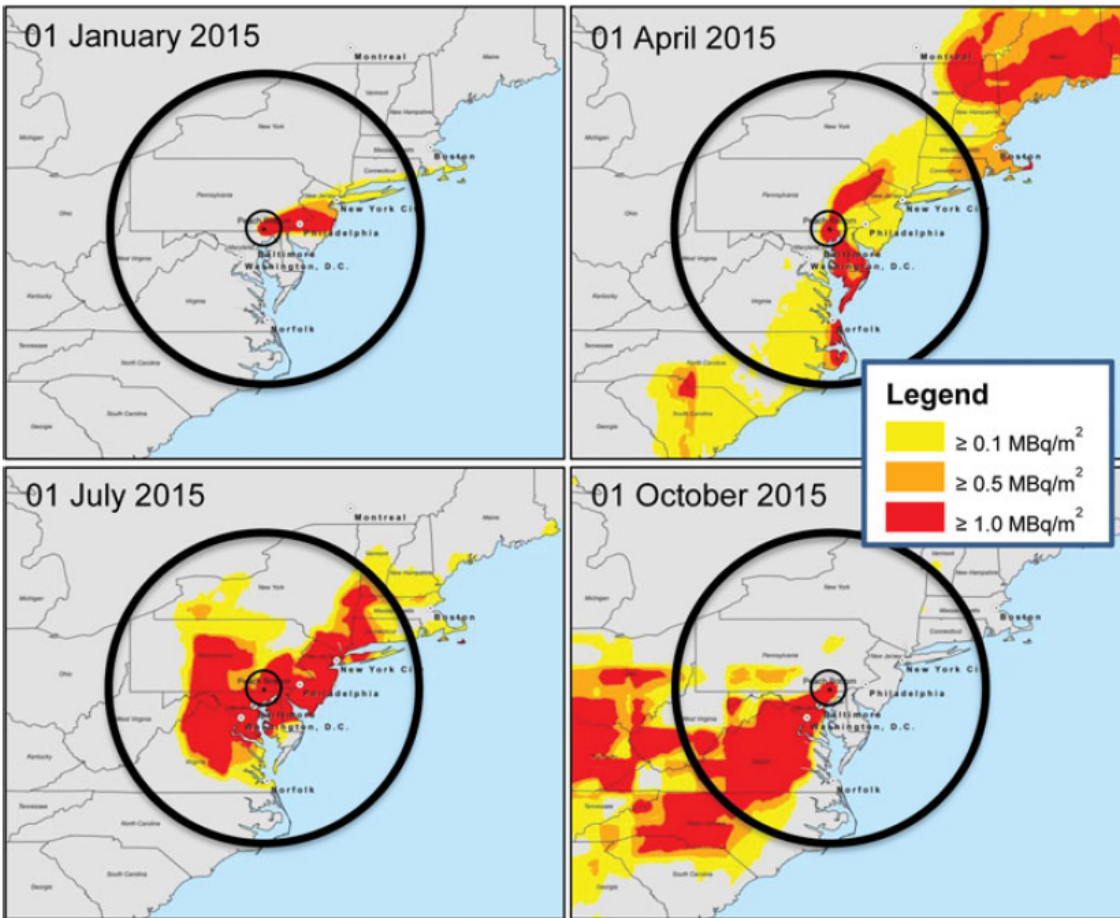


Figure 7-1 shows three levels of land contamination by Cs-137. The middle level – i.e., 0.5 MBq/m² – would yield a gamma ground-shine dose rate of about 5 mSv/yr in the second year. According to guidance from the US Environmental Protection Agency, doses above that rate call for relocation of affected populations. This relocation – i.e., abandonment of homes and communities – could last for years.

One sees from Figure 7-1 that a release on 1 April 2015 would require relocation of the populations of Boston and large parts of Massachusetts and Connecticut, with greater impacts further downwind. Note that analyses by von Hippel et al find that an SNF pool fire of the magnitude represented by Figure 7-1 would, on average, require the relocation of about 8 million people. Thus, we are discussing a potential national disaster of historic significance.

⁶⁶ Adapted from Figure 6 of: von Hippel, F.N., and Schoeppner, M. 2016. Reducing the Danger from Fires in Spent Fuel Pools. *Science and Global Security*, Volume 24, Number 3, pages 141-173.

Much can be said about the potential for an SNF pool fire. Here, some key findings are summarized, drawing upon the sources of evidence identified above. These findings are relevant to consideration of H.4744. They are:

- An SNF pool fire could be a national disaster.
- The SNF pool-fire hazard creates strategic vulnerability in the national-security context.
- This hazard is unnecessary.
- The nuclear industry has created this hazard by prioritizing cost reduction.
- The nuclear industry does not acknowledge the significance of this hazard.
- In response to nuclear-industry lobbying, Congress has limited the role of NRC.
- NRC is excessively deferential to the nuclear industry.
- NRC has performed shoddy, misleading analyses of the SNF pool-fire hazard.
- NRC employs a pseudo-scientific definition of risk to justify this hazard.
- NRC does not allow evidentiary hearings at which expert findings about this hazard could be openly debated.

These findings cast doubt upon the competence and professional integrity of the nuclear industry and its regulators. It can be expected that promoters of SMRs will challenge these findings. To do so credibly, they should acknowledge evidence that supports the findings, including the sources cited above.

Efforts by the Commonwealth to reduce the SNF pool-fire hazard

The Commonwealth of Massachusetts, via its Office of the Attorney General (AGO), has sought to reduce the SNF pool-fire hazard. AGO did this by intervening in NRC license proceedings, focused on the Pilgrim and Vermont Yankee nuclear power plants.

This author supported AGO's effort by providing technical advice and expert-witness services, on occasions beginning in the late 1980s. That work included the preparation of a technical report⁶⁷ in 2006 and another report⁶⁸ in 2011.

AGO conducted its interventions effectively. They were, however, ultimately unsuccessful. That outcome reflected the biased structure of NRC license proceedings, including the absence of evidentiary hearings. In 2012, NRC granted the Pilgrim nuclear plant a 20-year license extension without requiring any measure to reduce the SNF pool-fire hazard associated with that plant.

⁶⁷ Thompson, G.R. 2006. *Risks and Risk-Reducing Options Associated with Pool Storage of Spent Nuclear Fuel at the Pilgrim and Vermont Yankee Nuclear Power Plants*. A report for the Office of the Attorney General, Commonwealth of Massachusetts. IRSS, Cambridge, Massachusetts. 25 May 2006.

⁶⁸ Thompson, G.R. 2011. *New and Significant Information from the Fukushima Daiichi Accident in the Context of Future Operation of the Pilgrim Nuclear Power Plant*. A report for the Office of the Attorney General, Commonwealth of Massachusetts. IRSS, Cambridge, Massachusetts. 1 June 2011.

The Pilgrim licensee could have eliminated the SNF pool-fire hazard during the 20-year period of license extension. That outcome could have been achieved by re-equipping the SNF pool with low-density racks and transferring surplus SNF to an onsite ISFSI. That step would have involved additional cost. NRC did not require that step, and the licensee did not take it voluntarily.

Despite this cost saving, the Pilgrim plant was economically uncompetitive. It was shut down permanently in 2019. By the end of 2021 the entire inventory of SNF in the Pilgrim pool had been removed and transferred to an onsite ISFSI. That action demonstrates what could have been done with SNF earlier, at any point during the years of plant operation.

*Hazards arising from failure of the NWPA:
Potential for an ISFSI to become a toxic legacy*

One of the hazards created by failure of the NWPA is the potential for an ISFSI to become a toxic legacy. That potential is addressed here by focusing on a particular case – i.e., the ISFSI at the Pilgrim site in Massachusetts. Discussion here regarding this case draws upon a 2024 report by this author.⁶⁹

The licensee of the Pilgrim ISFSI currently projects that SNF will be entirely removed from the Pilgrim site by 2062. That projection does not, however, reflect a credible plan by the federal government to manage SNF. The timeline for SNF removal is unknown. Indeed, NRC concedes that SNF could be stored in the Pilgrim ISFSI indefinitely.

The Pilgrim ISFSI is now owned and operated by a for-profit corporation, under an NRC license. The licensee receives ongoing payment for its operating services from a decommissioning trust fund that it controls under NRC supervision.

This arrangement reflects a longstanding pretense of the federal government that nuclear power can function, at least in some respects, as a normal business. If SNF were to remain in the Pilgrim ISFSI indefinitely, however, that pretense could not be sustained. At some point, the trust fund would be depleted. Then, the licensee would probably leave the scene, if it had not done so earlier.

The ISFSI would then need a guardian that could function reliably over the long term. A prime candidate for the position would be the Commonwealth of Massachusetts. The federal government might provide financial support plus regulatory oversight via NRC or a successor agency.

The long-term guardian of the Pilgrim ISFSI, whomever that might be, would have ongoing responsibility for a facility that is cheaply built, poorly secured, and not designed for the long

⁶⁹ Thompson, G.R. 2024. *Civil Defense for Marshfield Related to Operations at Pilgrim Station*. A report for the town of Marshfield. IRSS, Cambridge, Massachusetts. 29 April 2024.

term. As a result of these attributes, and the likely atrophy of vigilance by facility personnel over time, the facility could experience long-term degradation and/or security events. Outcomes could include adverse impacts on surrounding communities.

For example, a credible security event at the Pilgrim ISFSI could release to the atmosphere an amount of Cs-137 ranging from 5 to 25 PBq. That release would be small compared to the hypothetical release of 1,600 PBq of Cs-137 that is represented in Figure 7-1. It would, however, be close to the actual release of 10 to 35 PBq of Cs-137 that occurred during the 2011 Fukushima accident. The Fukushima release caused substantial offsite impacts.

It is instructive to compare the design of the present Pilgrim ISFSI with a more prudent design that would reflect international best practice. Table 7-1 provides such a comparison. There is no current plan to rebuild the Pilgrim ISFSI but, in the meantime, Table 7-1 could provide food for thought.

Table 7-1
ISFSI Design Approaches: A Prudent Design versus the Pilgrim Design

ISFSI Feature	Design Approach	
	A Prudently-Designed ISFSI	The Present Pilgrim-Station ISFSI
SNF casks	Monolithic, thick-walled metal casks	Thin-walled MPCs inside concrete & steel overpacks with ventilation holes
Monitoring of SNF casks and contents	Easy access to cask exterior; sampling and pressure measurement of helium fill-gas	Difficult access to MPC exterior by specialized robot; no access to helium fill-gas
Protective structure surrounding SNF casks	Attack-resistant vault(s)	None
Damage-control measures	Engineered capability to spray foam on damaged SNF casks	None
ISFSI boundary	Berms and walls, chicanes on access road	Chain-link fences
Capability for re-packaging SNF into new containers	Dry transfer system within the ISFSI boundary	None
Discouragement of a “repository by default” outcome	Menacing appearance, visible from public places	No specific measure

SMRs and radioactive waste

Promoters of SMRs must concede, if asked, that SMRs would produce high-level radioactive waste. Thus, in the absence of a repository, operation of SMRs in the United States would add to an inventory of waste for which there is no disposal option. The promoters do not, apparently, view this outcome as a problem. They appear to assume that “someone else” will deal with SMR radioactive waste.

Lindsay Krall and colleagues apply a scientific perspective to this matter. In a 2022 paper they examine the waste streams from SMRs. Their conclusions, in full, are:⁷⁰

“This analysis of three distinct SMR designs shows that, relative to a gigawatt-scale PWR, these reactors will increase the energy-equivalent volumes of SNF, long-lived LILW, and short-lived LILW by factors of up to 5.5, 30, and 35, respectively. These findings stand in contrast to the waste reduction benefits that advocates have claimed for advanced nuclear technologies. More importantly, SMR waste streams will bear significant (radio-)chemical differences from those of existing reactors. Molten salt- and sodium-cooled SMRs will use highly corrosive and pyrophoric fuels and coolants that, following irradiation, will become highly radioactive. Relatively high concentrations of ²³⁹Pu and ²³⁵U in low-burnup SMR SNF will render recriticality a significant risk for these chemically unstable waste streams.”

“SMR waste streams that are susceptible to exothermic chemical reactions or nuclear criticality when in contact with water or other repository materials are unsuitable for direct geologic disposal. Hence, the large volumes of reactive SMR waste will need to be treated, conditioned, and appropriately packaged prior to geological disposal. These processes will introduce significant costs – and likely, radiation exposure and fissile material proliferation pathways – to the back end of the nuclear fuel cycle and entail no apparent benefit for long-term safety.”

“Although we have analyzed only three of the dozens of proposed SMR designs, these [our] findings are driven by the basic physical reality that, relative to a larger reactor with a similar design and fuel cycle, neutron leakage will be enhanced in the SMR core. Therefore, most SMR designs entail a significant net disadvantage for nuclear waste disposal activities.”

“Given that SMRs are incompatible with existing nuclear waste disposal technologies and concepts, future studies should address whether safe interim storage of reactive SMR waste streams is credible in the context of a continued delay in the development of a geologic repository in the United States.”

⁷⁰ Krall, L.M., and two other authors. 2022. Nuclear waste from small modular reactors. *Proceedings of the National Academy of Sciences*, Volume 119, Number 23, Paper e2111833119. Quoted text from Conclusions.

These findings by Krall et al have significant implications regarding the alleged advantages of SMRs. One of the alleged advantages is the SMR's comparatively small core, which supposedly facilitates mass production. Another alleged advantage is the SMR's use of "advanced" technology. Krall et al show that these alleged advantages are, in fact, liabilities when viewed from the perspective of radioactive-waste management.

8. A Political-Economy Perspective on Nuclear Power

Commercial nuclear power now has a seven-decade history. During that period the industry's prospects have risen and fallen in successive waves. For the purposes of discussion here, "prospects" are represented by an objective indicator – i.e., annual construction starts of new reactors.

These waves have been influenced by bouts of enthusiasm by political leaders. On repeated occasions, political leaders have called for revival of the nuclear industry and have allocated public resources to that mission. To date, each of these revival efforts has failed. Nevertheless, they keep recurring. In the United States we are now experiencing another revival effort. This time, SMRs have been added to the revival menu. In Massachusetts, the revival effort has found expression in H.4744.

Repetition of these revival efforts, despite repeated failures, requires explanation. Explanations cannot be found within the arena of politics or economics, considered separately. They probably reside somewhere at the intersection of these arenas. Anthropology might also offer some insights. A general explanation is not offered here. Instead, some relevant observations are offered, as possible contributions to an explanation.

The Trump administration's nuclear-revival effort

In May 2025 the Trump administration launched an effort to revive the nuclear power industry, as follows:⁷¹

“On May 23 [2025], President Trump announced four executive orders aimed at reinvigorating America's nuclear energy industry. The orders lay out a plan to modernize nuclear regulation, streamline nuclear reactor testing, deploy nuclear reactors for national security, and reinvigorate the nuclear industrial base. Together, they represent a bold new strategy for unleashing American energy and continuing our nation's dominance as the world's nuclear energy leader.”

This rhetoric is accompanied by specific targets. One is to expand US nuclear generation capacity from about 100 GWe today to 400 GWe by 2050. Another is to have “10 new large reactors with complete designs under construction [in the USA] by 2030”. Experience suggests that neither target is likely to be met.

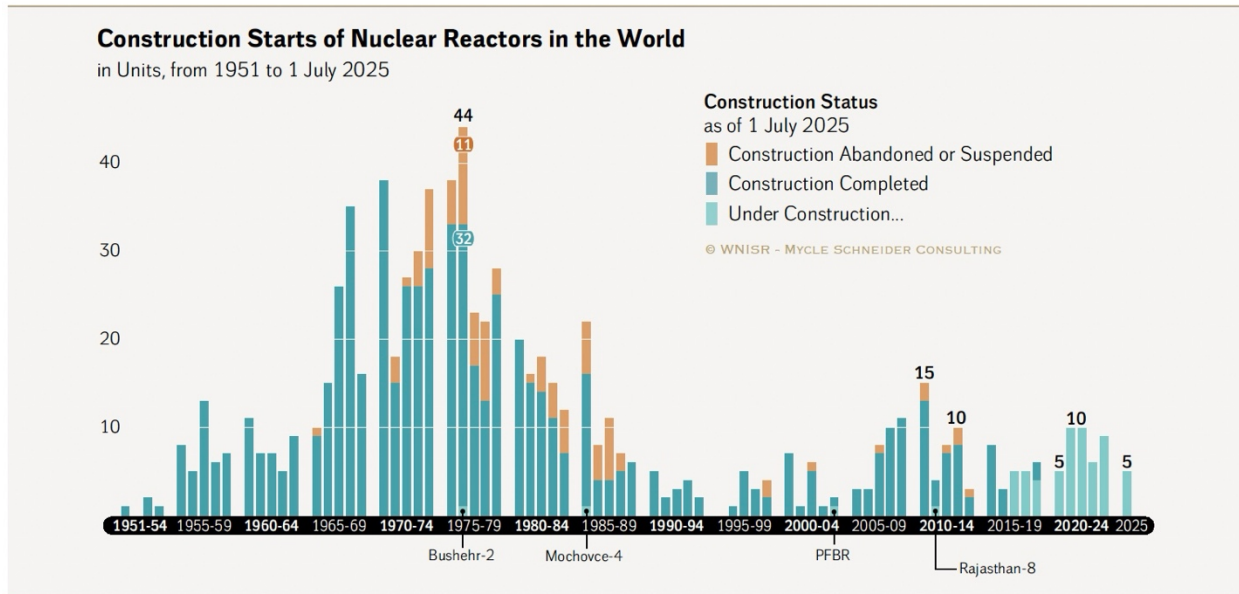
⁷¹ US Department of Energy. 2025. *9 Key Takeaways from President Trump's Executive Orders on Nuclear Energy*. DOE Office of Nuclear Energy. 10 June 2025.

Seven decades of experience with nuclear power

Prudence suggests that we compare the Trump administration’s rhetoric about nuclear power with actual, historical experience. Fortunately, that experience has become readily accessible via a valuable series of World Nuclear Industry Status Reports (WNISRs).

Figure 8-1 is reproduced from the 2025 WNISR. It shows annual construction starts of new commercial reactors over seven decades. We see the successive waves of construction mentioned above. We also see that the nuclear industry has not regained the momentum it exhibited in its early decades.

Figure 8-1
Construction Starts of Nuclear Reactors Worldwide, 1951-2025, per WNISR⁷²



The experience shown in Figure 8-1 suggests that the Trump administration’s effort to revive the nuclear industry is likely to fail. Other evidence supports that finding. A notable item of evidence is the high cost of nuclear power.

Although the Trump administration’s revival effort is likely to fail, it could have lasting impacts. Typically, these impacts would be harmful. For example, the current revival effort could lead to weakening of standards for radiation protection.⁷³

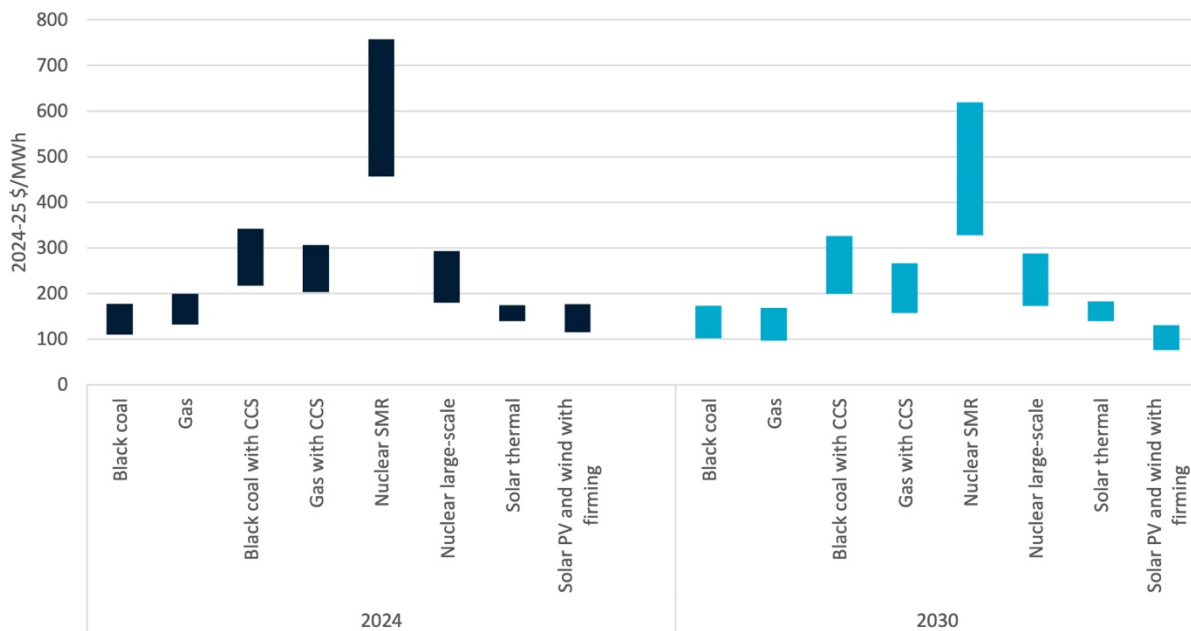
⁷² Schneider, M., and other authors. 2025. *The World Nuclear Industry Status Report 2025*. Mycle Schneider Consulting Project, Paris. Figure reproduced from Figure 13 at page 64.

⁷³ See: Cornwall, W. 2026. Scientists decry rush to loosen radiation standards. *Science*, Volume 391, Issue 6787, 19 February 2026, pages 748-749.

Costs of electricity from nuclear power and other options

Australia’s national science agency is the Commonwealth Scientific and Industrial Research Organization (CSIRO). Analysts at CSIRO have studied the costs of supplying electricity from a range of options. Figure 8-2 shows some of their findings.

Figure 8-2
Estimated Costs of Electricity Generation (LCOE in Aus\$ per MWh) by Various Technology Options Installed in 2024 or 2030, per CSIRO⁷⁴



Note that renewable-supply options, other than solar thermal, are represented in Figure 8-2 by a package termed “Solar PV and wind with firming”. That package can be compared directly with electricity-supply options capable of continuous operation. Components of the package include storage, spillage, and additional transmission. CSIRO includes the costs of these components in its LCOE estimates.

We see from Figure 8-2 that the estimated life-cycle cost of electricity from an SMR would be a multiple of the cost from any of the other options considered. Moreover, says CSIRO, the practical operational date of the first batch of SMRs would be in the mid-2040s. At that point, the costs of renewable-supply options will probably have fallen further.

⁷⁴ Graham, P., and two other authors. 2025. *GenCost 2024-25: Final Report*. CSIRO, Australia. July 2025. Figure reproduced from ES Figure 0-2 at page xiv.

Thus, CSIRO tells us that SMRs are economically uncompetitive and are likely to remain so across the next few decades. This finding is for Australia but could apply more generally.⁷⁵

Motives underlying nuclear revivalism: Overview

Efforts to revive the nuclear power industry keep recurring despite repeated failures and credible evidence that revival, even if successful, might not be worth the effort. Persistence of these efforts suggests that nuclear revivalism is driven by powerful motives.

It would be useful to understand these motives. Some possibilities are explored here. First, the possible role of 1960s nostalgia is examined. Then, the role of military connections is explored. Finally, purposeful distraction is considered as a possible motive.

Apropos of 1960s nostalgia, note that climate change emerged as an issue of concern in the scientific community during the 1960s. Also, at that time, nuclear power emerged as a commercial source of electricity. Nuclear power was new and exciting and seemed, at first sight, to be “clean”. Renewable-energy technologies were in nascent form. Thus, given the state of knowledge at the time, it was reasonable to consider nuclear power as a possible solution to the climate problem.

Now, six decades later, we know much more about the climate problem, including the options available to address it. Our present knowledge includes a seven-decade record of experience with nuclear power worldwide. The overall body of present knowledge has led many informed observers to conclude that nuclear power is not an effective solution to the climate problem and is also problematic in other ways. Yet, in some minds, 1960s nostalgia might linger.

Motives underlying nuclear revivalism: Military connections

Nuclear power is intimately connected with the military, as discussed above. Connections are especially strong in the contexts of naval nuclear propulsion and nuclear weapons.

Phil Johnstone and Andy Sterling explain, in an October 2025 essay, how military connections motivate nuclear revivalism. In the essay they say:⁷⁶

“While financiers see SMR hype as a way to profit from billions in government subsidies, their own analyses are less enthusiastic about the technology itself. So why then, all this attention to nuclear in general and smaller reactors in particular? There is clearly more to this than meets the eye.”

⁷⁵ Australia is comparatively rich in solar, wind, and fossil-fuel resources. These endowments do not, however, affect the costs of SMRs.

⁷⁶ Johnstone, P., and Sterling, A. 2025. The hidden military pressures behind the new push for small nuclear reactors. *The Conversation*, 27 October 2025.

“The neglected factor is the military dependence on civil nuclear industries. Maintaining a nuclear armed navy or weapons program requires constant access to generic reactor technologies, skilled workers and special materials. Without a civilian nuclear industry, military nuclear capabilities are significantly more challenging and costly to sustain.”

If military connections are a significant driver of nuclear revivalism, this influence should be acknowledged and openly debated. Absent such action, nuclear revivalism would be a threat to our democracy. Avoiding that outcome should be a high priority for leadership in Massachusetts and elsewhere.

Motives underlying nuclear revivalism: Distraction

Sadly, the list of possible motives for nuclear revivalism includes purposeful distraction for selfish reasons. M.V. Ramana addresses this possibility in a 2024 book. Ramana is a physicist with a thorough understanding of the technical aspects of nuclear power. While studying these aspects, Ramana has observed nuclear-industry behavior in the political-economy arena, yielding findings including the following:⁷⁷

“Nuclear energy is being promoted by powerful elites in governments and businesses precisely because it comes with the promise, even if it will be ultimately a false promise, that the economic system can continue more or less along the same path while avoiding large-scale climate change. It is analogous to the magician’s misdirection, getting people to focus on shiny new technological solutions promised for the (distant) future, while business as usual goes on. Talking about nuclear power from new reactors serves to delay dealing with the climate crisis. Procrastination⁷⁸ might be the thief of time, but it is good business strategy for companies that profit from the current system.”

Ramana warns us that “powerful elites in governments and businesses” could use nuclear power as a lure to distract us. Avoiding that abuse of our trust should be a high priority for leadership in Massachusetts and elsewhere.

⁷⁷ Ramana, M.V. 2024. *Nuclear is not the Solution: The Folly of Atomic Power in the Age of Climate Change*. Verso, London and New York. Quoted text from Conclusion at page 243.

⁷⁸ Apropos of climate-action procrastination as a business strategy, see, for example: Zaloom, C. 2025. Too Close for Comfort. *The New York Review of Books*, 13 February 2025, pages 36-38.

Opportunity costs of nuclear revivalism

Each bout of effort to revive the nuclear industry has consumed public resources – i.e., money, professional time, public attention, etc. These resources were usually wasted. They did not, typically, yield a lasting benefit.

Often, alternative projects in the triple-E space were available. If the resources spent on nuclear revivalism had been allocated to these projects, benefits could have resulted. The foregone benefits were the opportunity costs of nuclear revivalism. Opportunity costs are often difficult to estimate, but they can be substantial.

Improvement of leadership and strategy in the triple-E space would involve increased effort on an array of tasks. One task would be to develop sophisticated processes for technology assessment. These processes could compare potential investments in nuclear revivalism with potential investments in other projects. The comparisons could help decision-makers to avoid unnecessary opportunity costs.

To illustrate the comparisons that sophisticated processes of technology assessment must accommodate, let us consider two technology options:

- A nuclear fission or nuclear fusion power plant.
- A slab of transparent material developed by Amit Bhardwaj and colleagues, which they term a mesoporous optically clear heat insulator (MOCHI).⁷⁹

The nuclear plant is a large, complex, expensive facility within which numerous active processes are ongoing. It has substantial societal and environmental footprints. By contrast, the MOCHI is a passive, simple-appearing object with a negligible footprint.

⁷⁹ Bhardwaj, A., and seven other authors. 2025. Mesoporous optically clear heat insulators for sustainable building envelopes. *Science*, Volume 390, Issue 6778, 11 December 2025, pages 1171-1176.

The nuclear plant is intended to produce electricity, whose uses could include lighting, heating, and cooling of buildings. The MOCHI's intended function is described by Longnan Li and Wei Li as follows:⁸⁰

“Windows are among the least energy-efficient components of a building. They occupy a small fraction of the exterior but leak nearly half of the heating and cooling energy from the interior. Conventional solutions such as double glazing and low-emissivity coatings are mechanically robust and optically transparent, yet their thermal insulation performance is limited. Modern technologies such as silica and cellulose aerogels (a porous material filled with gas) could achieve better heat insulation. However, their optical haze, fragility, and limited scalability continue to hinder widespread adoption.”

“On page 1171 of this issue, Bhardwaj et al. report an optically transparent heat insulator that is built from self-assembled polysiloxane nanotube networks. The material transmits >99% of visible light while conducting heat more poorly than the surrounding still air. This could be used to make clear windows with thermal insulation that is comparable with that of building walls.”

A thorough comparison of these options is not offered here. The contrasting features of the two technologies provide food for thought.

⁸⁰ Li, L., and Li, W. 2025. Invisible heat insulators. *Science*, Volume 390, Issue 6778, 11 December 2025, pages 1104-1105.

9. Using H.4744 as a Marker for a Societal Turning Point

This paper explores planning and decision-making in the triple-E space in Massachusetts. H.4744 was chosen as a point of entry. That choice reveals unexpected, internal challenges facing the Commonwealth – i.e., deficiencies in leadership and strategy. Fortunately, there are opportunities for rapid, corrective actions. Taking these actions would enhance the Commonwealth’s ability to overcome the challenges and seize the opportunities that await us.

The necessary corrective actions would put us on a better pathway for planning and decision-making. A shift to that pathway would be a societal turning point. Here, H.4744 is proposed as a marker for that turning point. Note that the H.4744 in question is the original version that was created in November 2025.

Establishing H.4744 as a marker of change would require specific actions. Some actions are suggested here. Other suggestions would be welcome.

Deconstructing H.4744: The good and the bad

This paper’s discussion of H.4744 has focused, up to this point, on ill-advised policy proposals in two issue areas – i.e., climate action, and nuclear power. That focus has revealed deficiencies in leadership and strategy. These deficiencies are hindering the Commonwealth’s efforts in the triple-E space and could lead to failure of our climate-action program.

H.4744 does, however, contain potentially valuable proposals. An example is an Internet-based “smart” platform to expedite permitting of residential solar energy systems. That is the type of initiative we need if Massachusetts is to successfully navigate the triple-E space across coming decades.

The presence of both promising and bad proposals in H.4744 reflects a predilection of the Massachusetts legislature for bundling diverse initiatives into a single package that is subjected to a yes-or-no vote. In the case of H.4744, the overall package lacks coherence or logic. One fears that other packages considered in the legislature are similarly deficient.

Bundling of diverse initiatives might be convenient for the legislature, and for lobbyists. It is, however, a recipe for failure in the triple-E space. A more discriminating approach is needed. Establishing H.4744 as a marker of change could help us to develop such an approach.

If we choose to embark on a better pathway for planning and decision-making on triple-E issues, we could begin by identifying promising proposals in H.4744 and using them as experimental subjects for pathway development. A well-designed process of pathway development would test and refine an array of tools and practices to improve the effectiveness, speed, and coherence of planning and decision-making. Proposals selected as experimental subjects would receive special attention in this process, which could improve their prospects of successful application.

As mentioned above, one of the promising proposals in H.4744 is smart solar permitting. Use of that proposal as an experimental subject for pathway development is discussed below. This exercise would require that smart solar permitting would not be bundled into a package of legislation. Instead, it would be considered as a distinct initiative. The new pathway would include a statutory framework that facilitates such consideration.

Acknowledging responsibility and accountability through actions

Using H.4744 as a turning point should involve acknowledgments of responsibility and accountability. These acknowledgments could assist the development of a new pathway by demonstrating that entrenched interests would not obstruct needed changes.

While statements acknowledging responsibility and accountability could be useful, appropriate actions would be more important. These actions could contribute to developing the new pathway. Some appropriate actions by major players in Massachusetts could be as follows.

Civil society could:

- Conduct a shared exploration of challenges and opportunities in the triple-E space.
- Pursue consensus on strategies for better planning and decision-making in this space.
- Develop tools and practices to support these strategies.
- Work with the legislature and the executive branch to improve leadership and strategy.

The Massachusetts legislature could:

- Accept an audit.
- Conduct reforms to improve its openness, accountability, and effectiveness.
- Cease the bundling of diverse triple-E initiatives into single packages.
- Work with the executive branch and civil society to improve leadership and strategy.
- Upgrade statutes so as to support improved triple-E strategies.

The Massachusetts executive branch could:

- Review its compliance with existing statutes relevant to triple-E issues.
- Work with the legislature and civil society to improve leadership and strategy.
- Upgrade its capacity for critical assessment of technology and policy options.
- Embrace opportunities to support improved strategies by developing new tools and practices that could be used in Massachusetts and more widely.

Ingredients of good leadership and strategy: A reminder

Standards for leadership and strategy are discussed above. Here, in the context of using H.4744 as a marker of change, it is worth repeating the key ingredients of good leadership and strategy that are identified in that discussion. They are:

- Citizen empowerment.
- A long-term perspective.
- Adaptive management.
- Stakeholder engagement.
- Contingency planning.
- Partnerships.
- Information systems.

Smart solar permitting as an experimental subject: Introduction

The term “smart solar permitting” refers here to an Internet-based, smart – i.e., computerized – platform to expedite permitting of residential solar energy systems. The concept of using smart solar permitting as an experimental subject for pathway development in Massachusetts is introduced above. Operationalizing that concept properly would require thorough planning and careful implementation. Some preliminary suggestions are offered here. Other ideas would be welcome.

Smart solar permitting as an experimental subject: Background

Smart permitting of solar energy systems is not a new idea.⁸¹ It is used now in many towns and cities across the United States and is encouraged by state law in several states.⁸² There is broad agreement that smart permitting can be beneficial. The field is still evolving, however. Thus, Massachusetts would not be a first mover but could become a significant player.

A broad look at the field, from a US-wide perspective, suggests the following findings:

- Numerous, diverse players are involved.
- While the field is promising, it is likely that some smart platforms will not meet expectations.
- Overall success will require an underlying infrastructure of trust formalized via widely-supported protocols and standards.
- Building the infrastructure of trust must involve broad-based representation of players.

⁸¹ For background see: Solar APP+. 2026. APP+ website: Advancing Clean Energy, One Permit at a Time. Accessed on 27 February 2026 at: <https://www.gosolarapp.org/about>

⁸² For background see: Hartz, S. 2026. *What is smart solar permitting? And how does it help Virginians adopt solar?* Environment Virginia. 26 January 2026.

- The roles of successful platforms could be extended from permitting to include other functions related to solar systems – e.g., project planning, performance estimation and validation, utility integration, financing, maintenance, insurance, transfer of ownership, decommissioning.
- Platform development should encourage creativity and entrepreneurship, and should involve the testing and refinement of diverse options.

Smart solar permitting as an experimental subject: A nationwide partnership

Given the findings set forth above, one can imagine a nationwide partnership to advance the field. The organization Solar APP+ has already initiated such a partnership. Massachusetts could become a significant member. The partnership could move quickly, making substantial progress within a few years. Prudence suggests that the federal government's role should be minimized, to limit damage inflicted by the Trump administration.

A major task of the partnership would be to conduct nationwide stakeholder engagement in pursuit of several objectives. A key objective would be consensus on the protocols and standards that formalize an infrastructure of trust. Another objective would be consensus on processes to evaluate smart platforms.

Rapid stakeholder engagement at this scale would be challenging but seems feasible. Fortunately, the scope of issues to be addressed would be comparatively narrow, which could improve the prospects of agreement. Leaders of the stakeholder-engagement effort would acquire skills that are potentially marketable. Massachusetts could be one of those leaders.

*Smart solar permitting as an experimental subject:
Role of an enlightened Massachusetts*

How might this imagined nationwide initiative play out in Massachusetts? Let us imagine that, in parallel with this initiative, the Commonwealth has established forward-looking strategies for the triple-E space, with enabling statutes to match. These strategies and statutes would be structured to encourage innovation.

Massachusetts statutes could have temporary provisions to encourage technology development during a declared period of innovation. For example, statutes could allow smart-platform options to be tested during the innovation period with limited liability if an option implemented in good faith were to fail. After the innovation period, the Commonwealth could establish permanent statutory protections as needed.

Massachusetts could make a special effort to encourage extension of the roles of smart platforms beyond the initial focus on permitting. Some extensions are suggested above. The “digital twin” concept could be helpful in this context. Development of extended roles could create new markets.

As mentioned above, a key task for a nationwide partnership would be pursuit of consensus on protocols and standards that formalize an infrastructure of trust. Massachusetts could contribute to that pursuit and then incorporate consensus-based protocols and standards into its statutes.

An important feature of this imagined story is that enabling statutes would be flexible at first, to encourage creativity and entrepreneurship. They would not take final form until later.

*Smart solar permitting as an experimental subject:
Role of Massachusetts as envisioned in H.4744*

The story imagined above stands in stark contrast to the proposal of smart solar permitting in H.4744. That draft bill consists of 106 pages of dense legalese. Smart solar permitting appears at page 29 with no reference to any technical or policy analysis. There is no mention of innovation, stakeholder engagement, partnership, or trust building. The legalese establishes top-down, bureaucratic controls on smart permitting that are likely to stifle creativity and entrepreneurship.

10. Opportunities for Massachusetts in the Triple-E Space

Over the coming decades, Massachusetts will face major challenges in the triple-E space. Notably, the Commonwealth's effort to eliminate GHG emissions has entered a period – i.e., the period 2025-2050 – that will be technically difficult, and we expect that difficulty to be compounded by hostility from the Trump administration. Unfortunately, we are poorly prepared for this challenging period.

While addressing these challenges we should give ongoing attention to identifying and creating opportunities. Some suggestions are offered here. More input would be welcome.

Comparative advantage: Identifying it and creating it

Efforts by the Commonwealth to identify and create opportunities should give special attention to areas of economic activity where Massachusetts has a potential for comparative advantage.

For example, it seems that mass production of manufactured items – e.g., solar panels, battery packs – is not, at present, an area of comparative advantage for Massachusetts. We know, however, that present modes of manufacturing are not sustainable. As a matter of urgency, societies should be developing the techniques and practices of a circular economy. That is an area of activity where Massachusetts could serve humanity while creating comparative advantage for itself.

Systems integration for sustainable outcomes: An area of comparative advantage for Massachusetts

One area of activity where Massachusetts could acquire comparative advantage can be termed “systems integration for sustainable outcomes”. This author describes the activity in a 2013 paper that says:⁸³

“During the past several decades, great progress has been made in establishing the conceptual, scientific, technical, and institutional basis for a sustainable civilization.”

“A key lesson from experience to date is that each engineering project must integrate the functioning of three types of system – natural, human, and manufactured systems. With careful design, those systems can function synergistically, so that the outcomes of the project are sustainable. The systems within each type, added together, are collections of capital. Natural capital is the sum of the stocks and flows of pre-human planet Earth and its biosphere. Human capital is the sum of our knowledge, health, institutions, and similar assets. Manufactured capital is the sum of our artifacts. In a sustainable civilization, natural capital would be preserved. Human capital, on a per person basis,

⁸³ Thompson, G. 2013. Systems Integration for Sustainable Outcomes: A Proposed Curriculum. Paper presented at the conference: Engineering Education for Sustainable Development – EESD13, University of Cambridge, Cambridge, UK, 22-25 September 2013. Quoted text from Section 3.

could grow without limit. The efficiency and sophistication of manufactured capital could also grow without limit.”

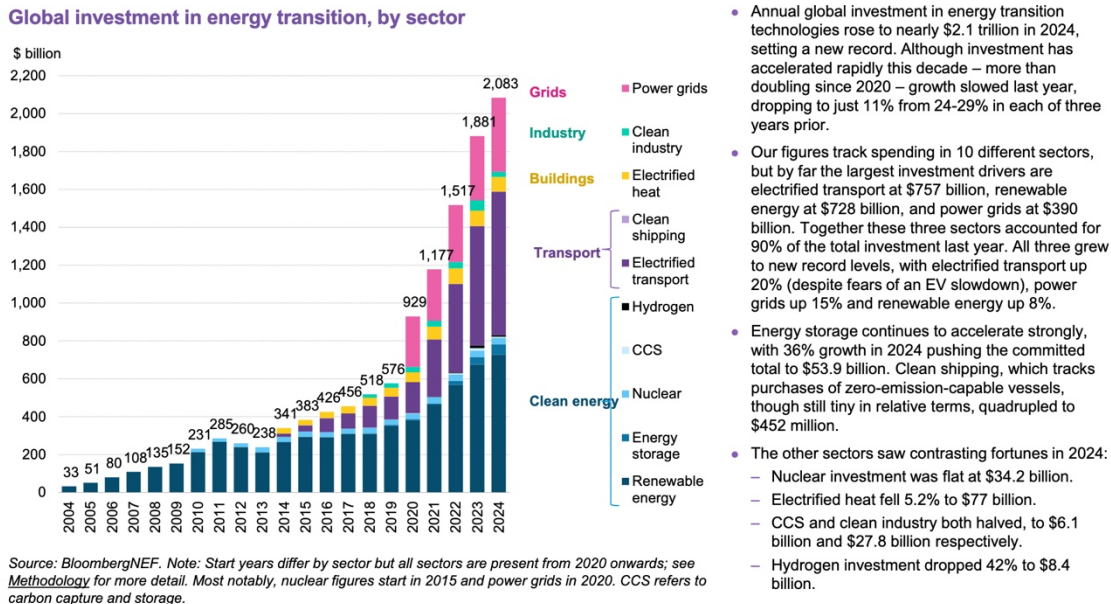
Development of smart platforms for solar-system permitting and related functions is a relatively simple but illustrative example of systems integration. A successful platform would have direct, physical impacts that are very small. In return, it could yield significant benefits – e.g., improved productivity and lower costs in the solar arena, increased use of solar systems.

Opportunities in decarbonization

Stabilization of Earth’s climate would require rapid decarbonization of economies everywhere. There are already large markets for decarbonization technologies and practices. A serious, worldwide commitment to climate stabilization would substantially increase these markets.

Figure 10-1 shows data, compiled by BloombergNEF, on worldwide, annual investments in decarbonization. BloombergNEF discusses decarbonization using the term “the low-carbon energy transition”. One sees a dramatic increase in decarbonization investments between 2004 and 2024.

Figure 10-1
Worldwide Annual Investments (US\$) in the Low-Carbon Energy Transition, 2004-2024, per BloombergNEF⁸⁴



⁸⁴ BloombergNEF. 2025. *Energy Transition Investment Trends 2025: Tracking global investment in the low-carbon transition*. BloombergNEF. 30 January 2025. Figure reproduced from the Executive Summary at page 9.

The Trump administration is foolishly obstructing investments in decarbonization. Fortunately, however, the Trump administration faces countervailing power. Around the world, large governmental entities – e.g., China, the European Union – strive to maintain polite relationships with the Trump administration but have no respect for its strategic acuity and are quietly pursuing strategies to offset its power.

China, the European Union, and like-minded entities tend to view decarbonization from three, integrated perspectives. First, decarbonization is an ethical obligation. Second, it is a practical necessity. Third, it is an area of opportunity.

Moreover, investments in decarbonization have already created feedback loops that encourage new investments. In illustration, a January 2026 report contends that Brazil could gain substantial economic benefits by accelerating its adoption of electric vehicles. The report says:⁸⁵

“Brazil stands at a pivotal moment in its transport and industrial development. While the country has benefited from decades of innovation in ethanol and flex-fuel systems, the global transition to Battery Electric Vehicles (BEVs) is accelerating and reshaping automotive value chains. This report sets out the economic, fiscal and wider strategic case for Brazil to leapfrog directly to BEVs, bypassing a prolonged dependence on internal combustion engine (ICE) technologies and capturing the benefits of a cleaner, more competitive transport system.”

Other countries could be in a similar position. China is vigorously pursuing market opportunities in electric vehicles and other decarbonization technologies. Massachusetts would be well advised to pursue related opportunities consistent with its areas of comparative advantage.

Opportunities in information systems

Ingredients of good leadership and strategy are identified above. These include information systems. Accordingly, this paper calls for creation of new, non-proprietary information systems spanning all phases and components of each major project in the triple-E space. These systems should complement each other. They should include diverse data bases together with decision-support tools including simulation models.

These information systems would serve important needs. They could enable us to achieve goals such as the elimination of GHG emissions. They could also be marketable worldwide. It would be crucially important, however, to ensure that these information systems always embody the highest standards of professional integrity. Absent those standards, stakeholders would not trust the information systems and they would be useless.

⁸⁵ Scott, B., and three other authors. 2026. *Leapfrog to Electric: The Economic Benefits of Pro-Electric Vehicle Policy – Brazil*. Carbon Tracker. January 2026. Quoted text from Executive Summary.

The new information systems should draw upon the best available techniques and skills. Unfortunately, however, many of these techniques and skills are currently controlled by members of a new, elite group that can be termed the “tech oligarchy”. Ulysses Pascal and colleagues describe this group as follows:⁸⁶

“Tech oligarchy is an emerging tendency characterized by founders and CEOs of technology firms leveraging economic and infrastructural power to influence political institutions and shape policy outcomes in favor of their own political-economic agendas.”

Clearly, the tech oligarchy cannot be trusted to create new information systems for the triple-E space. We must find other sources of expertise. These sources must exhibit both a high level of skill and a high level of professional integrity.

As we consider how we might obtain the needed expertise, we might find some guidance in work being done at the Australian National University. Peter Lewis and colleagues discuss that work in a November 2025 paper that includes the statements:⁸⁷

“We are in a race to rebuild trust and meaningful citizen engagement at a time when economic, social, political, and technological forces pull in the opposite direction. Traditional in-person engagement is declining, and government consultation processes are not meeting expectations. At the same time digital platforms have become central arenas of public life, yet in their current design many of these privately-owned digital environments amplify polarisation, reinforce grievance-driven interactions, and undermine constructive dialogue. Rather than setting up the conditions for navigating disagreement towards consensus, analysis suggests they are deepening divisions.”

“Across Taiwan, France, Germany, Brazil, and Spain, governments and civic leaders are experimenting with civic participation approaches, both digital and direct ones that prioritise inclusion, accountability, responsive deliberation, and consensus-building. These initiatives show that civic infrastructure and processes, both digital and in-person, when intentionally designed, can facilitate deliberation around responsive feedback loops that connect lived experience to decision-making at any local to national scale.”

⁸⁶ Pascal, U., and two other authors. 2026. Decentering tech oligarchy. *Science as Culture*, published online 10 February 2026. Quoted text from Introduction.

⁸⁷ Lewis, P., and other authors. 2025. *Civic Infrastructure in the Age of Digital Engagement*. Australian Resilient Democracy Research and Data Network Discussion Paper 10. Australian National University, Canberra. November 2025. Quoted text from Abstract.

11. A Warning and a Call for Action

This paper identifies deficiencies in leadership and strategy, explains why they are dangerous, and suggests corrective actions. These matters are discussed from theoretical and practical perspectives. The discussion combines objective evidence with subjective assertions. Major decisions in the triple-E space will always require the consideration of both types of information.

Here, findings in this paper are distilled into a personal commentary in two parts – i.e., a warning, and a call for action. This commentary focuses on the Commonwealth's effort to eliminate GHG emissions, but it also applies to other programs in the triple-E space. Some remarks here are pointed, but all are intended to be productive.

A warning

- Leaders downplay the climate emergency: Climate destabilization is a direct threat to humanity and also represents a larger polycrisis that is entirely attributable to human folly. Political leaders in Massachusetts have not fully acknowledged the growing dangers arising from these crises. Nor have they fully acknowledged the opportunities that could be created by corrective actions.
- The Commonwealth's climate action has been slow: In 2008 the GWSA committed Massachusetts to eliminating GHG emissions. Progress has been slow. After 18 years we lack a guiding strategy and an integrated plan of action. We are now in a period – i.e., 2025-2050 – of increasing technical difficulty, compounded by hostility from the Trump administration. We are poorly prepared to meet these challenges.
- Leaders prioritize rhetoric over planning: Political leaders like to announce new initiatives and make promises about the future. Realizing these promises, however, requires systematic, long-term planning and a disciplined, patient approach to implementation. Our leaders may exhibit a weak understanding of that imperative and may be more comfortable with rhetoric. This behavior is evident in the Commonwealth's climate effort.
- Leaders ignore or damage key societal assets: Decarbonizing the Massachusetts economy is a massive socio-technical task that will require the harnessing of every available asset. That includes two of the Commonwealth's most precious assets – i.e., a healthy democracy, and an empowered citizenry. These assets could be mobilized via civil society, programs of stakeholder engagement, and reform of the legislature. Our political leaders, however, may prefer to consort with lobbyists. They may treat civil society as a nuisance and democracy as an irrelevance. This damaging behavior is evident in the Commonwealth's climate effort.

- The legislature suppresses open debate: The Massachusetts legislature is notoriously non-transparent and unaccountable, although it is accessible to lobbyists. These proclivities play out in the climate-action context via suppression of open debate, both within the legislature and in the public arena. A package of legislation is prepared in secrecy and then suddenly submitted for an urgent vote. The public, and legislators not directly involved, struggle to understand the package in the short time available. Neither the secrecy nor the urgency is necessary. Both are destructive.
- The Commonwealth lacks capacity for technology assessment: Decarbonizing our economy will require an array of changes in technologies and policies. Making those changes in a coherent, appropriate manner will require, among other ingredients, a sophisticated, independent capacity for critical assessment of technologies and policies. At present the Commonwealth lacks this capacity and political leaders seem unconcerned about that lack. They may prefer to accept claims by lobbyists. This counterproductive behavior is evident in the Commonwealth's climate effort, especially in regard to nuclear power.

A call for action

This paper identifies serious deficiencies in leadership and strategy. Fortunately, however, these deficiencies could be corrected relatively quickly. This paper suggests various corrective options, including a set of ingredients for good leadership and strategy.⁸⁸ Other suggestions would be welcome.

The key action needed at this time is a concerted, statewide effort to establish high-quality leadership and strategy in the triple-E space in Massachusetts. That effort should involve all relevant stakeholder groups. It could be initiated by civil society and then extended more broadly. It should involve elected officials and public servants at every level.

This effort would be challenging but could yield significant benefits. Notably, it could put the Commonwealth on a pathway to success in achieving our climate goals.

⁸⁸ These ingredients are: Citizen empowerment; A long-term perspective; Adaptive management; Stakeholder engagement; Contingency planning; Partnerships; and Information systems.