

Munich, Germany

Background

Munich has set the goal to be climate-neutral by 2035, and have noted some impressive measures and instruments to achieve that goal such as a low-energy standard defined for the state capital of Munich - i.e. in particular a passive house standard or EH-40 standard - the obligation to use solar energy for all urban buildings, at least 30 percent greening in city-owned buildings in existing and new buildings as well as the introduction of a climate protection test for all decisions of the city administration.

The climate protection activities most put forward by the City of Munich are *Munich Cool City* ([München Cool City, n.d.](#)), the *Integrated Climate Protection Action Program* (IHKM) ([Landeshauptstadt München, 2018](#)), the municipal energy saving program (FES), and the expert report *Climate Protection Goal and Strategy Munich 2050* ([Kenkmann et al., 2017](#)). The *Munich Cool City* campaign was initiated in September 2018 by the Department of Health and Environment with the aim to sensitize, inspire and motivate all citizens to protect the climate. IHKM has already developed and implemented a large number of climate protection measures since 2010; the IHKM bundles the numerous activities of the city administration in climate protection and further expands them. Since 2017, the technical report *Climate Protection Goal and Strategy Munich 2050* has provided a comprehensive basis for the further development of the city's climate protection goals and the climate protection activities of the city administration. Every year, the city is required to submit an action plan for achieving climate neutrality by 2035. Munich is a good model city for Toronto because of their similar climates, with Toronto getting warmer and Munich getting more precipitation (Table 3.) and Munich has a population of 1.5 million.

Heating & Cooling

Heating and cooling in Munich are provided through Stadtwerke München (SWM), the publicly-owned municipal energy provider. Residents may also purchase cleaner electricity at premium rates from the private company Green City AG.

Heating and cooling account for 40% of all energy consumed in Germany, and even up to 90% of all energy used in private households. This is why Munich's energy transition is dependent on increasing building energy efficiency and waste heat recovery.

SWM is aiming to have district heating for more than one-third of Munich's households generated from a CHP process. By the year 2040, SWM intends to be carbon free and operate with geothermal energy. In parallel, the 800-kilometre-long district heating network is being made fit for green heating ([SWM, 2020](#))

District cooling is another key element of SWM's and Munich's climate strategy. By using the natural coldness of groundwater and urban streams, they are able to drastically reduce the power consumption for cooling. It is estimated that cooling through this method can save up to 70% of the electricity requirement ([SWM, 2020](#)).

Energy efficiency renovations have the greatest potential for lowering emissions in Munich. The climate protection program (Klimaschutzprogramm; KSP) 2019 was updated for energy-efficient building envelopes and heating renovation (Energieeffiziente Gebäudehülle und Heizungssanierung; EGuH) with a proposed annual investment rate increasing from 23.6 million € / yr (37.3 million CAD) to 70.8 million € (111.9 million CAD) ([Landeshauptstadt München, 2018](#)).

Energy Security

By 2025, the SWM wants to feed as much electricity from renewable energies from its own plants into the grid as the whole of Munich consumes (expansion target: 7.5 TWh/yr). By 2040, SWM wants Munich to be the first major city in which district heating is generated entirely from renewable energy.

Unlike other cities mentioned in this report, Munich is exploring wind turbines. In Munich there is currently a SWM wind turbine on the garbage landfill and a second is planned for another landfill. No other major projects such as these turbines appear feasible for the city, so councillors have begun investigating the potential for wind turbines on buildings-- although the discussion has been very limited.

To increase renewable energy power generation within Munich, for KSP 2013, the city began cataloging the solar potential in the city's own building stock. Particular attention has been given to schools as homes for photovoltaic systems of around 1.4 MW. This process is still ongoing and being expanded in the latest edition of KSP.

Grid Management

There are currently 11 photovoltaic plants (total peak output of 631 kW, six of which 257 kWp) and one biogas plant (765 kW) in Munich. The biogas plant is integrated into a virtual power plant operated by SWM, so that the electricity production can be controlled by the SWM depending on the current demand. The city is trying to further expand their solar systems to increase Munich's self-sufficiency, and build in a system of storage for peak shaving.

Recommendation

- Make major investments in geothermal technologies, district heating, and solar systems.
- Produce a solar potential map of the city noted with public buildings.
- Utilize the coldness of groundwater and Lake Ontario for cooling.

Tables

Table 3. Toronto and Munich climate data averages 1982-2012 ([Climate Data for Cities Worldwide, 2020](#)).

Metric	Elevation (m)	Annual Temp. (°C)	Summer average	Summer high	Winter average	Winter low	Annual Precip. (mm)	Precip. high	Precip. low
Toronto	105	8.0	21.5	26.6	-5.3	-8.9	785	81, Aug	51, Feb
Munich	521	8.0	17.4	22.8	-5.0	-3.7	930	124, Jun	49, Feb

Sources

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