

Milan 2050: A Data-Driven Vision for Urban Energy Decarbonization

Lorenzo Monga,
Head of sustainable transition grid, A2A

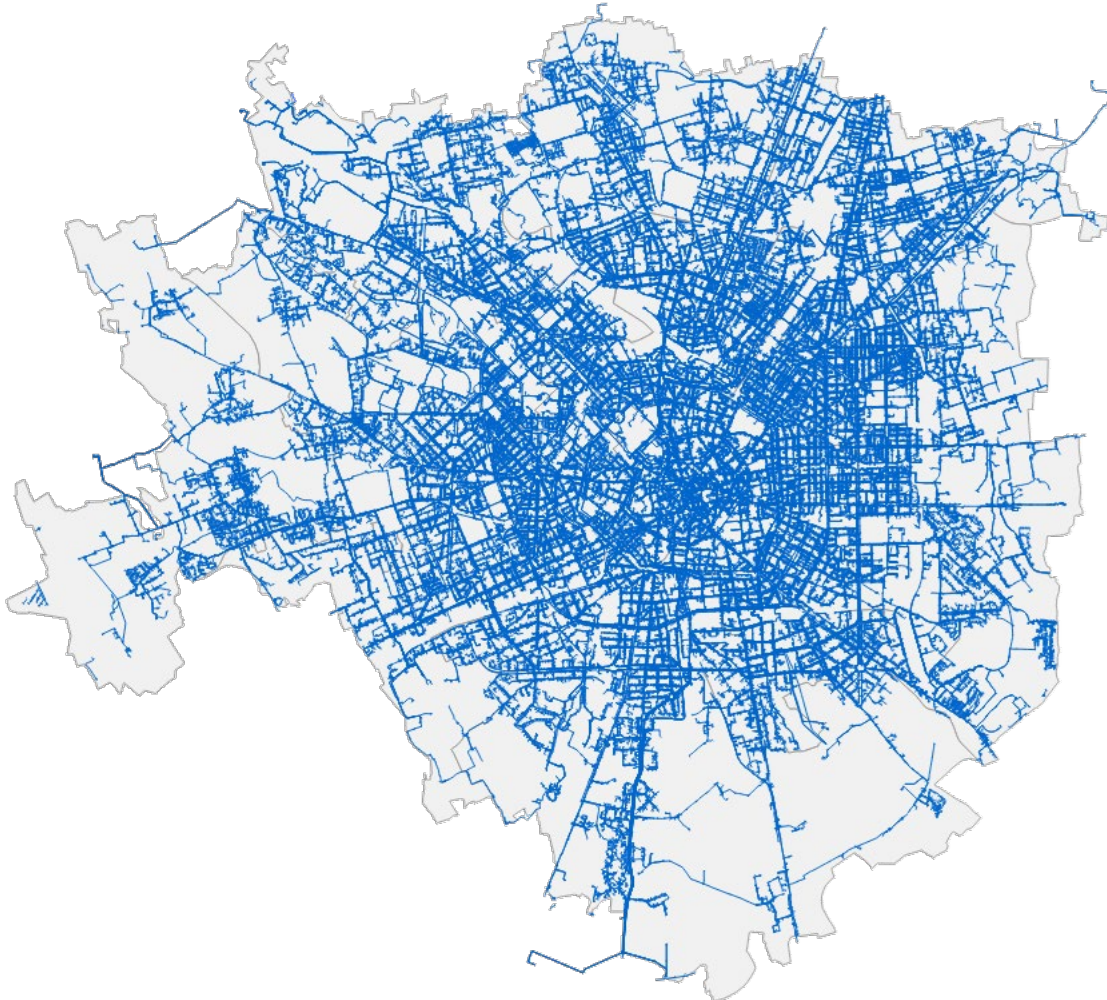
Rome, 21st November 2025



Milan electricity distribution grid

The electricity distribution grid is highly widespread and will play a key role in the energy transition, enabling renewable integration and the electrification of demand

Electricity distribution grid



Key data electricity grid

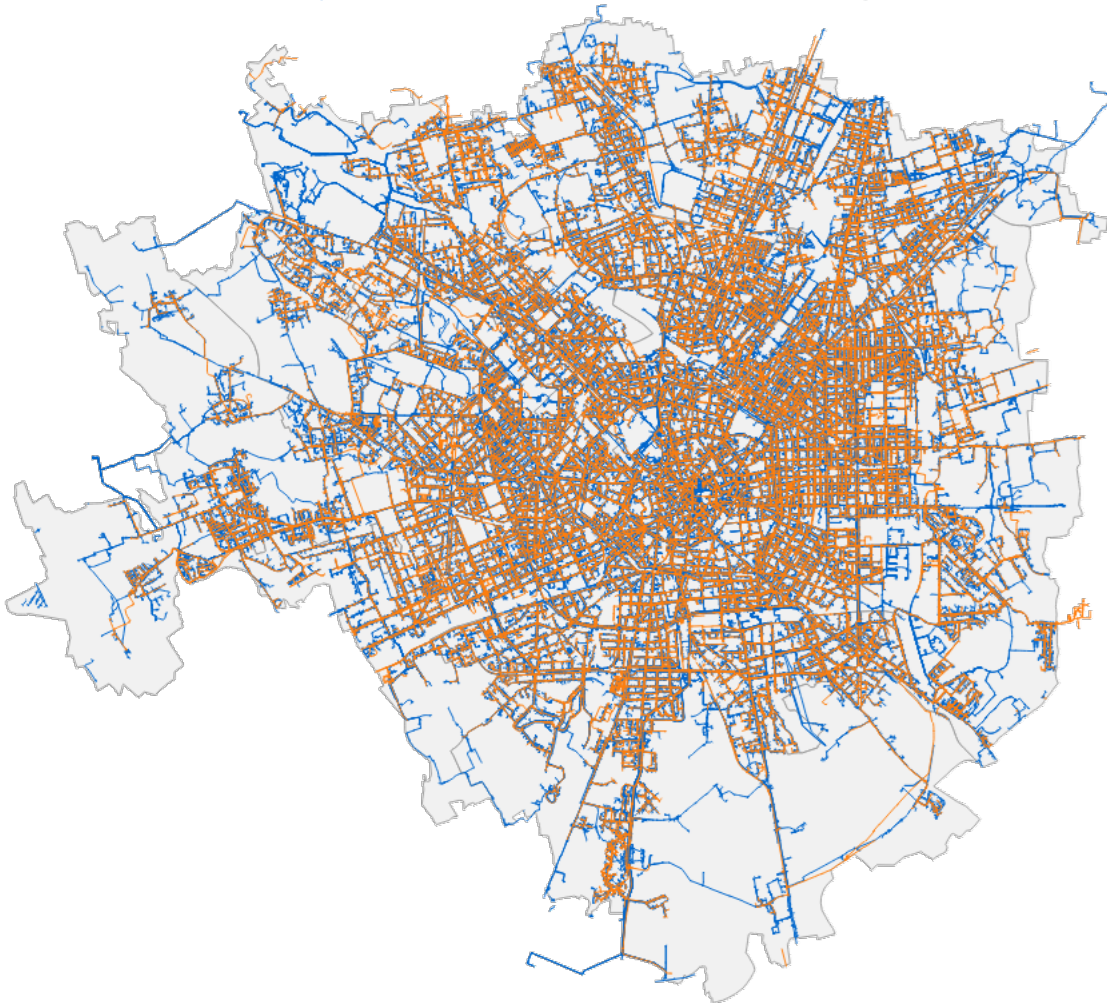
- 7,550 km of MT and BT grid
- 13 HV/MV Primary Substations
- >6,200 MV/LV Secondary Substations
- >900k point of delivery connected
- 6,5 TWh of electricity delivered



Milan gas distribution grid

The gas distribution network in Milan is a mature infrastructure that will continue to ensure supply reliability while enabling the city's energy transition

Electricity and Gas distribution grid



Key data gas grid

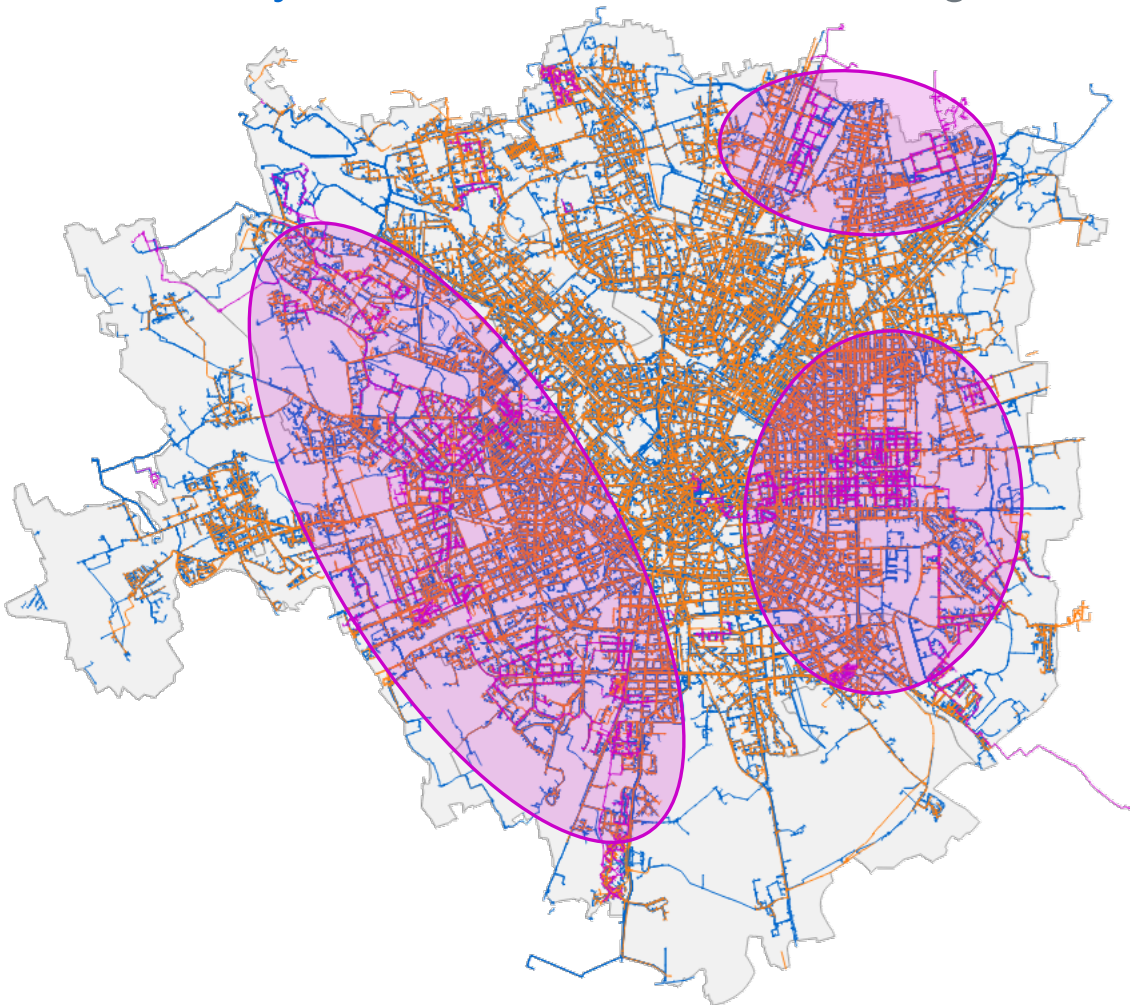
- 2,200 km of MP and LP grid
- 4 HP/MP reduction stations
- 173 MP/LP final reduction stations
- >650k final users connected
- 880 MSm³ of gas delivered



Milan district heating & cooling grid

The DHC system comprises three distinct, non-interconnected networks. Future expansion is key for decarbonizing household heating within densely populated urban areas

Electricity, Gas and DHC distribution grids



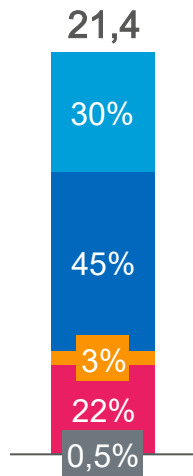
Key data DHC grid

- 390 km of DHC grid
- 25 heat production plants
- 3,500 customers connected
- 700 GWh thermal energy delivered

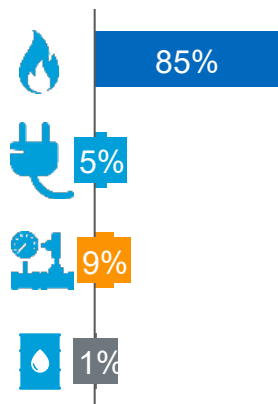
The Milan context

Significant use of gas for heating, high usage of fossil fuel for transport, predominant medium and low energy -class buildings

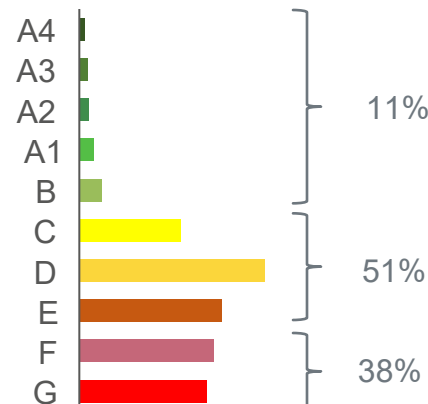
 Energy demand 2024 ¹



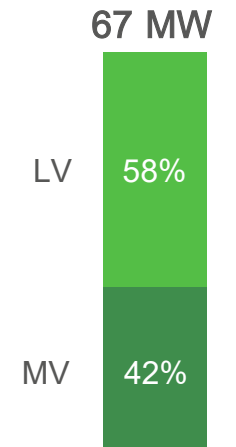
 Heating technologies mix ²
[number of buildings]



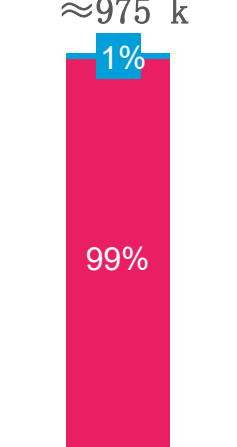
 Energy efficiency rating ³
[surface]



 Photovoltaic



 Mobility ⁴
[number of vehicles]



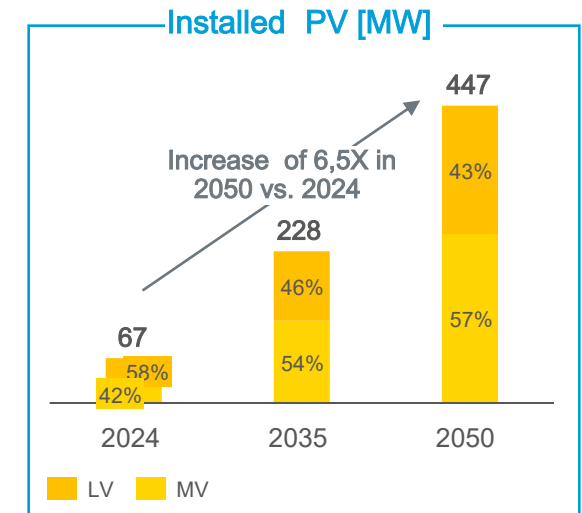
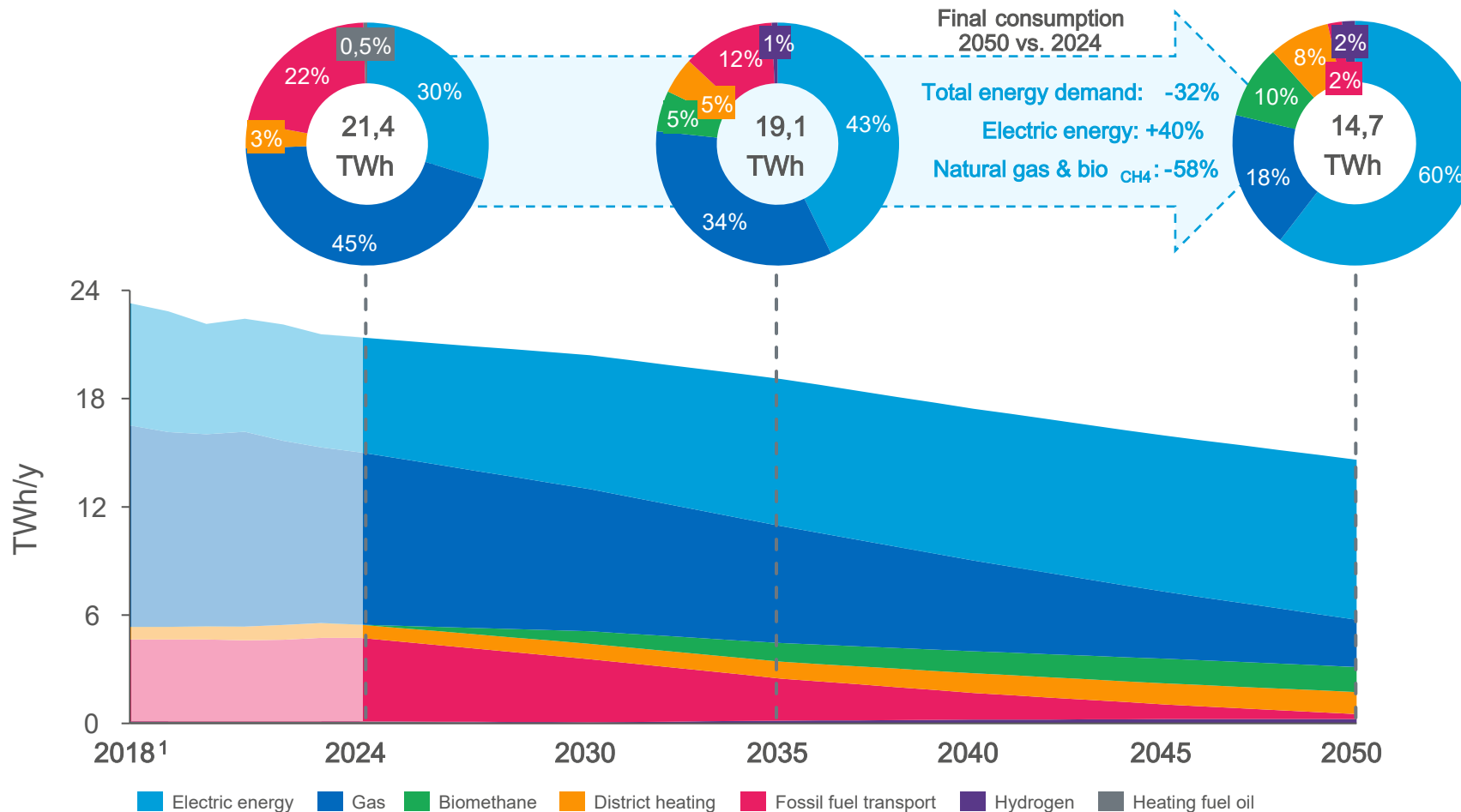
 Electric energy  Gas  District heating  Fossil fuel transport  Heating fuel oil

¹Combustion engine and fossil fuel transport consumption estimated. ²Distribution estimated by CURIT Milano. ³Distribution of energy classes estimated by CENED Milano. ⁴Data estimated from ACI considering only vehicles registered in Milan.

Energy demand evolution



Electrification of final consumption, district heating expansion, and improvements in energy efficiency are expected to reduce overall final energy consumption

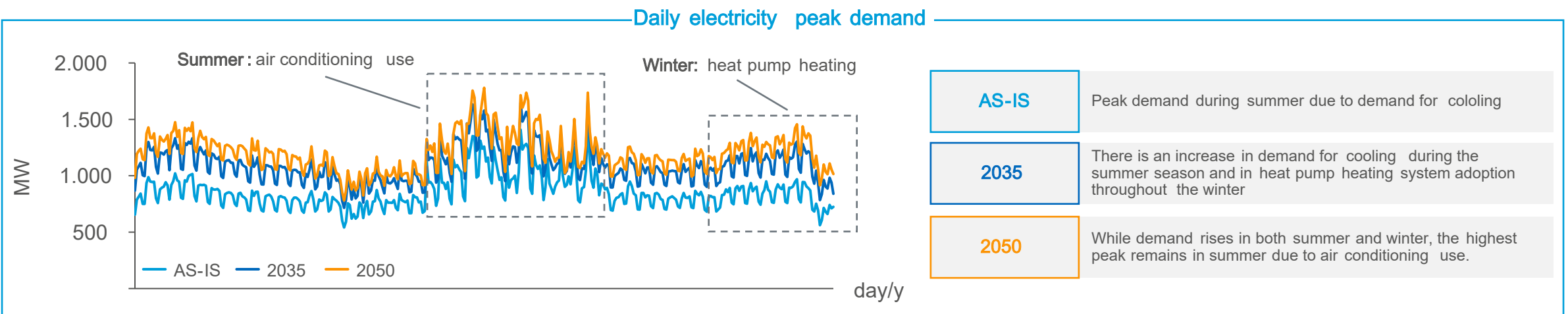
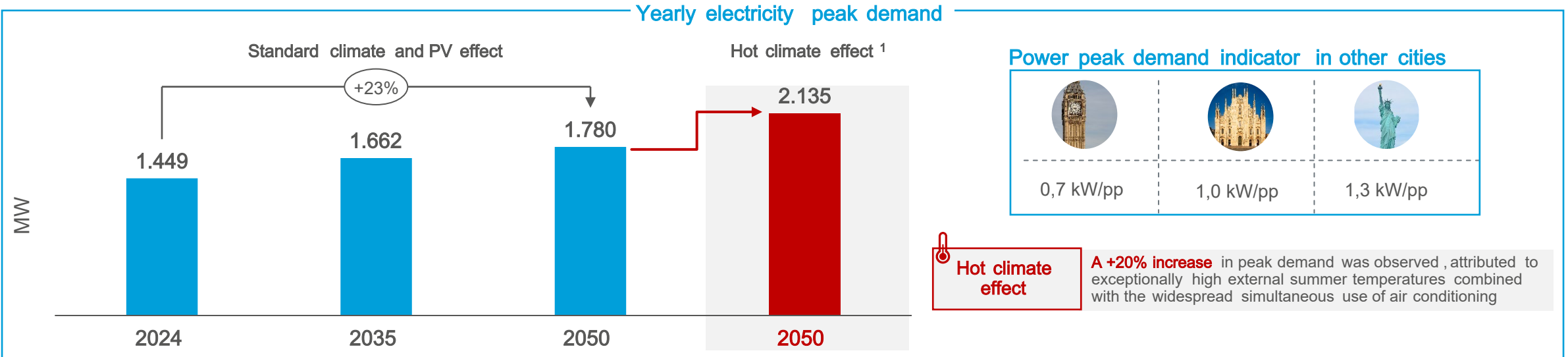


¹Historical heating consumption normalized with heating degree days



Electricity peak demand

Rising consumption increases electricity grid peaks, which photovoltaic systems only partly offset. Summer peaks are likely to persist due to air conditioning

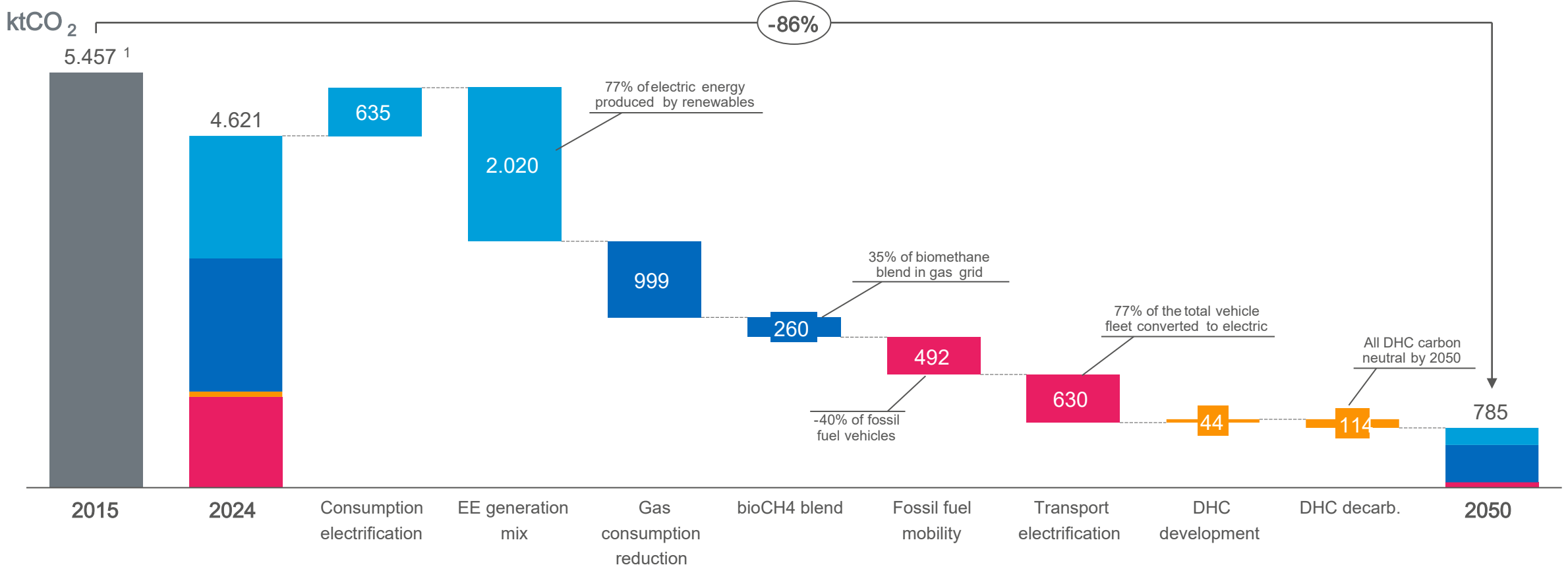


¹Hot climate effect: peak value calculated starting from the historical peak recorded in 2019.

CO₂ direct emission trend



A decrease in CO₂ emissions is facilitated by the decarbonization of electricity generation and the progressive transition away from fossil fuel technologies



■ Electric energy
 ■ Gas
 ■ District heating
 ■ Fossil fuel transport

¹Based on aggregated data at regional level.

Substation -level analysis



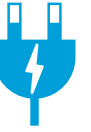
Strong presence of gas in all areas, greater diffusion of electricity in central areas and in new urban development, presence of DHC limited by network development



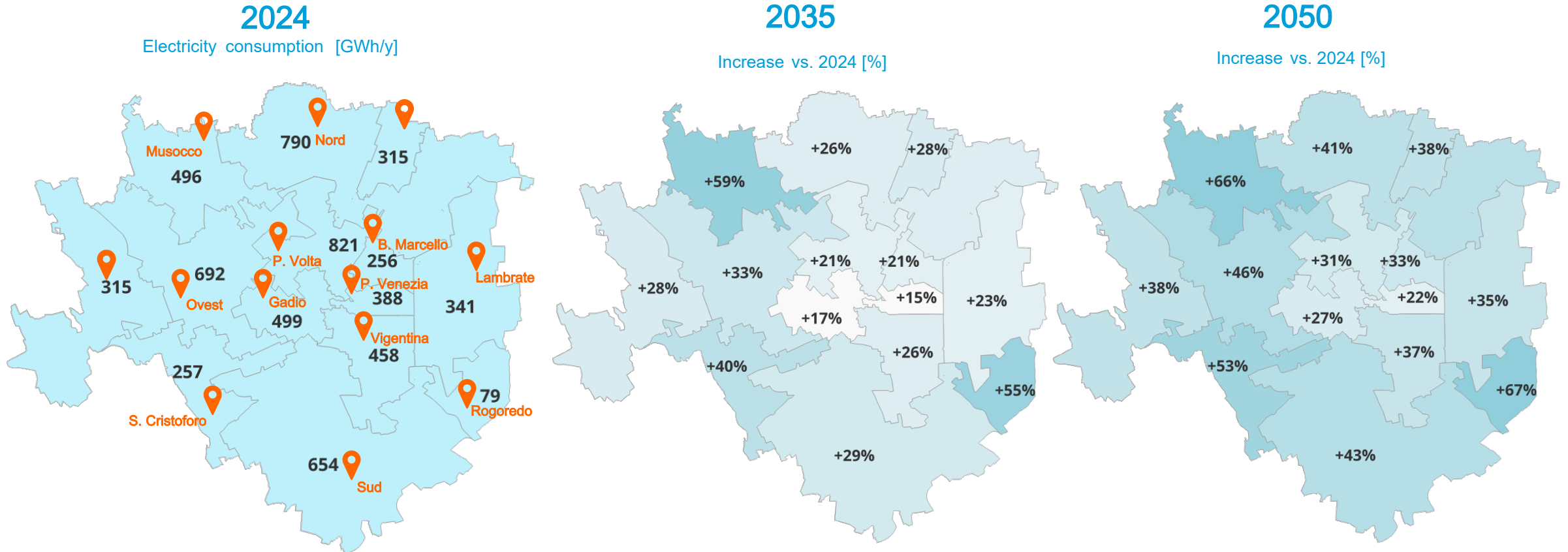
Primary Substation	Pop. [thousand]	Share electricity , gas and DHC consumption			Consumption [TWh/y]	PV [MW]	PV vs. elec cons [%]
Rogoredo	17	45%	43%	13%	0,2 (1%)	2	3,2%
B. Marcello	45	41%	57%	2%	0,6 (4%)	1	0,5%
S. Cristoforo	84	31%	62%	7%	0,8 (5%)	3	1,6%
P. Venezia	50	47%	49%	4%	0,8 (5%)	1	0,3%
Lambrate	85	36%	57%	7%	0,9 (6%)	5	1,8%
Musocco	73	47%	45%	8%	1,0 (6%)	8	1,9%
Gadio	81	45%	54%	0,2%	1,1 (7%)	2	0,5%
Vigentina	85	42%	55%	3%	1,1 (7%)	5	1,3%
P. Volta	122	48%	52%	0,1%	1,7 (10%)	6	0,8%
Ovest	170	38%	55%	7%	1,8 (11%)	6	1,0%
Sud	210	31%	61%	8%	2,1 (13%)	7	1,2%
Nord	218	31%	67%	2%	2,6 (16%)	11	1,6%
Duereti/e -dis.	131	35%	61%	4%	1,8 (11%)	10	1,9%
Milano	1.371	38%	57%	4%	16,5	67	1,2%

■ PV
 ■ ELEC
 ■ GAS
 ■ DHC

Electricity consumption increase



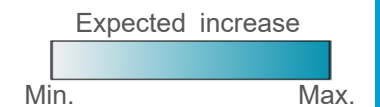
By 2050, the electricity consumption is set to increase by 42% on average



Milan primary substations



Strong growth expected on **Rogoredo** and **Musocco** primary substations, with electricity consumption set to increase more than **65%** mainly due to heating use related to new urban development projects.



Electrical power peak

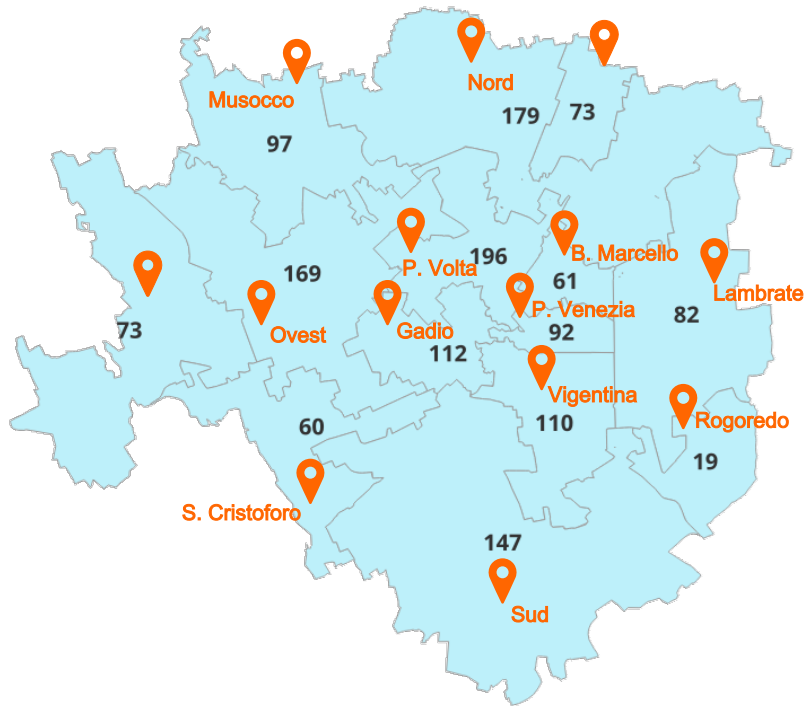


-use

Average peak growth of 23%, with greater increases in areas undergoing significant end consumption electrification. Primary substation saturation to rise on average by 11 p.p.

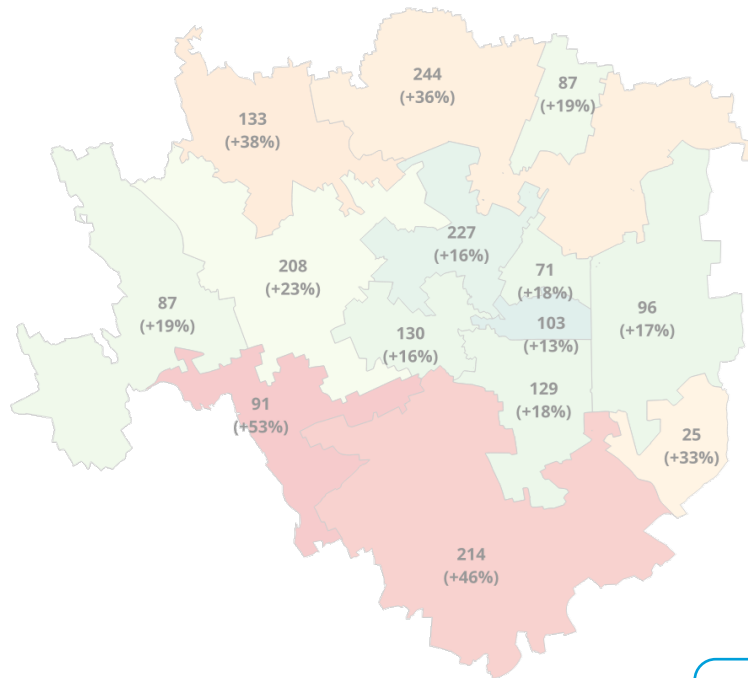
2024

Power peak [MW]



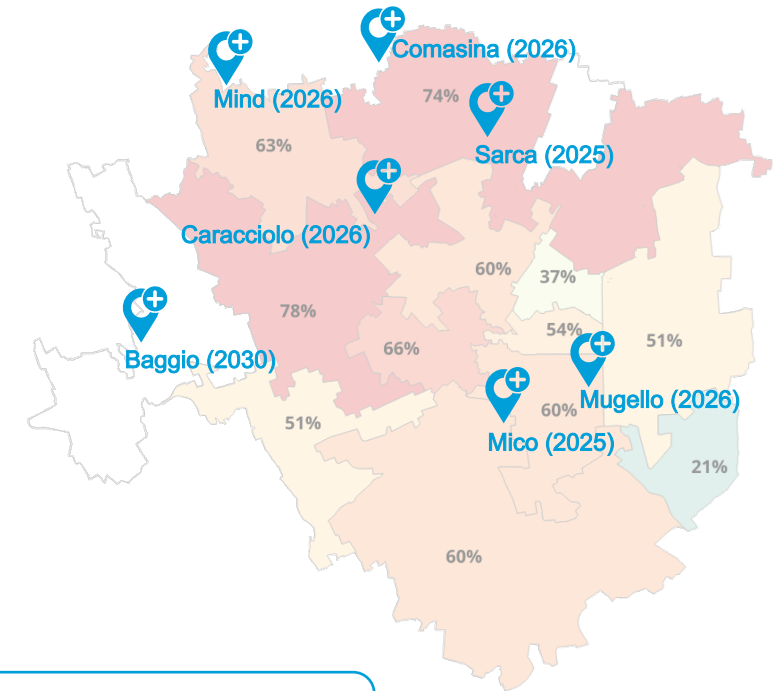
2050

Power peak with FV in 2050 [MW]
Increase vs. 2024 [%]



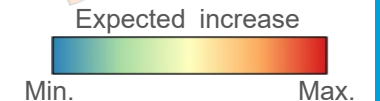
2050

Saturation [%]



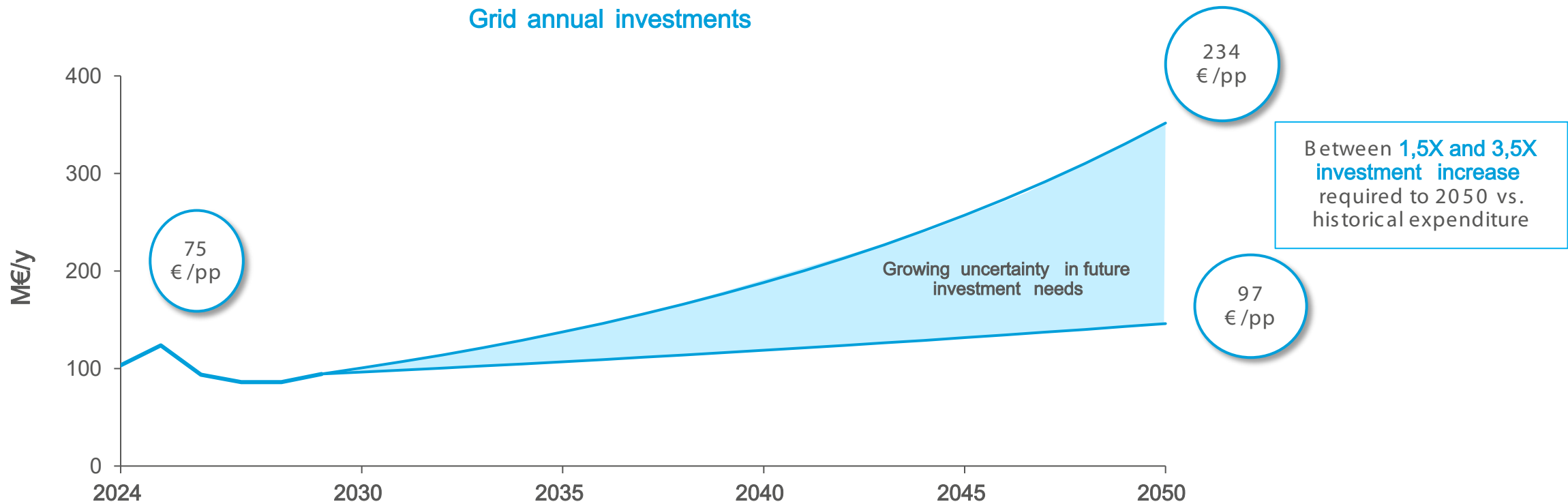
Milan primary substations

New primary substations (service year entry)



Economic outlook

Over €350 million in CAPEX investments will be required for Milan's distribution grid over the next years to support grid upgrades enabling the energy transition

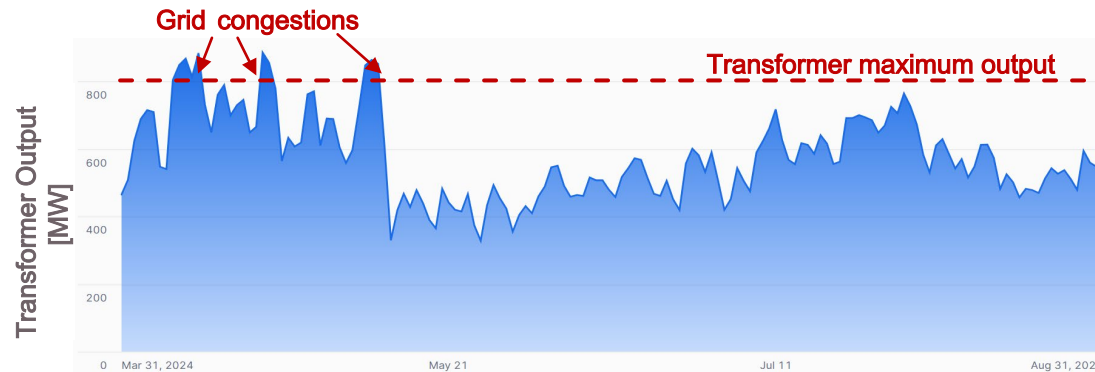


Future expenditure will be considerably influenced by capital investments (CAPEX) required for the **renewal of the existing network** and infrastructure, which are not included in this assessment

Innovative project for grid congestion management – MindFlex

Beyond traditional grid upgrades: local flexibility unlocks smarter, more efficient network management

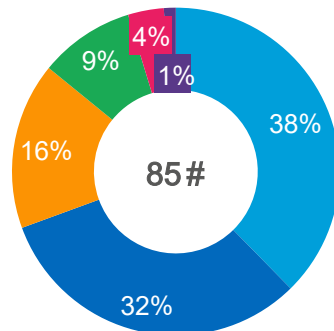
The role of local flexibility



- **Grid flexibility** can help managing moments of high stress on the network, thus helping to **defer or complement costly infrastructure upgrades**.
- **Local flexibility markets** enable DSOs to procure services directly from consumers and distributed resources, optimizing network operation and integrating more renewable generation efficiently.

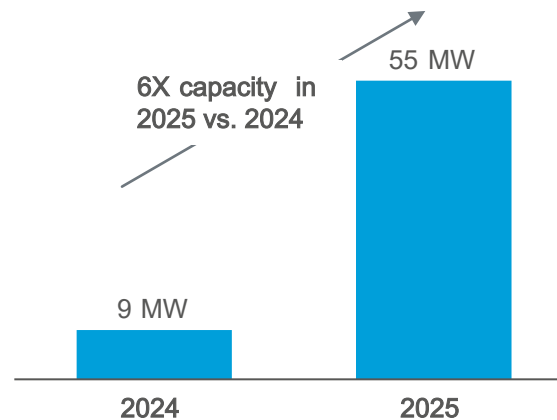
MiNDFlex approach

Resources qualified in MiNDFlex project



- EVs Charging Points
- Residential users
- Industrial users
- Non residential users
- CHP
- PV + storage

Capacity allocated in MiNDFlex auctions



- **The DSO** is testing innovative local flexibility mechanisms through the **MiNDFlex project**, promoted under the authorisation of ARERA.
- The initiative aims to develop a **local flexibility market**, where users receive **financial rewards** for providing flexibility services.



Shaping Milan's Energy System for 2050



Thank you