Expanding Solar Generation on the CMLP system

A Report prepared by CMLP staff in response to 2022 Town Meeting Article 38

… To urge the Concord Municipal Light Plant to develop an action plan and schedule for the achievement of the Town's 2030 solar capacity targets focused on development of new power generation on Town-owned properties…

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Executive Summary

Introduction

Article 38

Article 38 was passed at the 2022 Town Meeting. The article read:

> *Mr. Banfield moves that the Town urge the Concord Municipal Light Plant to develop an action plan and schedule for the achievement of the Town's 2030 solar capacity targets focused on development of new power generation on Town-owned properties and present the plan and schedule to both the Select Board and FinCom before the end of 2022. The plan should prioritize open sites and include a public process to evaluate any possible tree removal.*

The Town's 2030 Solar Capacity Target

The 2020 Annual Sustainability Report https://concordma.gov/DocumentCenter/View/29617/Town-of-Concord-Annual-Sustainability-Report-2020 published a 2030 solar target for solar generation on Town property of 20 megawatts (MW.)

Indicator	Baseline Data	Baseline Year	2030 Target
GHG Emissions from electricity generation[16]	54,234 $MTCO_2e$	2016	0
Percent carbon-free electricity[17]	54%	2018	100%
Total MW capacity of residential renewable generation installations in Concord[18]	3.5 MW	2020	5.44 MW
Number of homes with rooftop solar[19]	358	2020	558
Number of homes with battery storage[20]	9	2020	109
Total MW capacity of solar generation on town property[21]	7.57 MW	2020	20 MW
Total MWh capacity of battery storage on town property[22]	0	2020	60MWh

Developing Utility-Scale Solar Generation on Town-owned Property

Previous Studies and Strategies

2010 Town Meeting

Article 64 was passed at the 2010 town meeting authorizing the Town Manager to enter into a long term lease or purchase power agreement for solar production at specific Town-owned sites. The sites identified included the wastewater treatment plant, the CMLP building at 1175 Elm Street, the Public Works facility, and the former Ammendolia land. The article read:

> *AUTHORIZATION OF LONG TERM LEASE FOR SOLAR ENERGY*
>
> *ARTICLE 64. To determine whether the Town will vote to authorize the Town Manager to enter into a long-term license, lease and/or contractual agreements, subject to terms and conditions approved by the Board of Selectmen, involving the property at 509 Bedford Street, the Wastewater Treatment Plant site (Assessors Parcels 1195, 1196, 1197, 1198, 1199, 1200, 1201, and 1213), the property at 1175 Elm Street, the Light Plant headquarters (Assessors Parcel 1999-1), the property at 133/135/141 Keyes Road (Assessors Parcel 1682), and/or the property at 33X Old Bedford Road, the former "Ammendolia land" (Assessors Parcels 4209 and 4210-2), for the purposes of installing solar energy facilities and supplying solar energy, and further to authorize the Selectmen and Town Manager to take such action as may be necessary under State law to effectuate said agreements, or take any other action relative thereto.*
>
> *The purpose of this article is for the Town to enter into a long term lease and/or purchase power agreement for the purposes of supplying solar energy in Concord.*

2010 CMLP Utility-scale Solar Strategy

In 2010 CMLP published a long-term strategy for Utility-scale solar power. It called for the development of approximately 25 MW of solar generating capacity in Concord in units of approximately 5 megawatts deployed incrementally at intervals of about 5 years.

It suggested utilizing leases and PPA's until installation costs dropped to $2/watt, then owning and operating solar sites, financed by bonds authorized by Town meeting.

It assumed solar arrays would require five acres per megawatt of capacity, resulting in the need to find 125 acres of land to produce 25 MW.

The Strategy identified two immediate options:

- The W. R. Grace land in the southwestern end of Town
- The Massport land located in the eastern end of Town bordering aircraft flight paths

The Strategy identified three "longer term" options:

- The Landfill
- The Starmet Superfund site in the southwestern end of Town
- Town well sites. It was acknowledged that the Town well sites could only be pursued if the State were to allow passive solar arrays in combination with well use.

2011 Solar Siting Committee

The Select Board established and charged the Solar Siting Committee in early 2011 to identify and evaluate municipally owned land for the purpose of hosting ground-based solar arrays.

The Committee found sites (mostly forested) that could accommodate approximately 12–19 megawatts of photovoltaic solar arrays.

The Committee concluded that the suitable municipally owned sites they identified would be insufficient to meet the Light Board's goal of generating 25 MW of power within the Town's boundaries.

The Solar Siting Committee identified six parcels that could support at least one megawatt of power production and that were not designated as conservation land and/or are not protected by deed restrictions or other legal instruments.

Solar Siting Committee's Top Six Site Potentials with Power Production Ranges

Site	Power Production Potential (MW)
Concord–Carlisle High School	1-2
White Pond Reservation	3-5
former Town landfill	5
Sanborn School	1-2
Wastewater Treatment Plant	2-3
Concord Municipal Light Plant	1-2
Total	13-19

2020 Cadmus Report

In May 2020 the Town's Sustainability Director hired a consulting company, Cadmus, to evaluate the feasibility of solar and storage at Concord-Carlisle High School, the Beede Swim & Fitness Center, the Free Public Library and the Harvey Wheeler Community Center.

Solar Capacity Additions 2014-2016

Landfill

In 2014 a third-party company was awarded the right to develop 1.7 MW DC of solar panels at the former Town landfill site. CMLP purchases the unit contingent output of this facility under a 20-year purchase power agreement.

Virginia Road

In 2015 .45 MW DC of rooftop solar was constructed at Middlesex Green, a suburban office park. CMLP purchases the unit contingent output of this facility under a 20-year purchase power agreement.

WR Grace

In 2016 a third-party developer won a competitive bid to develop 5.6 MW DC of solar panels at the WR Grace Superfund site. This brownfield site was a part of the former chemical manufacturing facility owned by W.R. Grace. After years of remediation, the Town of Concord took a portion of the land by eminent domain in order to develop the solar array. CMLP purchases the unit contingent output of this facility under a 20-year purchase power agreement.

The total capacity of the three sites is 7.57 MW DC.

Solar Capacity Additions Needed to meet 2030 Goal

To achieve 20 MW of solar generation on Town-owned land, an additional **12.43 MW** would need to be developed on top of the 7.57 MW already under contract.

Possible Locations

Concord-Carlisle High School

White Pond Reservation

Sanborn School

Wastewater Treatment Plant

Concord Municipal Light Plant

Conclusion

Developing Utility-scale Solar Generation on Private Property

Need to Build on Private Property

Identifying Sites

Type chapter title (level 3)

Type chapter title (level 2

Type chapter title (level 3)

Integrating More Solar on CMLP's Grid

Overview of CMLP's Distribution System

The only electric generating facility to be located within the Town's confines closed in 1930. Since then, CMLP has either bought power from Boston Edison with whom CMLP shares an electrical interconnect; or it has bought power from regional suppliers post deregulation and had Eversource (Boston Edison's successor) wheel the power from the grid to the Town's borders.

CMLP does not directly interconnect with the regional grid. Eversource is physically situated between CMLP's distribution system and the ISO-NE grid. CMLP pays the ISO to transmit power purchased from facilities around the region to Eversource's point of interconnection with the grid. Then CMLP has a network transmission services contract with Eversource that requires Eversource to transmit whatever amount of power CMLP purchases from the grid, up to 60 MW, to CMLP's system.

Since the closure of the early power plant, the CMLP distribution system has been engineered to transmit power from the Eversource Sudbury Station to homes and businesses in Concord. CMLP was generally buying a minimum of 12 and up to a maximum of 45 MW of power on an hourly basis with power flowing from the Eversource substation to CMLP's distribution system.

The distribution system was not designed to flow power in reverse, that is from CMLP's system back to Eversource. There are faults and protectors in place to prevent reverse flow. The way CMLP's distribution system would behave if power tried to flow in reverse is: it would shut itself down - creating a Town-wide blackout.

CMLP's Current Load Profile

Over the last 15 years, the volume of megawatts CMLP buys each hour to meet its customers' needs has ranged from 6.6 to 45 MW. The trend has been down. The annual peak has dropped from 45 MW in 2006 to 39.3 MW in 2022. The annual average has dropped from 21.6 MW in 2006 to 18.9 MW in 2022. The annual minimum hourly amount has dropped from 12.5 MW in 2006 to 7.3 MW in 2022.

The steep decline between 2016 and 2017 in the minimum hourly import volume can be attributed in large part to the energizing of the solar field at the WR Grace property, although increasing amounts of residential solar also played a role.

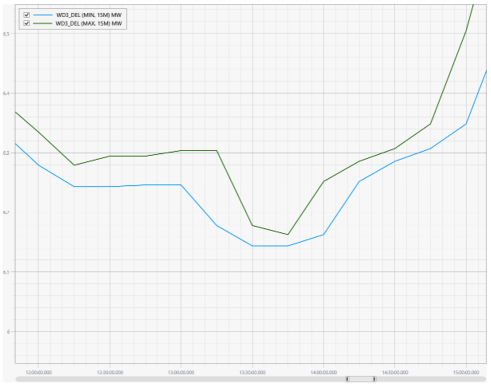
Technical Details of CMLP's Distribution System

CMLP's distribution grid is split between two busbars. A busbar is a type of electrical junction where electric power is collected from incoming feeders and redistributed to outgoing feeders. The busbar system has an isolator and circuit breaker that work to disconnect a faulty busbar section in the event of a fault. Splitting CMLP's load onto two busbars creates redundancy to reduce the possibility of a system wide outage.

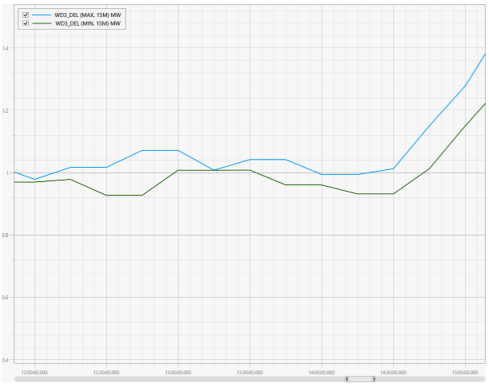
Splitting the load, however, means that the load on an individual bus is less than the minimum combined load shown in the chart. Load is not usually split evenly onto the busbars. On May 1, 2022 CMLP's lowest load hour for 2022 occurred between 1:00 and 2:00 p.m.

Low Load on May 1, 2022

STA 219 Bus 1 Demand



STA 219 Bus 2 Demand



On that day, the load on bus 1 dropped as low as 6.15 MW. The load on bus 2, however, dropped below 1 MW for much of the period between noon and 2:30 p.m.

The bus with the lowest load is at greater risk of causing an outage. Small disturbances on the system, such as a car hitting a utility pole, could wipe out the remaining load on the low busbar and create the Town-wide blackout scenario. The lower the load on the bus, the larger the pool of potential disturbances that could cause the blackout and the higher the probability that a blackout will occur.

Effect of Adding More Solar to CMLP's Grid

Each megawatt of new solar capacity added to the CMLP distribution system reduces the amount of electricity that CMLP must import to serve load. From an environmental perspective, that is a good thing. If the owner of the solar installation does not sell the RECs associated with the solar production, then the power produced is carbon free. Moreover, because the generation is local, CMLP does not have to use energy to transmit electricity from distant places to Concord.

However, from a CMLP distribution stability standpoint, each megawatt of new solar capacity reduces the load on the busbars, bringing them closer to the point of zero imports and the potential for a Town-wide blackout, particularly if the solar generation is located on the busbar with the lower load.

Conceivable Paths Forward

Settlement Only Generator

Redesigning Infrastructure

Renegotiating Transmission

Utility-scale Batteries

Cost Benefit

Rate Impacts

Residential-scale Batteries

Cost Benefit

Renegotiating Transmission

Curtailing Solar Generation

Cost Benefit

Contractual Barriers

Recommendations

Type chapter title (level 2)

Type chapter title (level 3)

Conclusion

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Type chapter title (level 3)

References

Appendices