Mission
The Ipswich school community is committed to developing in all students the knowledge, skills, and attitudes needed to succeed and excel throughout life.

IPSWICH SCHOOL COMMITTEE MEETING
THURSDAY, JANUARY 7, 2021
7:00 PM
MIDDLE/HIGH ENSEMBLE ROOM
(School Committee Members only)

AGENDA

Public invited to join meeting via Zoom
https://us02web.zoom.us/j/89285970318?pwd=UTRkZnBKNFBFK01xVE41dGlLclo3UT09
Meeting ID: 892 8597 0318 Passcode: 071071

Dial by your location
+1 301 715 8592 US (Washington D.C)
+1 929 205 6099 US (New York)
Meeting ID: 892 8597 0318 Passcode: 071071
Find your local number: https://us02web.zoom.us/u/kchctKA8ns

I. OPEN SESSION 7:00 PM

CALL TO ORDER

READING OF DISTRICT MISSION STATEMENT
ANNOUNCEMENTS
CITIZENS' COMMENTS
SPECIAL ACKNOWLEDGEMENTS

HIGH SCHOOL STUDENT REPRESENTATIVE REPORT
Caroline Jepsen, Student Representative

II. SCHOOL COMMITTEE PRESENTATIONS

A. ELEMENTARY SCHOOL IMPROVEMENT PLANS 7:10PM
Sheila Halloran, Principal, Paul F. Doyon Memorial School
Sheila McAdams, Principal, Winthrop School

B. ZERO CARBON RESOLUTION PRESENTATION 7:40 PM
Mike Johnson, Ipswich Climate Resiliency Committee

C. SUPERINTENDENT'S ADMINISTRATIVE REPORT 8:00 PM
Dr. Brian Blake, Superintendent of Schools

D. SCHOOL COVID OVERSIGHT UPDATE — 8:10 PM
Dr. Brian Blake, Superintendent of Schools

E. BUS STOP LETTER DISCUSSION — 8:30 PM
Chub Whitten, Chair

F. SUBCOMMITTEE REASSIGNMENTS — 8:40 PM
Chub Whitten, Chair

G. PUBLIC COMMENT — 8:50 PM

III. SCHOOL COMMITTEE REPORTS — 9:00 PM

A. VOUCHERS/BILLS
B. SUBCOMMITTEE REPORTS
1. ATHLETICS
2. BUDGET
3. OPERATIONS
4. POLICY
5. COMMUNICATIONS
6. MUTUAL CONCERNS
7. NEGOTIATIONS
C. WORKING GROUP REPORTS
D. LIAISON REPORTS
E. NEW BUSINESS*

IV. CONSENT

A. CONSENT AGENDA

V. ADJOURNMENT

***All business not reasonably anticipated 48 hours in advance of the meeting.**
Agenda items may be taken out of order to fill time gaps and/or to accommodate presenters when necessary. All times are approximate.

Announcements: January 7, 2021

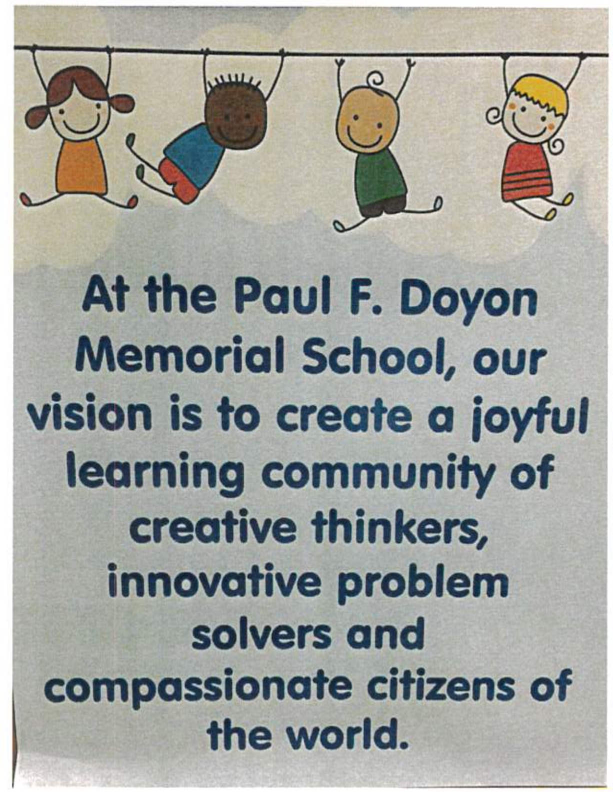
- The next School Committee meeting is Thursday, January 21, 2021 at 7:00pm
.
- The Budget Subcommittee will meet on Thursday, January 14th at 6:00pm remotely via Zoom.

- The Communications Subcommittee will meet Tuesday, January 19th at 3:30pm remotely via Zoom.

- The Policy Subcommittee will meet Tuesday, January 19th at 4:00pm remotely via Zoom.

Paul F. Doyon Memorial School

School Improvement Plan 2020-2021



2020-2021 Goals

- **Academics:**
  - Math: Beta Pilot *Illustrative Math K-5* - 2020-2021
  - Remote, Hybrid and In-Person Learning
- **Communication:**
  - Safety & Caring
  - Explore opportunities for communication among our Doyon families
- **Inclusion and Equity:**
  - Global Community
  - Social Justice

2019-2020 Academic Accomplishment

Alpha Pilot: Illustrative Math K-5, Grades 1-3

IM was founded by the lead author of the common core for math **Content** & **Mathematical Practices** (Habits of Mind for Mathematicians). Development is funded by the Gates & other major foundations.

IM K–5 Math builds a joyful mathematical community.

- **Rigorous, sequenced based on the Standard and researched learning trajectories**
- **Students see math as a *connected set of ideas;* problem based**

2020-2021 Academic Goals

- ***Illustrative Math K-5 Beta Pilot***

Provide **conceptual understanding, procedural fluency, and application.**

Three overarching & interconnected principles—*learning, teaching, and equity.*

Participate in Professional Development with IM and Learn Zillion.

- ***Remote, Hybrid, and In-Person Learning***

Provide Social-Emotional support to students, staff, and families.

Create and adapt lessons and curriculum to new teaching and learning environments.

2019-2020 Communication Accomplishments

- **Early Childhood Outreach:** Mini Grant written by Doyon Kindergarten teachers to increase partnership and collaboration with Birth to Three & Coordinated Family & Community Engagement (CFCE)
- **Safety & Caring:** Planning of an outreach evening was put on hold due to the Pandemic
- **FRIES** - Continue to increase involvement

2020-2021 Communication Goals

- **Safety & Caring**: The Safety & Caring subcommittee which includes teachers, Council members, our social worker, and IPS school resource officer will finalize the updated plan.
- **Explore opportunities for communication** among our Doyon families.

2019-2020 Accomplishments

Social Emotional Learning & Connecting with the Global Community

- Celebrating the success of Responsive Classroom
- Expanding our Global Connections
- Implementing our new K-2 World Language Program

2020- 2021 Inclusion and Equity Goals

- **Global Community**

The expansion of the World Language Program.

- **Social Justice**

Deepen our knowledge and understanding of the 4 domains: Diversity, Identity, Justice, and Action of the Social Justice & Anti-Racist Standards. Explore ways to share with our students and Doyon Community.

Winthrop School

School Improvement Plan

2020-2022

Resilience

Table of Contents

School Council Members

2020/2021

Parent Representatives

Christopher Chapman*

Anne Carroll

Christina Donehew

Michele Hunton

Ana Laguarda

Jeffrey Poirier

Jen Rita

Melissa Sciola

Peter Zetlan

Staff Representatives

Melissa D'Andrea

Sheila McAdams*

Katie Norris

Robbyn Wile

Kerry Zagarella

Goals

Goal 1: Social Justice ~ We all have personal work to do.

Positive and inclusive ethics, values and actions of our community that define us are contingent on a deep and empathetic understanding of cultural differences; accurate historical events; social systems that serve to unite, and divide, us; and the global impact of individual and community actions. In our quest to foster critical thinkers, this knowledge is critical. To this end, we seek to:

Develop common understanding through the use of shared readings, deliberate discussions, and protocols meant to engage respectfully in productive and challenging conversations about social justice issues.

To do so, we will:

- Research models and systems for having discussions on social justice issues.
- Identify foundational readings and articles.
- Facilitate discussion with a variety of groups: Council members, parents, staff, community members.
- Coordinate with local community partners to explore Ipswich's immigration history and enhance history and social studies curriculum.
- Identify actions demonstrating good citizenship.
- Choose discussion models to pilot in the classroom and with staff/peers.
- Establish a set of vocabulary and working definitions (akin to social thinking).
- Display, post in classroom, actively publicized vocabulary.
- Connect parents to the social justice curriculum and provide talking points and guidance for difficult discussion at home.

Goal 2: Academic Impacts ~ Learning has been impacted by the changes in educational routines.

In recognition of the pandemic-caused disruption in learning, special attention may be required to address any learning gaps that have occurred as a result of the shift in instructional format and structure of education. Recent data is currently inconclusive, yet strongly suggests, vulnerable populations have been especially hurt by this disruption. (https://www.npr.org/sections/coronavirus-live-updates/2020/12/01/938048852/some-good-news-student-reading-gains-are-steady-while-math-slows-down, retrieved October 2020)

To this end, we seek to:

Employ a variety of assessment methods to identify instructional weaknesses caused by disrupted learning.

To do so, we will:

- Scheduled data analysis sessions across grade levels in which an in-depth analysis of student performance will be conducted.
- Develop consistent Tier II supports for students identified with needs with clear progress monitoring tools for use.
- Explore structures through which Tier II supports can be implemented (during school, before/after school)
- Create a budget to support academic interventions.
- Educate parents as to the support resources and process that occurs as students are referred for Tier II and/or Tier III supports.

Goal 3: Social Emotional Health ~ Ensuring the social and emotional mental health of all. Maslow's hierarchy of needs has taken on increased importance in these unprecedented times. Generally represented in a pyramid, this theory contends that humans must have their most basic needs met before they are able to address more complex life functions. In education, we see evidence of this daily. Students who feel hungry, thirsty or unsafe are not available for friendship development or finding their place in a social circle. Disengaged students struggle to feel accomplishment or pride in their learning.

By necessity, the global pandemic has distanced and minimized our social connections, while creating disruptions to daily life. Over time, these changes have taken a toll on students, families and our faculty. Many, if not all households have experienced school format change, altered job demands, and fiscal challenges. Now, more than ever, an emphasis on the social emotional health of all is required. To this end, we seek to:

Create a safe and supportive learning environment that fosters caring relationships between and among adults and peers, provides emotional check-ins and strengthens self-regulation strategies.

To do so, we will:

- Develop routines and structures that result in continuous communication between teachers and the mental health team to ensure a team approach to addressing needs.
- Provide social/emotional learning opportunities, such as healing interventions, in response to toxic stress or responsive negative behaviors. Provide opportunities and social coaching for positive interactions that extend beyond family and close friends.
- Embed the social emotional curriculum in the regular ed curriculum.
- Offer time for self-regulation strategies such as mindfulness, physical exercise, and reflection.
- Encourage open communication regarding needs and available services.
- Support initiatives that address basic needs such as food support, clothing swap, etc.
- Collaborate and coordinate, through FRIES, support for parents.
- Use communication platforms to post resources for parents.
- Explore family programming, such as a winter hike, family yoga, etc., to strengthen bonds.

Goal 4: Connections ~ Strong social connections are foundational.

The isolation and reduced interactions of today leave many students and families feeling disconnected. In a recent survey, 29% of adolescents reported not feeling connected at all to school adults, their classmates or their school community. (America's Promise. The State of Young People During COVID-19, June 2020). Since a sense of belonging is embedded in social emotional well-being, finding ways to connect within and among each other takes on greater importance.

Our ability to communicate with each other is critical when establishing a unified learning community. For non-English speaking families, deliberate efforts must be made to ensure inclusive communication and access to information. To date, our communication systems fail to take into account the challenges embedded within. To this end, we seek to:

Create, strengthen and extend ways in which students, families and faculty can connect within and among each other.

To do so, we will:

- Establish, broaden and strengthen communication methods and systems for sharing information.
- Explore various platforms that may allow for "one stop" communication (Brightwheell) or can be used as a specific application (pikmykid).
- Brainstorm and plan revised and/or alternative afterschool programming plans such as ACE which meet the safety requirements of today.

Ipswich Municipal Government
Resolution for Zero Carbon Energy by 2040
Approved by the Ipswich Climate Resiliency Committee December 1, 2020

Whereas, Ipswich is experiencing the impacts of climate change today and it will become increasingly more damaging to our community and citizens, our health, coastal ecosystems, and economy; and,

Whereas, the burning of fossil fuels is the primary cause of climate change; and,

Whereas, the Ipswich municipal government is taking steps to reduce its carbon emissions and promote clean energy, reduce its climate vulnerability, and increase climate resiliency; and,

Whereas, a Zero Carbon Energy goal will result in the use of cleaner energy, increase energy efficiency and resiliency, avoid negative impacts associated with fossil fuel use, and provide better local control and ownership of energy generation that reduces the Town's exposure to volatile fossil fuel energy prices; and,

Whereas, Ipswich can obtain 100% of its energy from clean, non-carbon sources, including solar and wind energy coupled with energy storage, and reduce energy use through energy efficiency and conservation measures, and electrify space and water heating and transportation;

Now, therefore, be it resolved by the Ipswich Select Board, School Department and School Committee in the County of Essex, Commonwealth of Massachusetts, that the municipal government of Ipswich commits to achieving a Zero Carbon Energy goal no later than 2040, with the following interim goals: 25% by 2025, 50% by 2030, and 75% by 2035;

And be it further resolved that the Town of Ipswich will address the Zero Carbon Energy goal through the creation of an implementation plan via an integrated, transparent and inclusive planning process that encourages the participation of all community members and local businesses;

And be it further resolved that all new municipal buildings will be fully electric with no on-site fossil fuel combustion;

And be it further resolved that the Town's major capital strategic investment plan will be fully evaluated to identify decision-points where investments and projects will need to incorporate electrification, energy conservation, and renewable energy installation;

And be it further resolved that all municipal decisions, including land use and development planning, shall include the review of the total capital, operations, and maintenance costs and benefits of alternative options, including energy source and use, climate adaptation and resiliency costs and benefits associated with climate change, including sea level rise, more extreme weather events, and higher temperatures over their expected life span;

And be it further resolved that the municipal government will establish and/or expand programs that support Ipswich residents and businesses in efforts to increase energy efficiency and conservation and the use of renewable energy;

Include list for signatures (SB, SC, Town Manager)

Background Paper in support of an Ipswich Municipal Government Zero Carbon Energy Resolution

Prepared by the Ipswich Climate Resilience Committee, December 2020

Background

This paper is intended as background and rationale for a proposed Ipswich municipal government Zero Carbon energy resolution. This background paper defines the goals and strategies for the municipal government to follow in pursuit of the resolution.

An Ipswich committee (Commission on Energy Use and Climate Protection) first developed a Climate Action Plan in 2011, and an update was prepared in 2017 to provide more focus for the municipal government. Further, the Community Development Plan was updated in 2008 with a section directly addressing the role of municipal government in reducing its greenhouse gas (GHG) emissions, and developing energy conservation and renewable energy programs.

As a coastal community with a tidal river running through its central downtown, Ipswich is facing a high degree of climate vulnerability. Large numbers of homes, businesses, and municipal infrastructure are located in low-lying areas, making them vulnerable to predicted sea level rise, increased storm surge, erosion, and storm-related flooding. These and other climate-related vulnerabilities must be addressed to protect human life as well as the economic well-being of Ipswich.

At the same time, it will be necessary to reduce the town's GHG emissions, which collectively causes climate change. It is imperative for Ipswich to reduce its GHG emissions if we are to meet the goals of the 2008 Massachusetts Global Warming Solutions Act (GWSA). On April 22, 2020, the GWSA was updated by establishing a goal of meeting "net zero" emissions by 2050. Ipswich should also meet its own climate goals established in the 2011 and 2017 Climate Action Plans.

Recently, Ipswich has made encouraging progress towards reducing the municipal government's GHG emissions, such as achieving a Green Communities Program designation in February 2020. In addition, in 2019, Ipswich completed requirements for the State Municipal Vulnerability Preparedness (MVP) program and is now eligible for MVP Action Grant funding and other climate resiliency opportunities. However, ambitious work lies ahead for the entire community to reduce and eventually eliminate all GHG emissions, and to address the town's climate vulnerability.

How is Ipswich vulnerable to climate change?

Like many North Shore communities, much of Ipswich is low-lying and exposed to rising sea levels and flooding. Low-elevation areas flood on annual and semi-annual basis during storms and abnormally high tides, which is exacerbated by improperly-size stormwater infrastructure, such as road culverts, which function as hydrological barriers. Approximately 25% of Ipswich is vulnerable to coastal inundation under present-day conditions, according to a climate vulnerability assessment prepared for seven communities in the Great Marsh[1]. The Great Marsh Coastal Adaptation Plan (GMCAP) identified 46 structures in Ipswich that are subject to a 1% annual chance of flooding, with 11 being regarded as critical infrastructure (i.e., one well, two dams, and eight bridges)[2]. According to the recently released State of the Coast Report prepared by the Trustees of

[1] Schottland, Taj, Melissa G. Merriam, Christopher Hilke, Kristen Grubbs, and Wayne Castonguay. 2017. *Great Marsh Coastal Adaptation Plan*. National Wildlife Federation Northeast Regional Office, Montpelier, VT.

[2] Ibid.

Reservations, a 10-year storm in Ipswich may flood more than 340 buildings, and chronic daily tidal flooding could impact 50 buildings by 2050[3].

Crane Beach, Plum Island, Clark Beach, and Pavilion Beach are exposed and highly vulnerable to wind, wave action, and sea level rise. An analysis completed by the Massachusetts Coastal Erosion Commission found Crane Beach was experiencing the second highest erosion rate on the North Shore, with an average beach loss of 4.6 feet per year between 1970 and 2009[4]. Rising seas and increased storm activity, erosion and its associated impacts are likely to worsen. New England coastal communities, including Ipswich, are projected to experience sea levels higher than the global average. Under a 2-meter (6.6 feet) global sea level scenario, Portsmouth and Boston would experience increased mean sea levels of about 0.9 meter (3 feet) by 2050 and around 2.7 meters (9 feet) by 2100[5]. While some uncertainties in future projections for sea level rise exist, such as the sensitivity of Antarctic and Arctic ice sheets to future warming, it is possible that higher sea levels may occur[6].

Ipswich is fortunate to hold diverse and productive natural resources that provide important economic drivers for the tourism and seafood industries, but they are also vulnerable to the effects of climate change. Crane Beach draws over 250,000 users annually-both locals and visitors. Open fields, conservation land, and farms attract tourists and provide local residents with valuable recreational and agricultural destinations. Ipswich is the largest soft-shell clam producer in Massachusetts, and provides an estimate direct value of $2 million and a total economic value of $8 million to the area[7]. Approximately 21% of the landmass in Ipswich contains salt marsh wetlands which are part of the Great Marsh, the largest contiguous salt marsh in New England[8]. Salt marsh wetlands provide valuable storm surge and flood protection for the community, as well as serving as productive nursery and feeding habitat for commercial and recreational fisheries and waterfowl. These and many other important natural resources are at risk from more frequent drought and flooding, rising sea levels and storm surge, and warming ocean waters and ocean acidification. Nearly 322 acres of high marsh and 445 acres of estuarine beach/tidal flats could be lost to open water by 2050[9]. Increasing red tide events have caused shellfish closures for parts of most years, often linked to large storm events that carry fecal-coliform and other pollutants from urban areas into creeks and marshes[10].

Over the past decades, the northeastern U.S. region saw a 55% increase in the amount of precipitation falling as very heavy events[11]. In 2006, the Town experienced its worst flooding in its history during the Mother's Day flood, and increased impacts from both coastal and inland flooding are becoming more and more common throughout the seasons and the years[12]. Extreme precipitation events are projected to be 22% more likely under

---

[3] State of the Coast: Future climate-driven risks- and their solutions- on Massachusetts' North Shore. 2020. Trustees of the Reservations. https://www.onthecoast.thetrustees.org/download-a-copy

[4] Massachusetts Executive Office of Energy and Environmental Affairs (MA EEA). *Shoreline Characterization and Change Analyses. North Shore Region. Regional Coastal Erosion Commission Workshop*. Gloucester, MA: 2014. http://www.mass.gov/eea/docs/czm/erosioncommission/shoreline-profile-north-shore.pdf

[5] https://tidesandcurrents.noaa.gov/publications/techrpt083.csv

[6] Sweet WV, Kopp RE, Weaver CP, Obeysekera J, Horton RM, Thieler ER, Zervas C. 2017. Global and regional sea level rise scenarios for the United States. National Oceanic and Atmospheric Administration, National Ocean Service. NOAA Technical Report NOS CO-OPS 083. p. 1-56

[7] Town of Ipswich. 2013. Open Space and Recreation Plan. Ipswich, MA.

[8] Schottland et al. 2017.

[9] State of the Coast: Future climate-driven risks- and their solutions- on Massachusetts' North Shore. 2020.

[10] Schottland et al. 2017.

[11] Easterling DR, Kunkel KE, Arnold JR, Knutson T, LeGrande AN, Leung LR, Vose RS, Waliser DE, F. WM. 2017. Precipitation change in the United States. Climate Science Special Report: Fourth National Climate Assessment. [Wuebbles DJ, Fahey DW, Hibbard KA, Dokken DJ, Stewart BC, Maycock TK (eds)]. U.S. Global Change Research Program. p. 207-30.

[12] Town of Ipswich. 2019. Municipal Vulnerability Preparedness Plan. Community Resilience Building Workshop Summary of Findings. March 2019. Prepared for the Town of Ipswich by the Ipswich River Watershed Association.

a "business as usual" emissions scenario over the 21st century[13]. Conversely, the Ipswich River watershed suffered its worst drought in the history of the region in 2016[14]. Climate projections forecast changes in precipitation patterns and an overall increase in both temperature and stretches of dry days, suggesting that these patterns of drought and flooding will only be more problematic for the community in the future.

How can Ipswich limit its vulnerability to climate change?

The 2017 GMCAP report includes a climate vulnerability assessment for Ipswich and specific adaptation strategies and recommendations for the town and for the region as a whole. Some of the GMCAP report recommendations include:
1) Best Practices. Establishing and maintaining a permanent Municipal Resiliency Task Force or committee; collaborating across municipal departments; incorporating climate change adaptation planning and climate projections into all relevant local and regional plans as well as capital investment projects;
2) Natural and Nature-based Strategies. Using living shorelines to stabilize shoreline edges in lieu of hardened structures, where appropriate; restoring degraded salt marshes; facilitating marsh migration; open space conservation for flood storage and uptake of carbon from the atmosphere;
3) Gray Infrastructure and Retrofits. Removing unnecessary dams; upgrading road-stream crossings, retrofitting buildings to be more flood resilient;
4) Land-use Planning and Policy. Updating municipal policies; prioritizing low-impact development practices; revising local wetlands protection bylaws and regulations; moving development away from the coast and from wetlands; instituting comprehensive water resources management, including strategies for stormwater, waste water, and public drinking water; creating "freeboard incentive" for residential and commercial buildings; using transferable development credits to reduce risky coastal development;
5) Outreach and Engagement. Developing municipal strategies for enhanced outreach and education; strengthening existing regional outreach and education programs.

If implemented across the board, climate resiliency and adaptation measures can ensure the municipal government is operating in a coordinated and comprehensive manner. These measures include policies, local regulations, ordinances, and rules, and should be incorporated in all municipal departments and operations and Town advisory boards and committees. A Town Resolution is needed to codify climate resiliency and GHG reduction goals across broad municipal government boards and departments.

Why should Ipswich reduce its greenhouse gas emissions?

Greenhouse gas emissions, primarily carbon dioxide released from burning fossil fuels, must be reduced and eventually eliminated to prevent the worst consequences of climate change. In 2018 the Intergovernmental Panel on Climate Change (IPCC) issued Special Report 15, which concluded humankind has a mere 12 years left, during which time sufficient and dramatic carbon-emission mitigation strategies must be inaugurated to avoid the global average temperature from rising above the 1.5°C limit which the 2015 Paris Climate Change Agreement aimed for, while pledging to keep it well below 2°C above pre-industrial levels[15] [16]. The IPCC report stated that in order to prevent exceeding the 1.5°C limit, global net anthropogenic CO_2 emissions must decline by about 45% from 2010 levels by 2030 and reach net zero around 2050. While this will require extraordinary and immediate action, it is (as yet) an attainable goal.

---

[13] Easterling et al. 2017.

[14] Town of Ipswich. 2019.

[15] IPCC. 2018. Summary for policymakers. In: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P. R. Shukla, et al. (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp.

[16] Rhodes CJ. 2019. Only 12 years left to readjust for the 1.5-degree climate change option – Says International Panel on Climate Change report: Current commentary. Science Progress 1–15.

While the goal of reducing and eventually phasing out all fossil fuel energy use will require robust international and national efforts, cities and towns on every continent and country must be a part of the process if these goals are to be met. It will require substantial cooperation and collaboration between municipal, state, federal, and international government, as well as private and non-governmental organizations. Ipswich, in particular, has a strong incentive for meeting these goals given the Town's high vulnerability to the effects of climate change. As stewards of our children's future, we have special responsibilities to minimize the worst consequences of climate change for them and their children. In this regard, Ipswich is confronting both economic and logistical challenges, as well as the moral imperatives of meeting these climate goals.

Zero Carbon Energy Goal

The primary strategies for reducing carbon emissions can be grouped in four general approaches:

1. **Conservation and Efficiency**: Reducing all energy use through conservation efforts (e.g., lowering thermostat in winter and turning off lights in unoccupied rooms) and energy efficiency (e.g., installing programmable thermostats, LED lighting, Energy Star appliances, and increased building insulation)
2. **Replacing Fossil Fuels with Non-Carbon Energy as a Source of Electricity**: Increased use of clean, non-carbon energy through the installation of locally-sited solar and wind generation, and purchasing grid-sourced electricity from non-carbon generation only
3. **Electrification of all On-site Building Energy Use**: Preventing expansion of fossil fuel usage by requiring all new buildings to be "Net-Zero" (all energy use is offset by on-site renewable energy) and by electrification of all energy use in new and existing buildings and transportation
4. **Energy Storage**: Installation of utility- and smaller-scale (e.g., business and residential) energy storage systems to reduce peak demand and extend the use of renewable-sourced electricity beyond the times of generation

All four of these paths must be followed in order to achieve a Zero Carbon Energy future. In addition to eliminating fossil fuel use, the Town must reduce its energy us through conservation and efficiency. Not doing so will require a long-term and enormously expensive challenge to develop and purchase enough carbon-free energy sources to power our current use levels. In the interim, we have to electrify all of our energy uses so that they can be powered by carbon-free energy. Finally, incorporating energy storage not only extends the time of use in locally-generated, renewable energy, but allows it to be dispatched during periods of peak energy demand that typically results in the use of the most carbon-intensive energy sources that releases largest amount of GHGs and other emissions that contribute to poor air quality.

A transition to zero carbon energy presents an opportunity to address inequality and environmental injustice caused by a carbon-based energy system and centralized production of electricity. As we transform how we power our communities, Ipswich can make an intentional effort to improve social equity.

The benefits of a clean energy transition are broad in scope and significant. Developing clean energy sources can translate to local and statewide job creation, more reliable energy supplies and more stable energy prices, improved public health, and a better environment. In addition to the proliferation of zero carbon energy commitments by municipalities, more than 180 mayors nationally, both democrats and republicans, have pledged to promote sustainability and reduce GHG emissions, low-carbon transportation, energy efficiency in new and existing buildings, and green electricity and conservation efforts. The United States Conference of Mayors, the nation's largest nonpartisan organization of cities, approved a historic resolution this year, establishing a policy framework to support zero carbon energy goals in cities nationwide[17].

---

[17] Mayors Leading the Way on Climate. How Cities Large and Small are Taking Action. January 2020. https://www.c2es.org/document/mayors-leading-the-way-on-climate-2020/

Elements of a Zero Carbon Energy Goal for Ipswich by 2040:

1. Electrification of energy uses: Transition of all energy uses in all sectors (transportation, heating/cooling, etc.) to electric power provided by clean, non-carbon energy;
2. Ensure justice, equity, affordability, and access: A commitment needs to include measures that prioritize equity and affordability, and access to clean energy for all members of the community, including low income communities;
3. Develop clean, local renewable resources only and phase out carbon sources: Renewable energy includes carbon and pollution-free energy sustainably collected from renewable sources including wind, solar, and geothermal. Some forms of biomass may be included after being evaluated for sustainability and environmental justice implications. Natural gas, coal, oil, or any other forms of carbon-based energy production are not included as clean, renewable sources of energy. Fossil fuel infrastructure for new construction of public buildings should be avoided. New fossil fuel sources of energy should not be added to existing buildings, such as expanding new gas lines into neighborhoods or businesses where they currently do not exist;
4. Net-Zero buildings: A commitment to work toward requiring all new buildings, to the extent allowable under existing codes, to be constructed as net-zero buildings. Work towards establishing a building code that requires new buildings be net zero;
5. Zero carbon energy generation: The Ipswich Electric Light Department (ELD) should set a goal of providing zero carbon electricity by 2040. This includes a goal of local distributed renewable generation, as well as Zero Carbon goal for the Ipswich ELD grid-sourced electricity portfolio;
6. Promote and increase energy storage: The ELD should investigate and pursue the installation of utility-scale energy storage (e.g., battery banks) as part of an effort to reduce peak demand and eliminate carbon-based electricity sources during those periods. In addition, the ELD should promote and incentivize energy storage devices (e.g., Tesla Power Wall) for residents and businesses, and investigate the feasibility of dispatching stored energy to the grid during peak demand periods;
7. Undertake campaign to convert heating systems to electricity-only in existing buildings: Develop an aggressive campaign for the municipal government, local residents and businesses to install and undertake comprehensive efforts to replace fossil fuel energy sources (i.e., oil, natural gas, and propane) for space and water heating needs and cooking with electricity, combined with energy conservation and efficiency measures;
8. Transparent and inclusive planning and implementation process: Ensure that community members and local businesses have an opportunity to engage and participate in planning and implementing the Zero Carbon Energy goal.

Strong commitments also include organizational change in Ipswich town government:

1. Consolidate recommendations: Ipswich needs to collect its recommendations for climate action from the 2011 and 2017 Climate Action Plan, the GMCAP, and other related plans and goals into a comprehensive list of recommended actions. The recommendations should be prioritized by effectiveness in addressing the problem, and timing, so it can serve as a blueprint for achieving a Zero Carbon goal for the entire community. A climate action recommendation blueprint should be a living document that is updated and revised as technology and strategies evolve. These plans should be integrated into every Town department and used in annual planning and project review;
2. Commitment to regional collaboration: Make a commitment to working with surrounding communities to achieve aligned climate and clean energy and equity goals;
3. Commitment to advocate: A commitment to advocate for policies or regulations at the state, regional and/or federal level that aid the Town in the energy transition;
4. Municipal-wide organizational commitment: Town departments should have coordinated review and implementation of climate and energy-related goals, projects, and budgets. This effort needs to include all relevant departments. Examples include road (e.g., ensuring safe pedestrian and bicycle access, climate resiliency), buildings (e.g., prioritizing construction of only net-zero buildings), and Town vehicles (e.g., purchasing electric vehicles when available and feasible).

5. Municipal planning, review and monitoring of building projects: Key Town department and committees should be involved with and coordinate in the planning and budgeting stages of all Town building projects as part of a Zero Carbon energy goal. The current Strategic Planning Committee, composed of representatives of a broad array of boards and committees, can be a starting point for establishing a permanent committee to review projects to ensure fully-electric heating systems (i.e., air and ground-source heat pumps) are included in the design and construction of building projects. This permanent committee could also be tasked with monitoring the resulting operations of net-zero buildings, renovation of existing buildings, and more.
6. Functional and effective oversight method: The committee tasked with monitoring planning, design, and operations will need to adopt a process and method for evaluating project design for construction and operation costs, and track and evaluate operations to assure projects function as designed relative to energy use.

Working towards Zero Carbon Energy:

A number of environmental non-profits in the state, including the Sierra Club Chapter in Massachusetts, Environment MASS, and 350 MA for a Better Future, joined together in the MassPowerForward coalition and have embraced the goal of 100% renewable energy.

Thirteen communities in Massachusetts have adopted a commitment to work toward 100% renewable energy – either for the municipality or for the community as a whole. These municipalities include cities like Salem, Lowell, and Cambridge, to towns such as Leverett, Greenfield, and Marblehead. The Sierra Club "Ready for 100" Campaign recognizes community commitments as places where a city's or town's leadership has established a goal to transition the entire community to 100% clean, renewable energy. The links below contain more detailed information on this subject.
https://www.sierraclub.org/ready-for-100/commitments
https://www.mapowerforward.com/

Briefing Paper on Definitions for the Ipswich Municipal Climate Resolution Goal

Prepared by the Ipswich Climate Resiliency Committee, October 2020

Purpose of Briefing Paper

During deliberations for the municipal climate resolution, the Climate Resiliency Committee (CRC) identified various options as it applied to the goal. The three primary options were Zero Carbon, Net Zero, and 100% Renewable. In order to better evaluate and select the most appropriate option for the goal, the CRC requested a briefing paper be prepared by some of the members that would define and evaluate the options, and consider the implications to the municipal government and the feasibility of meeting each option.

Background

Since early 2020, the Ipswich Climate Resiliency Committee (CRC) has been drafting a resolution that proposes climate goals for the municipal government. The purpose of the goal is to establish a vision and goal for climate resiliency throughout the municipal government. There are two primary strategies for climate resiliency: climate adaptation and climate mitigation.

Climate adaptation involves managing the effects of climate change that is occurring and will occur as a result of historic greenhouse gas (GHG) emissions since the beginning of the industrial revolution in the late 19th century. This includes rising sea levels, warming atmosphere, changes in the patterns, amount, and types of precipitation (i.e., rain vs snow), and extreme weather events. Adaptation may include changes to how existing and new buildings and roads are constructed; soft, vegetated buffers at the interface of land and ocean; and relocating infrastructure to less vulnerable areas.

The second strategy, climate mitigation, involves reducing the emissions of GHGs through energy conservation and efficiency, and replacing fossil-fuel energy (primarily natural gas and petroleum fuels for Ipswich) with non-carbon, renewable sources, such as wind and solar energy. Climate mitigation may also include carbon sequestration– the capturing of carbon dioxide from the atmosphere using both technological or biological approaches (e.g., reforestation and wetland restoration). Although carbon sequestration will be an important part of future climate mitigation, there are many technical and scientific questions remaining and we are focusing on reduction of GHG emissions in the current resolution and goal.

There are a number of different types of non-carbon energy sources available, some of which has its own environmental concerns, including nuclear energy and hydropower (see discussions below). Developing a concise and effective climate goal for the municipal government that considers the costs and benefits of the energy source options, as well as the terminology used for the goal, is complicated. This briefing paper attempts to define and explain the energy options and their costs/benefits as applicable to the climate goal.

The levelized cost of energy (LCOE) is one measure of a power cost that allows comparison of different sources of electricity generation on a consistent basis. The LCOE can be regarded as the minimum constant price at which electricity must be sold in order to break even over the lifetime of the project. LCOE includes capital costs, operations and maintenance (e.g., fuel and repairs), transmission, and tax credits, if applicable. Some criticism of using LCOE as a metric for comparing new generating sources include not considering the effects of the time required to match production and demand (e.g., dispatchability, or the ability of a generating system to come online, go offline, or ramp up or down, quickly as demand swings, and the extent to which the availability profile matches or conflicts with the market demand profile).[18]

---

[18] https://en.wikipedia.org/wiki/Cost_of_electricity_by_source

This briefing paper will evaluate the following three primary options for the municipal climate resolution:

1. Zero Carbon,
2. Net Zero, and
3. 100% Renewable

While the three options are similar in terms of reducing fossil fuel energy use and GHG emissions, each have differing costs, benefits, and implications to the sources of energy the municipal government purchases and generates. First, we will define and explain the three options.

Zero Carbon

Simply put, zero carbon means 100% of the energy used for space heating, lighting, and transportation is obtained from carbon-free sources. Specifically, it requires that the consumption or use of the energy does not release carbon dioxide into the atmosphere. The primary sources of zero carbon energy available today are wind, solar, hydropower, and geothermal (all renewable sources), and nuclear energy. Although nuclear energy is carbon free, it is not considered renewable because the energy is derived from uranium extracted from the ground and is therefore not a renewable resource. Although uranium is found in rocks all over the world, nuclear power plants usually use a very rare type of uranium, U-235. There are other environmental concerns related to nuclear power (see below). Although hydropower is both carbon free and renewable, there are other environmental concerns related to hydropower (see below).

Pros: Addresses GHG emissions, the root causes of climate change; accelerates the transition to a goal of carbon-free energy; the Levelized Cost of Energy (LCOE) for carbon-free energy (especially wind and solar PV) is projected to decline[19] over the next two decades (see Appendix Tables).

Cons: The LCOE of some carbon-free energy today is higher than natural gas, but with substantial variability (see Appendix Tables)[20]; there are practical constraints and it is somewhat difficult to achieve zero carbon in the short-term (<10 yrs.); nuclear and hydropower have their own environmental and societal impacts.

Net Zero

The concept of net zero is most commonly used to describe buildings that generate an equivalent amount of on-site renewable energy consumed in the building. As a community goal, net zero (sometimes referred to as carbon neutral) refers to "balancing" a measured amount of carbon dioxide released with an equal amount of carbon offsets. A very simple example would be offsetting X metric tons of carbon dioxide from burning natural gas with the generation of electricity from a wind turbine that generates the energy equal to X metric tons of carbon dioxide. Other means of achieving a net zero carbon goal is to purchase carbon offsets in "carbon markets" that sell renewable energy credits or carbon sequestration projects like reforestation projects. However, in order to achieve zero carbon, any increase in the amount of energy used from fossil fuel sources must be "balanced" by a corresponding increase in carbon-free sources or offsets, and requires accurate and detailed tracking of emissions from all fossil fuel sources and the equivalent carbon offsets. In addition, because net zero could allow continued use of some fossil fuels, a net zero goal would extent the amount of time necessary to reach a fully zero-carbon goal.

Pros: Net zero goal could allow a mix of carbon and non-carbon energy, so allows more flexibility to achieve progress; it targets creation and removal of carbon emissions; the LCOE for carbon-free energy (especially wind and solar PV) is projected to decline [21] over the next two decades (see Appendix Tables)

Cons: In the short-term, the LCOE of some carbon-free energy is higher than natural gas, but with substantial variability (see Appendix Tables)[22]; demand for carbon offsets is expected to rise, which is expected to increase

[19] Annual Energy Outlook 2020 with projections to 2050 (https://www.eia.gov/aeo)

[20] Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2020 (https//www.eia.gov/aeo

[21] Annual Energy Outlook 2020 with projections to 2050 (https://www.eia.gov/aeo)

[22] Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2020 (https//www.eia.gov/aeo

the market price and costs; there are practical constraints and it is somewhat difficult to achieve zero carbon in the short-term (<10 yrs.); nuclear and hydropower have their own environmental and societal impacts; transfers the root problems (GHG emissions) from one resource/entity to another; allows continued investment in long-lived fossil fuel infrastructure (e.g., gas pipelines, heating systems); because new fossil fuel infrastructure is difficult/costly to replace with non-carbon energy, it can extend the time frame needed to achieve a fully, carbon-free energy goal.

100% Renewable

100% renewable means all of the energy used by the municipal government is obtained from renewable sources. Renewable energy includes zero carbon (i.e., wind, solar, hydropower, and geothermal) and carbon emitting sources (i.e., biomass). See below for more information about renewable energy.

Pros: Addresses GHG emissions, the root causes of climate change; accelerates the transition to carbon-free, environmentally-sustainable, zero-carbon power supply; the LCOE for renewable energy sector is projected to decline substantially[23] over the next two decades (see Appendix Tables).

Cons: In the short-term, the LCOE of some renewable energy is higher than natural gas, but with substantial variability (see Appendix Tables)[24]; there are practical constraints and it is somewhat difficult to achieve in the short-term (<10 yrs.); renewable energy has lower power density compared to nuclear and fossil fuel energy (i.e., large area requirements); wind and solar energy is intermittent/non-dispatchable without energy storage capacity.

Energy Source Overview

Renewable Energy

According to the Department of Energy, Energy Information Administration (EIA), renewable energy is energy from sources that are naturally replenishing but flow-limited; renewable resources are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time.[25] The EIA projects renewable energy to expand and replace most fossil fuels, and the costs are projected to decline by 2050[26].

The major types of renewable energy sources are:

Biomass:

Biomass is organic material that comes from plants and animals, and is a renewable source of energy. Plants absorb the sun's energy and atmospheric carbon in a process called photosynthesis. Biomass can be burned directly or converted to liquid biofuels or biogas that can be burned as fuels.

Although biomass is considered renewable, it is a carbon energy source and when burned the carbon dioxide is released into the atmosphere. Although most of the embodied carbon in biomass was extracted from the atmosphere by plants through photosynthesis, there are concerns that the energy used in the processing of biomass fuel, and in some cases growing the crops used in the feedstock, can substantially increase emissions of GHGs. Biomass can release other air pollutants that are known to cause smog, ozone, and respiratory disease. Other concerns with biomass energy are that the land and resources it uses can compete with food crops, causing food shortages and higher consumer prices. Biomass production for energy can also increase the amount of chemicals used, including pesticides and fertilizers. Biomass energy can include:

> *Wood and wood waste*–Wood pellets are manufactured wood products that can involve substantial energy use and emissions in production and transportation.
>
> *Municipal solid waste*– Municipal solid waste (MSW) or garbage, is used to produce energy at waste-to-energy plants and at landfills. MSW includes plant or animal products, materials such as paper,

[23] Annual Energy Outlook 2020 with projections to 2050 (https://www.eia.gov/aeo)

[24] Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2020 (https//www.eia.gov/aeo

[25] https://www.eia.gov/energyexplained/renewable-sources/

[26] Annual Energy Outlook 2020 with projections to 2050 (https://www.eia.gov/aeo)

cardboard, food waste, and wood. MSW also includes non-biomass combustible materials such as plastics and other synthetic materials made from petroleum and non-combustible materials such as glass and metals. Waste-to-energy plants can "scrub" some pollutants after combustion, but are known to emit carbon dioxide, dioxin, lead, and mercury. In addition, they generally consume more energy and are more costly compared to recycling and composting the materials.

Landfill gas and biogas– Biogas is produced from biomass through the process of anaerobic decomposition. Anaerobic bacteria digest biomass and produce biogas. Biogas is composed mostly of methane and carbon dioxide. Biogas forms in, and can be collected from, municipal-solid-waste landfills and livestock manure holding ponds. Biogas can be used as a fuel similar to natural gas, and like other biomass sources carbon dioxide is released during the combustion process.

Ethanol–Ethanol is a clear, colorless alcohol made from a variety of biomass materials called feedstocks (the raw materials used to make a product). Fuel ethanol feedstocks include grains and crops with high starch and sugar content such as corn, sorghum, barley, sugar cane, and sugar beets. Ethanol can also be made from grasses, trees, and agricultural and forestry residues such as corn cobs and stocks, rice straw, sawdust, and wood chips. Carbon dioxide is released during the combustion of ethanol.

Biodiesel– Biomass-based diesel fuels is used in transportation and heating fuels. Biodiesel is made from biomass or materials derived from biomass, and can be made from nearly any feedstock (raw material) that contains adequate free fatty acids (e.g., raw vegetable oils, used cooking oils, and animal fats). Biodiesel is typically blended with petroleum distillate/diesel in ratios of 2%-20%.

Hydropower:
Hydropower is created by the force of water flowing in streams and rivers to produce mechanical energy. Hydropower was one of the first sources of energy used for electricity generation and until 2019, hydropower was the largest source of total annual U.S. renewable electricity generation. Hydropower plants uses water flowing through a pipe, or penstock, then pushes against and turns blades in a turbine to spin a generator to produce electricity. Conventional hydroelectric facilities include run-of-the-river systems, where the force of the river's current applies pressure on a turbine, and storage systems, where water accumulates in reservoirs created by dams on streams and rivers and is released through hydro turbines as needed to generate electricity. Most U.S. hydropower facilities have dams and storage reservoirs.

Although hydropower is a zero-carbon energy source, hydropower facilities can have a major impact on aquatic ecosystems, both upstream, on-site, and downstream of the dammed reservoir and facility. Reservoir water is usually more stagnant than normal river water. As a result, the reservoir will have lower oxygen levels and higher than normal amounts of sediments and nutrients, which can cultivate an excess of algae and other aquatic weeds. These weeds can crowd out other river animal and plant-life. In addition, if too much water is stored behind the reservoir, segments of the river downstream from the reservoir can dry out. Older dams, especially in New England, can have substantial maintenance costs and liabilities[27]. Hydropower dams, with either inefficient or nonexistent fish bypass structures, restricts the movement of fish and invertebrates in rivers and streams. Damming of rivers and streams has been a major cause of the population decline of U.S. Atlantic salmon, and other diadromous species including alewife, blueback herring, American shad, and American eel in New England and Canada.

Geothermal:
Geothermal energy is heat within the earth and is a renewable energy source because heat is continuously produced inside the earth. In New England, geothermal energy is typically extracted using buried pipes that are drilled several meters underground and using geothermal heat pumps. Although geothermal "fuel" is free and

---

[27] https://stories.usatodaynetwork.com/climatechange/aging-dams/; https://patch.com/massachusetts/marlborough/unsafe-local-dam-one-39-mass-documents-show

geothermal heat pumps are extremely energy efficient, they require energy to operate the associated pumps, compressors, and fans.

Wind:
Wind is a renewable energy that is caused by uneven heating of the earth's surface by the sun. The wind is extracted as mechanical energy to generate electricity. Wind energy "fuel" is free and is a zero-carbon energy source.

Solar:
Solar energy can be extracted as thermal energy to heat water for use in buildings for space and water heating, or at high temperatures in solar thermal power plants. Solar photovoltaic (PV) devices, or solar cells, change sunlight directly into electricity. Arrangements of many solar cells in PV panels and arrangements of multiple PV panels in PV arrays can produce electricity for an entire building. Commercial PV power plants can involve large arrays that cover many acres to produce electricity for thousands of homes. Using solar energy has three main benefits: solar energy is free, the systems do not produce air pollutants or carbon dioxide, and it has minimal effects on the environment. The two primary limitations of solar energy is the amount of sunlight that arrives at the earth's surface is not constant, and varies depending on location, time of day, season of the year, and weather conditions, and the amount of light reaching a square foot of the earth's surface is relatively small, so a large surface area is necessary to absorb or collect a useful amount of energy. According to the EIA, solar PV has the lowest estimated levelized cost of energy (LCOE) of any other utility-scale electricity source (see Appendix Tables)[28]

Nuclear Power

As discussed above, nuclear power is zero carbon, but is not a renewable energy source. Nuclear power uses nuclear reactions that release energy to generate heat, which most frequently is then used in steam turbines to produce electricity in a nuclear power plant. Nuclear power can be obtained from nuclear fission, nuclear decay and nuclear fusion reactions. Presently, the vast majority of electricity from nuclear power is produced by nuclear fission of uranium and plutonium. Nuclear decay processes are used in niche applications such as radioisotope thermoelectric generators. Generating electricity from fusion power remains at the focus of international research.

Nuclear power is a safe energy source in terms of fatalities per unit of energy generated compared to other energy sources. Coal, petroleum, natural gas and hydroelectricity each have caused more fatalities per unit of energy due to air pollution and accidents. Because there are no emissions from operation, nuclear power has prevented about 1.84 million air pollution-related deaths and the emission of about 64 billion tons of carbon dioxide equivalent that would have otherwise resulted from the burning of fossil fuels since commercialization in the 1970s.[29]

However, accidents in nuclear power plants have occurred, including the Chernobyl disaster in the Soviet Union in 1986, the Fukushima Daiichi nuclear disaster in Japan in 2011, and the more contained Three Mile Island accident in the United States in 1979. In addition to concerns of accidents or terrorist acts at nuclear power plants, disposal of nuclear waste is often considered the most politically divisive aspect in the lifecycle of a nuclear power facility. Because there is no current U.S. plan for disposing of nuclear waste at central depositories, all plants will be required to keep the waste on the plant premises indefinitely.[30]

There is a debate about nuclear power as strategy for addressing the climate change crisis. Proponents, such as the World Nuclear Association and Environmentalists for Nuclear Energy, contend that nuclear power is a safe,

---

[28] Annual Energy Outlook 2020 with projections to 2050 (https://www.eia.gov/aeo)
[29] https://en.wikipedia.org/wiki/Nuclear_power
[30] Ibid

sustainable energy source that reduces carbon emissions. Nuclear power opponents, such as Greenpeace, the World Information Service on Energy, and the Nuclear Information and Resource Service, contend that nuclear power poses many threats to people and the environment.

The economics of new nuclear power plants is a controversial subject, and there are diverging views on the topic. Nuclear power plants typically have high capital costs for building the plant, but low fuel costs. The US Energy Information Administration estimated that for new nuclear plants going online in 2025, capital costs are higher than fossil-fuel power plants and all renewable energy plants except offshore wind.[31] An analysis by Lazard in 2019 found the global LCOE for nuclear was $118-192/MWh, compared to $28-54/MWh for onshore wind and $32-42/MWh for utility-scale solar.[32] The EIA reported similar LCOE values.[33]

Although nuclear power's future is not bright, it could experience a revival as countries address climate change more seriously and seek to increase non-carbon sources. However, in January 2020 the EIA projected a 19% decline in nuclear electric generating capacity from 98 GW in 2019 to 79 GW in 2050, and no new plant additions occurring after 2022. Projected nuclear retirements are driven by declining revenues that result from low growth in electricity load and from increasing competition from low-cost natural gas and declining cost of renewables.[34]

Summary

According to the EIA's 2020 Energy Outlook Report, the LCOE for carbon emitting and non-renewable energy was projected to be higher for both the short-term (2025) and long-term (2040) compared to non-carbon and renewable energy. The primary cost factor differential in these technologies is fuel costs (included in the column for levelized variable O&M). Solar and wind have no fuel costs for generation and relatively small operation and maintenance costs, so their LCOE is mostly determined by capital and financing costs. For generators that consume fuels such as coal and natural gas, both fuel costs and capital cost significantly increase their LCOEs.

The levelized capital cost of non-carbon and renewable energy sources are generally higher on average than carbon and non-renewable sources. In the year 2025, for example, combined cycle and combustion turbine natural gas plants have levelized capital costs of 8.40 and 16.17 MWH, respectively, while solar PV and onshore wind have levelized capital costs are 26.14 and 29.63 MWH, respectively. Offshore wind has the highest levelized capital cost of any of the compared energy sources (90.95 MWH) because it is relatively new technology and higher costs associated with working in marine environments. However, the levelized capital costs for non-carbon and renewable energy sources are projected to decline by the year 2040 and beyond. For example, offshore wind levelized capital costs in 2040 are nearly half the costs in 2025.[35]

[31] Annual Energy Outlook 2020 with projections to 2050 (https://www.eia.gov/aeo)
[32] https://www.lazard.com/perspective/lcoe2019/
[33] Annual Energy Outlook 2020 with projections to 2050 (https://www.eia.gov/aeo)
[34] https://www.eia.gov/outlooks/aeo/
[35] Annual Energy Outlook 2020 with projections to 2050 (https://www.eia.gov/aeo)

Summary of Three Options for the Municipal Climate Resolution

Each option will require energy conservation and efficiency as a complementary initiative, as well as targeted incentives and restrictions to achieve the goal. Note the costs ($) are current technology costs and the future cost projections (2025-2040) are depicted as red, black or green triangles (see Appendix for details).

Net Zero (Carbon-Neutral): As a community goal, carbon-neutral refers to "balancing" a measured amount of carbon dioxide emissions with an equal amount of credits or offsets. Carbon offsets can be either purchased or created. Demand for offsets is expected to rise, which will increase costs. For the Town, both options would likely involve purchasing carbon offsets from established vendors that aggregate funds for renewable energy and wetland/forest restoration projects.

Pros	Cons
Allows flexibility to achieve progress	Transfers (does not solve) many of the root problems
Targets creation and removal of emissions	Can encourage investments in long-lived, fossil fuel infrastructure (e.g., gas pipelines, heating systems)
	Can extend time frame to achieve carbon-free energy goal
Current Relative New Construction, O&M Costs & Projections: **$ $ $ ▲**	
Implementation Time: ⌛	

Carbon-Free (Zero Carbon): Simply put, zero carbon means all of the energy used for heating, lighting, and transportation is obtained from carbon-free sources. Specifically, it requires that the consumption or use of the energy does not release carbon dioxide into the atmosphere. The primary sources of zero carbon energy available today are wind, solar, hydropower, geothermal, and nuclear energy. Costs of nuclear and hydropower projected to remain constant and renewable energy costs will decline, resulting in a modest reduction in cost by 2040 (depending upon energy mix).

Pros	Cons
Targets the root causes	Difficult to achieve (practical constraints)
Accelerates transition to carbon-free energy goal	Some carbon-free energy sources have other environmental and societal impacts (i.e., nuclear and hydropower)
Current Relative New Construction, O&M Costs & Projections: **$ $ ▶**	
Implementation Time: ⌛⌛	

100% Renewable: 100% renewable means all of the energy used is obtained from renewable sources which includes both carbon (i.e., biomass) and carbon-free sources (e.g. wind, solar, hydropower, and geothermal). The cost of all renewable energy, particular offshore wind, is projected to decline significantly by 2040.

Pros	Cons
Environmentally sustainable, zero-carbon power supply	Difficult to achieve (practical constraints)
Targets the root causes	Low-power density (large area requirements)
Accelerates transition to sustainable, carbon-free energy goal	Intermittent/non-dispatchable and requires energy storage capacity
Current Relative New Construction, O&M Costs & Projections: **$ $ $ $ ▼**	
Implementation Time: ⌛⌛⌛	

Appendix

Table 1. Estimated levelized cost of electricity (LCOE, unweighted) for new generation resources entering service in 2025 (2019 dollars/MWH)

Plant type	Capacity factor (%)	Levelized capital cost	Levelized fixed O&M[1]	Levelized variable O&M	Levelized transmission cost	Total system LCOE	Levelized tax credit[2]	Total LCOE including tax credit
Dispatchable technologies								
Ultra-supercritical coal	85	47.57	5.43	22.27	1.17	76.44	*NA*	76.44
Combined cycle	87	8.40	1.59	26.88	1.20	38.07	*NA*	38.07
Combustion turbine	30	16.17	2.65	44.33	3.47	66.62	*NA*	66.62
Advanced nuclear	90	56.12	15.36	9.06	1.10	81.65	-6.76	74.88
Geothermal	90	20.38	14.48	1.16	1.45	37.47	-2.04	35.43
Biomass	83	39.92	17.22	36.44	1.25	94.83	*NA*	94.83
Non-dispatchable technologies								
Wind, onshore	40	29.63	7.52	0.00	2.80	39.95	*NA*	39.95
Wind, offshore	44	90.95	28.65	0.00	2.65	122.25	*NA*	122.25
Solar photovoltaic[3]	29	26.14	6.00	0.00	3.59	35.74	-2.61	33.12
Hydroelectric[4,5]	59	37.28	10.57	3.07	1.87	52.79	*NA*	52.79

1 O&M = operations and maintenance.
2 The tax credit component is based on targeted federal tax credits such as the production tax credit (PTC) or investment tax credit (ITC) available for some technologies. It reflects tax credits available only for plants entering service in 2025 and the substantial phaseout of both the PTC and ITC as scheduled under current law. Technologies not eligible for PTC or ITC are indicated as *NA,* or not available. The results are based on a regional model, and state or local incentives are not included in LCOE calculations. See text box on page 2 for details on how the tax credits are represented in the model.
3 Costs are expressed in terms of net AC (alternating current) power available to the grid for the installed capacity.
4 As modeled, EIA assumes that hydroelectric generation has seasonal storage so that it can be dispatched within a season, but overall operation is limited by resources available by site and season.
5 Costs are for 2023 online year. See page 6 for details on the exception.
Source: U.S. Energy Information Administration, *Annual Energy Outlook 2020*

Table 2. Estimated levelized cost of electricity (LCOE, unweighted) for new generation resources entering service in 2040 (2019 dollars/MWH)

Plant type	Capacity factor (%)	Levelized capital cost	Levelized fixed O&M[1]	Levelized variable O&M	Levelized transmission cost	Total system LCOE	Levelized tax credit[2]	Total LCOE including tax credit
Dispatchable technologies								
Ultra-supercritical coal	85	43.97	5.43	22.17	1.25	72.81	*NA*	72.81
Combined cycle	87	7.50	1.59	32.52	1.28	42.89	*NA*	42.89
Combustion turbine	30	13.89	2.65	52.15	3.70	72.39	*NA*	72.39
Advanced nuclear	90	48.21	15.36	9.47	1.18	74.22	-4.85	69.37
Geothermal	90	18.86	15.88	1.16	1.55	37.44	-1.89	35.56
Biomass	83	33.25	17.22	35.02	1.34	86.83	*NA*	86.83
Non-dispatchable technologies								
Wind, onshore	40	25.51	7.49	0.00	2.97	35.97	*NA*	35.97
Wind, offshore	44	53.85	28.83	0.00	2.85	85.53	*NA*	85.53
Solar photovoltaic[3]	29	19.86	6.00	0.00	3.83	29.70	-1.99	27.71
Hydroelectric[4]	70	40.98	9.22	1.39	2.00	53.58	*NA*	53.58

1 O&M = operations and maintenance.
2 The tax credit component is based on targeted federal tax credits such as the production tax credit (PTC) or investment tax credit (ITC) available for some technologies. It reflects tax credits available only for plants entering service in 2040 and the substantial phaseout of both the PTC and ITC as scheduled under current law. Technologies not eligible for PTC or ITC are indicated as *NA*, or not available. The results are based on a regional model, and state or local incentives are not included in LCOE calculations. See text box on page 2 for details on how the tax credits are represented in the model.
3 Costs are expressed in terms of net AC (alternating current) power available to the grid for the installed capacity.
4 As modeled, EIA assumes that hydroelectric generation has seasonal storage so that it can be dispatched within a season, but overall operation is limited by resources available by site and season.
Source: U.S. Energy Information Administration, *Annual Energy Outlook 2020*

Table 3. Estimated levelized cost of electricity (LCOE, unweighted) by carbon and non-carbon sources for new generation resources entering service in 2025 (2019 dollars/MWH) (adapted from Table 1 above)

Plant type	Capacity factor (%)	Levelized capital cost	Levelized fixed O&M[1]	Levelized variable O&M	Levelized transmission cost	Total system LCOE	Levelized tax credit[2]	Total LCOE including tax credit
Carbon emitting technologies								
Ultra-supercritical coal	85	47.57	5.43	22.27	1.17	76.44	*NA*	76.44
Combined cycle	87	8.40	1.59	26.88	1.20	38.07	*NA*	38.07
Combustion turbine	30	16.17	2.65	44.33	3.47	66.62	*NA*	66.62
Biomass	83	39.92	17.22	36.44	1.25	94.83	*NA*	94.83
Mean		28.02	6.72	32.48	1.77	**68.99**		**68.99**
Non-carbon emitting technologies								
Wind, onshore	40	29.63	7.52	0.00	2.80	39.95	*NA*	39.95
Wind, offshore	44	90.95	28.65	0.00	2.65	122.25	*NA*	122.25
Solar photovoltaic[3]	29	26.14	6.00	0.00	3.59	35.74	-2.61	33.12
Hydroelectric[4,5]	59	37.28	10.57	3.07	1.87	52.79	*NA*	52.79
Advanced nuclear	90	56.12	15.36	9.06	1.10	81.65	-6.76	74.88
Geothermal	90	20.38	14.48	1.16	1.45	37.47	-2.04	35.43
Mean		43.42	13.76	2.22	2.24	**61.64**		**59.74**

Table 4. Estimated levelized cost of electricity (LCOE, unweighted) by carbon and non-carbon sources for new generation resources entering service in 2040 (2019 dollars/MWH) (adapted from Table 2 above)

Plant type	Capacity factor (%)	Levelized capital cost	Levelized fixed O&M[1]	Levelized variable O&M	Levelized transmission cost	Total system LCOE	Levelized tax credit[2]	Total LCOE including tax credit
Carbon emitting technologies								
Ultra-supercritical coal	85	43.97	5.43	22.17	1.25	72.81	*NA*	72.81
Combined cycle	87	7.50	1.59	32.52	1.28	42.89	*NA*	42.89
Combustion turbine	30	13.89	2.65	52.15	3.70	72.39	*NA*	72.39
Biomass	83	33.25	17.22	35.02	1.34	86.83	*NA*	86.83
Mean		24.65	6.72	35.47	1.89	**68.73**		**68.73**
Non-carbon emitting technologies								
Wind, onshore	40	25.51	7.49	0.00	2.97	35.97	*NA*	35.97
Wind, offshore	44	53.85	28.83	0.00	2.85	85.53	*NA*	85.53
Solar photovoltaic[3]	29	19.86	6.00	0.00	3.83	29.70	-1.99	27.71
Hydroelectric[4]	70	40.98	9.22	1.39	2.00	53.58	*NA*	53.58
Advanced nuclear	90	48.21	15.36	9.47	1.18	74.22	-4.85	69.37
Geothermal	90	18.86	15.88	1.16	1.55	37.44	-1.89	35.56
Mean		34.55	13.80	2.00	2.40	**52.74**		**51.29**

Table 5. Estimated levelized cost of electricity (LCOE, unweighted) by non-renewable and renewable sources for new generation resources entering service in 2025 (2019 dollars/MWH) (adapted from Table 1 above)

Plant type	Capacity factor (%)	Levelized capital cost	Levelized fixed O&M[1]	Levelized variable O&M	Levelized transmission cost	Total system LCOE	Levelized tax credit[2]	Total LCOE including tax credit
Non-renewable technologies								
Ultra-supercritical coal	85	47.57	5.43	22.27	1.17	76.44	*NA*	76.44
Combined cycle	87	8.4	1.59	26.88	1.2	38.07	*NA*	38.07
Combustion turbine	30	16.17	2.65	44.33	3.47	66.62	*NA*	66.62
Advanced nuclear	90	56.12	15.36	9.06	1.1	81.65	-6.76	74.88
Mean		32.07	6.26	25.64	1.74	**65.70**		**64.00**
Renewable technologies								
Wind, onshore	40	29.63	7.52	0	2.8	39.95	*NA*	39.95
Wind, offshore	44	90.95	28.65	0	2.65	122.25	*NA*	122.25
Solar photovoltaic[3]	29	26.14	6	0	3.59	35.74	-2.61	33.12

Hydroelectric[4,5]	59	37.28	10.57	3.07	1.87	52.79	*NA*	52.79
Biomass	83	39.92	17.22	36.44	1.25	94.83	*NA*	94.83
Geothermal	90	20.38	14.48	1.16	1.45	37.47	-2.04	35.43
Mean		40.72	14.07	6.78	2.27	**63.84**		**63.06**

Table 6. Estimated levelized cost of electricity (LCOE, unweighted) by non-renewable and renewable sources for new generation resources entering service in 2040 (2019 dollars/MWH) (adapted from Table 2 above)

Plant type	Capacity factor (%)	Levelized capital cost	Levelized fixed O&M[1]	Levelized variable O&M	Levelized transmission cost	Total system LCOE	Levelized tax credit[2]	Total LCOE including tax credit
Non-renewable technologies								
Ultra-supercritical coal	85	43.97	5.43	22.17	1.25	72.81	*NA*	72.81
Combined cycle	87	7.5	1.59	32.52	1.28	42.89	*NA*	42.89
Combustion turbine	30	13.89	2.65	52.15	3.7	72.39	*NA*	72.39
Advanced nuclear	90	48.21	15.36	9.47	1.18	74.22	-4.85	69.37
Mean		28.39	6.26	29.08	1.85	**65.58**		**64.37**
Renewable technologies								
Wind, onshore	40	25.51	7.49	0	2.97	35.97	*NA*	35.97
Wind, offshore	44	53.85	28.83	0	2.85	85.53	*NA*	85.53
Solar photovoltaic[3]	29	19.86	6	0	3.83	29.7	-1.99	27.71
Hydroelectric[4,5]	70	40.98	9.22	1.39	2	53.58	*NA*	53.58
Biomass	83	33.25	17.22	35.02	1.34	86.83	*NA*	86.83
Geothermal	90	18.86	15.88	1.16	1.55	37.44	-1.89	35.56
Mean		32.05	14.11	6.26	2.42	**54.84**		**54.20**

Ipswich School Committee

1 Lord Square

Ipswich, MA 01938

December 19, 2020

Mr. Robert Gambale, Chair

Ipswich Zoning Board of Appeals

25 Green Street

Ipswich, MA 01938

Dear Mr. Gambale,

Please let this letter serve as notice of the Ipswich School Committee's concern that a bus pickup and drop off spot has not been made available at the proposed Essex Pastures, LLC housing project. A review of the plans implies that the present intention would be that the pickup/drop off area would be directly on State Highway Route 133.

With the many anticipated students that this development projects, the School Committee believes that having a pickup/drop off location on the highway creates an extremely unsafe and inappropriate condition.

If the transportation company cannot pick up our students on private property, we would suggest that the applicant provide land to the town of Ipswich so that the school buses can pick up and drop off our students on a dedicated turnoff.

Thank you for your consideration of this matter.

Very truly yours,

Chub Whitten, Chair

Ipswich School Committee

cc: Linda Alexson, Chair Ipswich Selectboard, Anthony Marino, Ipswich Town Manager

2020-2021
Ipswich School Committee
Subcommittees, Working Groups, and Liaisons

Subcommittees

Subcommittees are the standing committees which remain consistent from year to year

Athletics Work with the HS Athletic director & other appointed school/community members to address issues relative to the School district's athletic programs	**Budget** Assist administrators and finance department in creation of the school budget	**Communications** Provide our community with consistent, clear information about Ipswich Public Schools
Hugh O'Flynn	Hugh O'Flynn	Pavica Kneedler
Greg Stevens	Carl Nylen	
X	Greg Stevens	Greg Stevens

Mutual Concerns Created to hear issues brought forward to the School Committee by teachers in the district	**Negotiations** Represent the school district in its negotiations with various unions	**Operations** Work with the Superintendent to formulate his goals as well as onboard new SC members	**Policy** Responsible for keeping school policies up to date
Greg Stevens	Chub Whitten	Pavica Kneedler	Emily Cannon
Pavica Kneedler	Emily Cannon	Chub Whitten	
Chub Whitten		Carl Nylen	Pavica Kneedler

Working Groups

Working Groups are annually established, short-term committees that change from year to year

Feoffees Report Provide the Feoffees with an update showing how the annual Trust distributions were spent. Create annual report for the Annual Town Meeting	**Race and Equity** Working Group description TBD	**Reopening Oversight** Work with Superintendent, Administrators, Parents & Staff on reopening during pandemic	**Vision 2030** Provide a framework for what our district should look like in the future and create a path to get there
Hugh O'Flynn	Emily Cannon	Chub Whitten	Greg Stevens
Carl Nylen	Pav Kneedler	Pavica Kneedler	Carl Nylen
Greg Stevens		Carl Nylen	Pavica Kneedler

Liaisons

Liaisons are School Committee members chosen to represent the group at broader community/committee meetings. These liaisons provide updates from the School Committee to these groups and also report back to the full School Committee.

Audit Review the findings of the annual school department financial audit	**Birth to Three** Collaborative preschool/kindergarten meetings hosted by Birth to Three	**Climate** Develop policies to keep our district on the leading edge of energy efficient operation	**Community Development Plan** The town-wide Community Development Plan provides a long-term vision/plan for Ipswich	**Feoffees Committee** The Ipswich Feoffees Committee manages the charitable Feoffees Trust that benefits Ipswich Public Schools
Chub Whitten		Chub Whitten	Carl Nylen	Greg Stevens
X	X	Carl Nylen	Chub Whitten	X

Ipswich Education Foundation The Ipswich Education Foundation is a non-profit fundraising and advocacy group in support of Ipswich Public Schools	**MASC Voting Delegate to Annual Business Meeting** Attend the annual MASC/MASS joint conference as the IPS voting delegate	**Paine Grants** Discuss/vote on proposals made for funding via the Feoffees Paine Grants. Also includes appointed IPS staff and community members	**Special Education Parent Advisory Council** SEPAC by law is permitted to advise the school committee on matters that pertain to education/safety of students with disabilities: planning, development & evaluation of the program.
	Emily Cannon	Pavica Kneedler	Emily Cannon

STEAM Team Work with the Ipswich STEAM Team to support the development of the STEAM vision and alignment in Ipswich Public Schools, and to help plan the annual STEAM Showcase	**Strategic Planning** The town-wide Strategic Planning Working Group is tasked with using the updated Community Development Plan to formulate a cost projection and investment model for key infrastructure development in Ipswich	**Student Advisory Council** The Ipswich High School Student Advisory Council	**Traverso-Weatherall Grants** Discuss/vote on proposals made for funding via the Feoffees TW Grants. Also includes appointed IPS staff and community members	**Turf Field** Represent the schools as part of a larger group overseeing the use and maintenance of the High School Turf Field
	Carl Nylen	Pavica Kneedler	Emily Cannon	Hugh O'Flynn
X	X	X	X	Greg Stevens