

Roadmap to “Net Zero 2050”

DECARBONIZATION OF FLUGHAFEN ZÜRICH AG



Management Summary

Zurich Airport has recognized the need and urgency of climate actions for a long time. Beginning in 1991, measures to reduce energy consumption and decrease carbon emissions from Scopes 1 and 2 have been successfully implemented. These programs were supported by robust monitoring and reporting tools, as well as by the integration of carbon actions into the Environmental Management System in 2001.

In 2010, Flughafen Zürich AG has defined a dedicated climate action commitment in combination with absolute climate reduction targets for 2030 and has joined the ACI Europe *Airport Carbon Accreditation* program directly at Level 3. Responding to the call for more ambition actions by the international communities, Flughafen Zurich AG has set the commitment in 2019 for a “Net Zero” carbon goal for 2050 and developed the corresponding roadmap in 2020 – both endorsed by the Management Board of Flughafen Zürich AG – that demonstrates how and at what costs this goal will be reached.

Flughafen Zurich AG pursues a dual strategy. The first is to reach the net zero target for Scopes 1 and 2 for Flughafen Zürich AG. The second is to influence, guide and support other aviation industry partners both locally at Zurich Airport and nationally and internationally to reduce their emissions (in Scope 3).

On Scopes 1 and 2, the reduction strategy is based on the priority cascade “reduction” (using less fuels and electricity), “efficiency” (increase efficiency use of fuel and electricity) and finally “substitution” (substitute fuel and electricity to renewables).

A comprehensive model taking into account technology, operations, infrastructure programs and costs has formed the pathway to net zero, demonstrating its feasibility while indicating required investments.

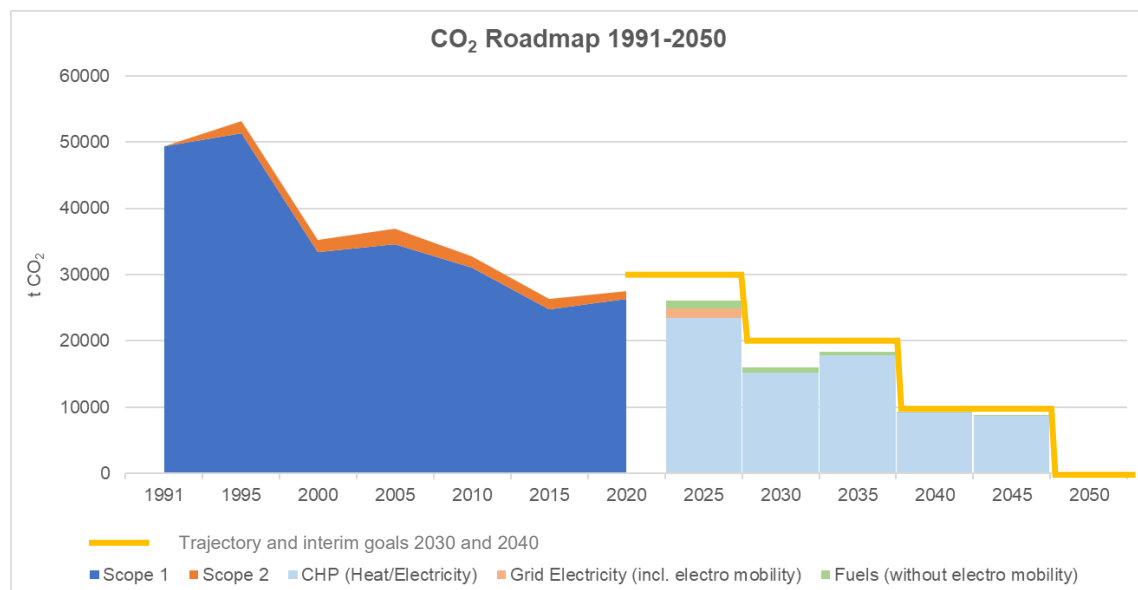


Figure 1: CO₂-Emissions 1991-2050 (historical and anticipated) and milestones

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1. Commitment and Targets

1.1. Framework

Zurich Airport has recognized the need and urgency of climate actions for a long time. Beginning in 1991, measures to reduce energy consumption and decrease carbon emissions from Scopes 1 and 2 have been successfully implemented. These programs were supported by robust monitoring and reporting tools, as well as by the integration of carbon actions into the Environmental Management System in 2001.

In 2010, Flughafen Zürich AG has defined a dedicated climate action commitment in combination with absolute emission reduction targets for 2030 and has joined the *ACI Europe Airport Carbon Accreditation* program directly at Level 3. Responding to the call for more ambitious actions by the international communities in the context of the Paris 2015 agreement and the IPCC Global Warming Report, Flughafen Zürich AG has set the commitment in 2019 for a “Net Zero” carbon goal for 2050 and developed the corresponding roadmap in 2020 – both endorsed by the Management Board of Flughafen Zürich AG – that demonstrates how and at what costs this goal will be achieved.

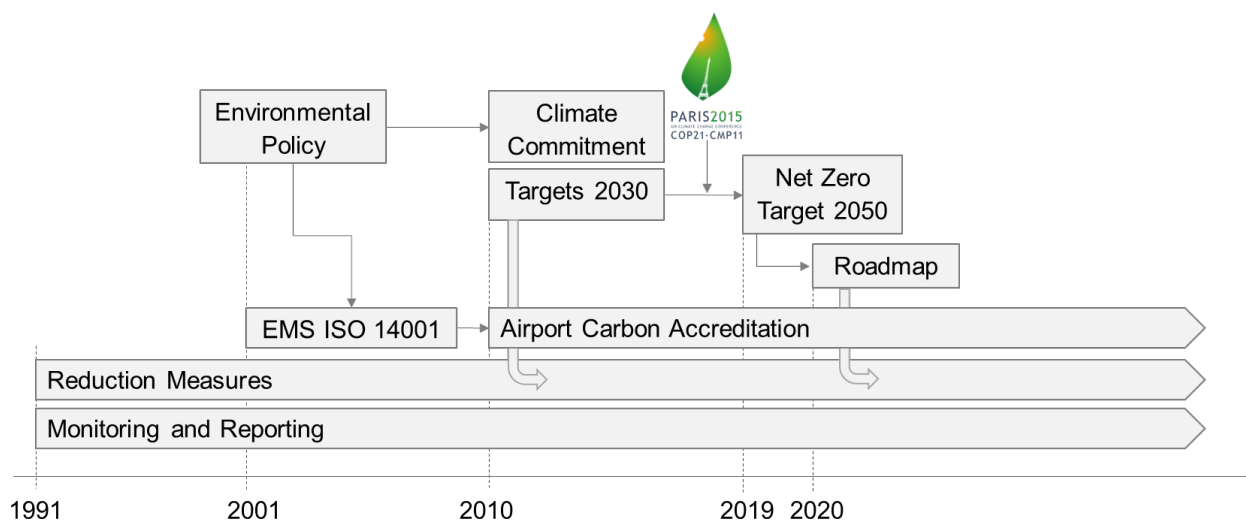


Figure 2: History and Framework of Zurich Airport Carbon Management

1.2. Climate Commitment and Targets

Flughafen Zürich AG has adopted the following climate protection position (cf. Annex):

“The contribution of aviation to the climate change is relatively small with approximately 2% of all anthropogenic CO₂-emissions. However, aviation is expected to grow with increasing demand of mobility.

Flughafen Zürich recognizes the need for a comprehensive climate protection, aiming at limiting global warming well below 2°C and has goals and measures in place that go beyond the Swiss commitment under the Paris Climate Agreement.

Flughafen Zürich AG as the airport operator is part of the aviation system and we commit ourselves to enable the development of aviation climate conscious under consideration of legal and economical conditions.

Measures have to be adopted and become effective globally. We thus reject local measures without global effects or of purely fiscal nature.

Flughafen Zürich AG takes responsibility in international aviation and the national context and reduces its own CO₂-emissions according to scopes 1 and 2 after 20'000 t CO₂ in 2030 further to 10'000 t CO₂ in 2040 and ultimately aims towards Zero-Emissions in 2050.”¹

2. Carbon Emission Reduction Approach

Flughafen Zurich AG pursues a dual approach to achieve a decarbonization of the aviation industry:

- The first is to reach the net zero target for Scopes 1 and 2 for Flughafen Zürich AG itself (outlined in Chapter 3).
- The second is to influence, guide and support other aviation industry partners both locally at Zurich Airport and nationally and internationally to reduce their emissions (in Scope 3, outlined in Chapter 4).

On Scopes 1 and 2, the reduction strategy is based on the priority cascade “reduction” (using less fuels and electricity), “efficiency” (increase efficiency use of fuel and electricity) and finally “substitution” (substitute fuel and electricity to renewables).

¹ Management Board Flughafen Zürich AG, 29.04.2019

3. Roadmap to Net Zero in 2050 (Scopes 1 & 2)

3.1. Development Approach

In the basic roadmap approach (figure 3), first the emission source groups for Scopes 1 and 2 are identified. Typical for the airport, Zurich Airport's buildings and installations are the main sources, followed by the company's own vehicle and machinery fleet and various processes like surface de-icing or air-conditioning systems. Based on the reduction priorities and strategies (cf. chapter 3.2), an individual Masterplan Energy 2050 and Vehicle Strategy Plan 2050 have been developed. They both show how operations, technology improvements, alternative fuels feasibility and availability impact the future demand of carburant, fuels and electricity. The resulting road map then shows the consequences and requirements on energy sources, investments and operations in order to meet the targets at their milestones and towards the final deadline.

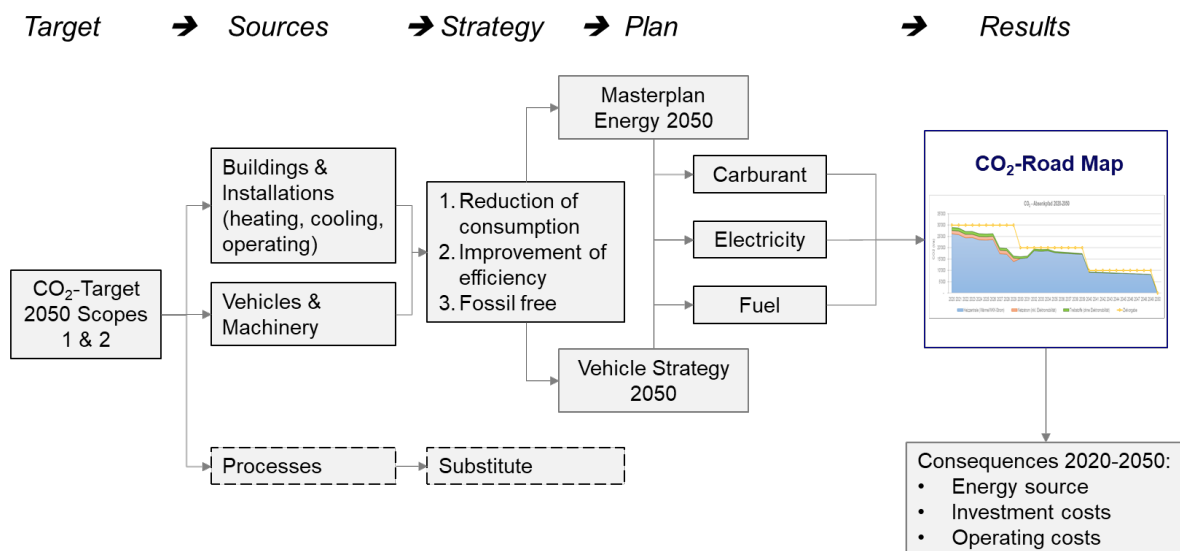


Figure 3: Roadmap Development Approach

3.2. Emission Reduction Priority and Strategy

Emission reductions always come at cost. As such, it is paramount to first reduce the demand of energy that is needed, irrespective of whether it has high or low carbon emissions. That approach defines the priorities whereas the strategy then sets out the main elements to meet that respective priority (table 1).

Priorities and strategies have been set out in the respective Energy Masterplan and Vehicle Strategy Plan for 2050.

Priority / Strategy	Buildings and Installations	Vehicles and Machinery
1. Reduction of Consumption Measures to reduce the demand on primary energy (consumer side).	(according to Masterplan Energy): <ul style="list-style-type: none"> • Building-Guidelines. • Renovation and operational optimization plans. 	No increase in numbers of vehicles and machinery.
2. Efficiency Increase Measures to use less primary energy for the same amount of demand (supplier side).	(according to Masterplan Energy): <ul style="list-style-type: none"> • Development of geothermal seasonal energy storage. • Initializing of heat pumps, cooling plants, CHP plant and remote grid. 	Where possible, vehicles and machinery with lower power (and fuel consumption) are procured.
3. Decarbonisation Procurement of renewable energy.	Biogas (RNG), synthetic gas, photovoltaic, naturmade electricity, geothermal.	Synthetic fuel, hydrogen, renewable electricity.

Table 1: Emission Reduction Priorities

3.3. Road Map Model

A specific model has been developed and applied to derive the actual carbon emission reduction road map (detailed in figure 4).

Input parameters for the model consist of two categories: Basics and variables. Basics are the energy concepts as defined in the two strategic plans for buildings and vehicles and the targets and emission factors. The variables include assumptions on energy reduction opportunities, the choice of energy carrier (e.g. synthetic fuels, hydrogen, electricity) and energy costs. The variables have always been adjusted in order to meet the targets and milestones.

The output results first provide the reduction path and demonstrate the feasibility of the framework. The results further rehearse the split in different energy carriers and the associated costs for required investments and operations. As a special feature, some additional scenarios (“what if...”) can be run.

The model provides annual results. It has been developed by Flughafen Zürich AG.

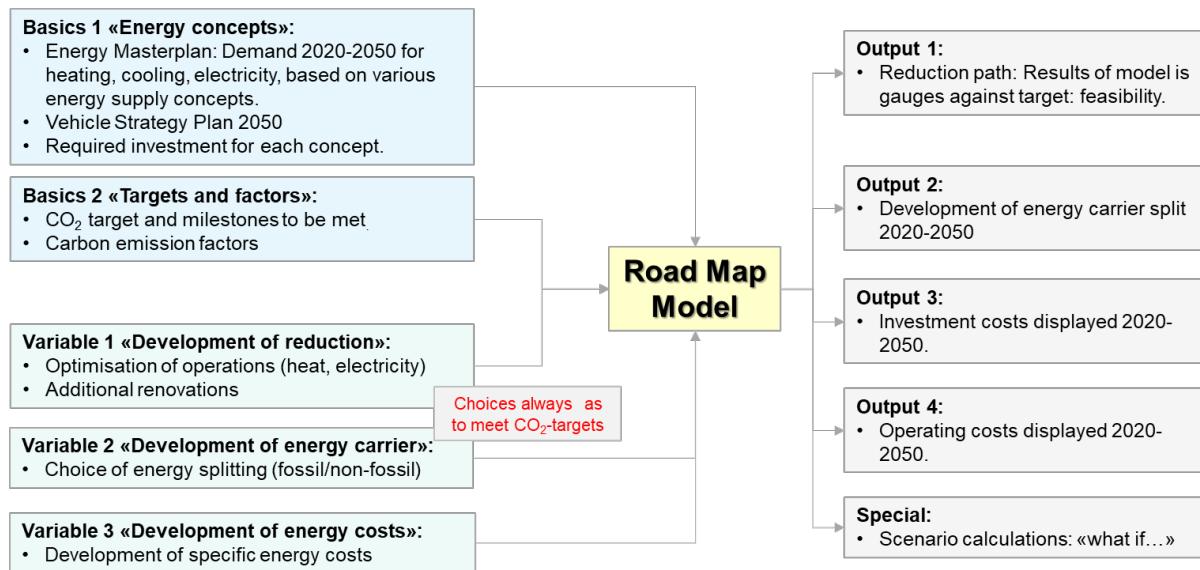


Figure 4: Roadmap Model

3.4. Road Map Results

In order to meet the annual maximum emission allowance according to the reduction trajectory (Basics 2 of the model), measures that reduce the energy demand have been specified along the timeline (renovation of buildings, change of heating systems, vehicle fleet replacement, Variable 1 of the model). To reach interim targets, renewable energies are also taken into account (Variable 2 of the model).

The results of the modelling demonstrate the principal feasibility of the “Net Zero Target 2050” (figure 5). The roadmap has thus been endorsed by the Management Board.²

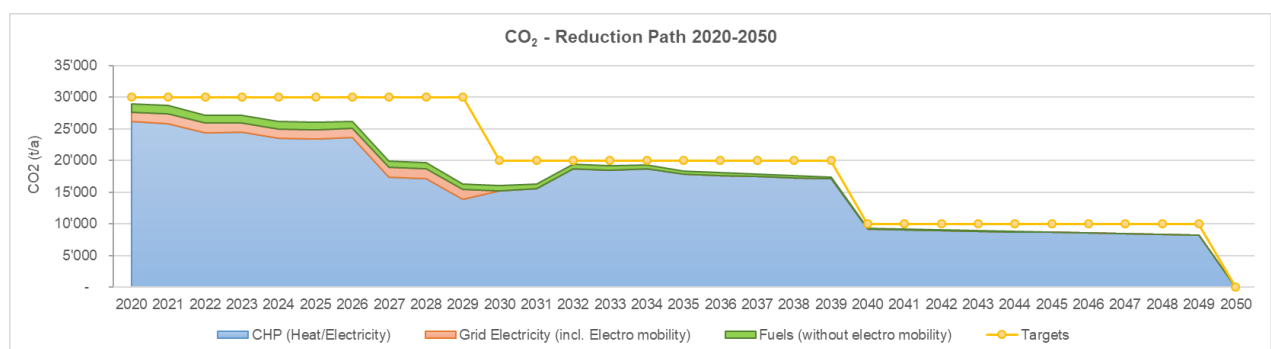


Figure 5: Emission reduction path to 2050

² Management Board Flughafen Zürich AG, 29.09.2020

3.5. Costs

It has been estimated that the total investment costs until 2050 will be between 104 and 130 mio. CHF or on average 4 mio. CHF per year. Additionally, approximately 13 mio. CHF fuel and energy costs per year will accrue that also includes renewable energy costs. The majority of the investments will occur in the beginning of the 2030ies and in the mid 2040.

3.6. Chances and Risks

The chances of the roadmap lays in the longer lead-time available for investment decisions and preparations and the ability to respond to technological developments. The dynamic model allows to periodically check actual numbers with forecasts and to respond with additional measures should the trajectory be at stake.

The main risk is considered to be the currently unknown availability of renewable fuels and their actual cost. In order to alleviate the risk, early market signals will be sent through procurement of such fuels at low scale to confirm their demand.

3.7. Monitoring, Reporting and Verification

Flughafen Zürich AG has a long-standing history of data management and processing, starting in 1991. This is continued and all relevant data is captured and analyzed on an annual basis. Results are published in the annual business reports and through special information papers if need be.

The independent verification of such data and information is paramount for the credibility of the road map. As such, data and information are independently audited within the Environmental Management System (ISO 14001) and the ACI Europe Airport Carbon Accreditation certification.

4. Third Party Support (Scope 3)

Beyond its own affectedness, Flughafen Zürich AG also takes responsibility in influencing and guiding industry partners and the public to reduce their own Scope 1 and 2 emissions. The stakeholder management for Scope 3 emissions is comprehensive and covers the main stakeholder groups and initiatives as described in table 2.

Stakeholder group	Their emissions	Our support initiatives (selection)
Airport: Airlines	Emissions from main engines and auxiliary power units (APU)	<ul style="list-style-type: none"> • Support for uptake of SAF at airports (Zurich and Switzerland): development of federal administrative import process, facilitation of interested parties and producers. Facilitating demonstrator project (2020) and first delivery for scheduled traffic (2021). • Provision of aircraft ground energy systems (400Hz and PCA) on terminal and open stands for aircraft and mandated use of the systems. Emissions savings are larger than Flughafen Zürich's own Scope 1 and 2 emissions combined. • Airport Collaborative Decisions Making (A-CDM) in place to improve ground operations of aircraft.
Airport: Handling Agents	Ground Support Equipment (GSE)	<ul style="list-style-type: none"> • Provision of electric charging stations airside; • Support in applications for government-funded alternative GSE. • Preparation of carbon emission inventories for 3rd parties.
Public	Emissions from ground transportation (cars, taxi)	<ul style="list-style-type: none"> • Support to develop and maintain comprehensive public transport network and regional node at the airport. • Provision of electric charging stations in the public parking garages.
Other airports or aviation industry partners globally	All emissions from operations.	<ul style="list-style-type: none"> • Development and maintenance of ACERT, the ACI Airport Carbon Emission Reporting Tool. • Development of tool and models to support other airports in their decision-making process: AGES-S (ACI tool to model aircraft ground energy systems), ALECA (aircraft associated emissions model), ASPA (solar plant feasibility analyzer), • Participation in global working groups on decarbonization initiatives (ACI EUROPE, ACI, ICAO).

Table 2: Stakeholder Management

Annex

A. Climate Commitment and Goals

Position and Goals Flughafen Zürich AG

CLIMATE PROTECTION

FLUGHAFEN ZÜRICH AG HAS ADOPTED THE FOLLOWING CLIMATE PROTECTION POSITION:

"The contribution of aviation to the climate change is relatively small with approximately 1.5% of all anthropogenic CO₂-emissions. However, aviation is expected to grow with increasing demand of mobility.

Flughafen Zürich recognizes the need for a comprehensive climate protection, aiming at limiting global warming well below 2°C and has goals and measures in place that go beyond the Swiss commitment under the Paris Climate Agreement.

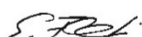
As an airport operator we are part of the aviation system and we commit ourselves to enable the development of aviation climate-friendly under consideration of legal and economical conditions.

Measures have to be adopted and become effective globally. We thus reject local measures without global effects or of purely fiscal nature.

Flughafen Zürich AG takes responsibility in international aviation and the national context and reduces its own CO₂-emissions according to scopes 1 and 2 to 20'000t CO₂ in 2030, further to 10'000t CO₂ in 2040 and ultimately aims towards Zero-Emissions in 2050."



Stephan Widrig
Chief Executive
Officer



Emanuel Fleuti
Head of Officer
Environment

THE FACTS

The main CO₂-emission sources at the airport of Zurich are the building heating, electricity, vehicles and machinery on site, ground access traffic as well as aircraft. Flughafen Zürich AG is directly responsible (Scopes 1 and 2) for approximately 0.6 percent according to the actual situation.

Flughafen Zürich AG emitted approximately 50,000t of CO₂ in 1991 with all its direct emission sources (vehicles and machinery, power plant and emergency generators) and purchased electricity. Despite expansion and traffic growth, CO₂ emissions have since been reduced by around 50 %, and even by 75 % relative to traffic growth. More than 80% of the CO₂-emissions from Flughafen Zürich AG are emitted by the own combined heat power plant.

The emissions of Flughafen Zürich AG represent 0.05 % of the total CO₂-emissions of Switzerland in 2015.



Imprint

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Zurich Airport

B. Summary of Energy Masterplan 2050

The energy masterplan to 2050 covers various elements and their dependency as displayed in figure 6. While the decarbonization of the energy supply will be relevant to achieve the net zero goal, the reduction of energy on the consumer side is likewise key for achieving the target.

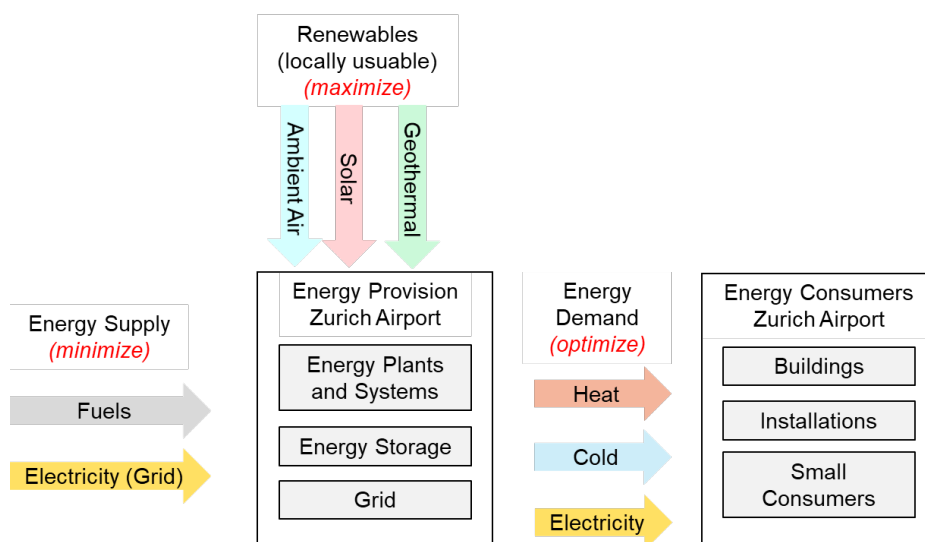


Figure 6: Interacting elements of the Energy Masterplan

The various measures are within the priorities listed and cover both the supply and demand side.

Priority	Supply Side	Demand Side
Reduction	n.a.	<ul style="list-style-type: none"> Guidelines Buildings³: Energy specifications, Swiss energy standard (MINERGIE). Partial/total renovation of buildings. Reduction of process heat temperatures.
Efficiency	<ul style="list-style-type: none"> Modular CHP plant (replacement of current CHP). Resizing of grid system Renovation of chiller centers 	<ul style="list-style-type: none"> Guidelines Buildings: Energy efficiency specifications. Operational improvements (building management, installations, e.g. lighting).
Renewable	<ul style="list-style-type: none"> Use of renewable natural gas (RNG), later synthetic gas. Use of geothermal heat/cold from local storage. Use of renewable electricity. Installation of additional solar PV-plants on Buildings roofs, potentially facades. 	n.a.

Table 3: Measures from the Energy Masterplan

³ Guidelines Buildings is an internal guideline document of Flughafen Zürich AG on standards and provision related to planning and realization of buildings at the airport. This includes, but is not limited to, energy, materials and consumption specifications.

C. Summary of Vehicle Strategy Plan 2050

Strategy

The number of vehicles in total, but also within each category will be kept constant (no fleet enlargement) and the decarbonization will be done through the shift in fuel type, from today diesel, gasoline, CNG and electricity to synthetics fuel, hydrogen and electricity. This also implies required vehicle technology and infrastructure changes.

Quantification and Feasibility Assessment

In order to quantify the fuel demand, the vehicle and machinery fleet of Flughafen Zürich AG has been grouped into 6 categories. For each, the average life cycle time, fuel consumption, annual workload and the number of units has been determined for 2020 and then up to 2050:

- | | |
|---|-----------|
| • Passenger cars and light duty vehicles (<3.2t) | 200 units |
| • Passenger busses | 31 units |
| • Heavy duty busses | 4 units |
| • Light duty busses | 5 units |
| • Heavy duty vehicles (trucks) | 24 units |
| • Agriculture, construction and maintenance machinery | 74 units |
| • Total | 338 units |

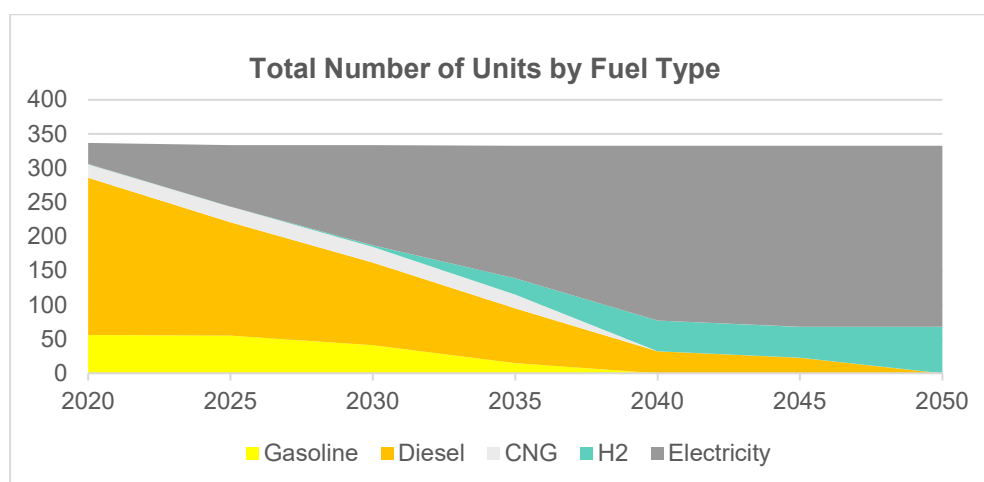


Figure 7: Development of vehicle/machinery units 2020-2050 by fuel type

From 2035 on, the split between synthetic fuel, hydrogen and electricity is not yet fully defined and depends on the availability of fuel systems. Passenger busses, for example, could thus be either electric or hydrogen when the current fleet replacement takes place from 2030 on.

D. Copy of the Airport Carbon Accreditation Certificate



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