VISUALIZING THE ENERGY DEMAND OF FUTURE URBAN TRANSPORT

Breakfast meeting Urban Transport ("Transport i by")

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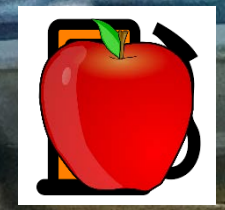
Calculating the energy demand

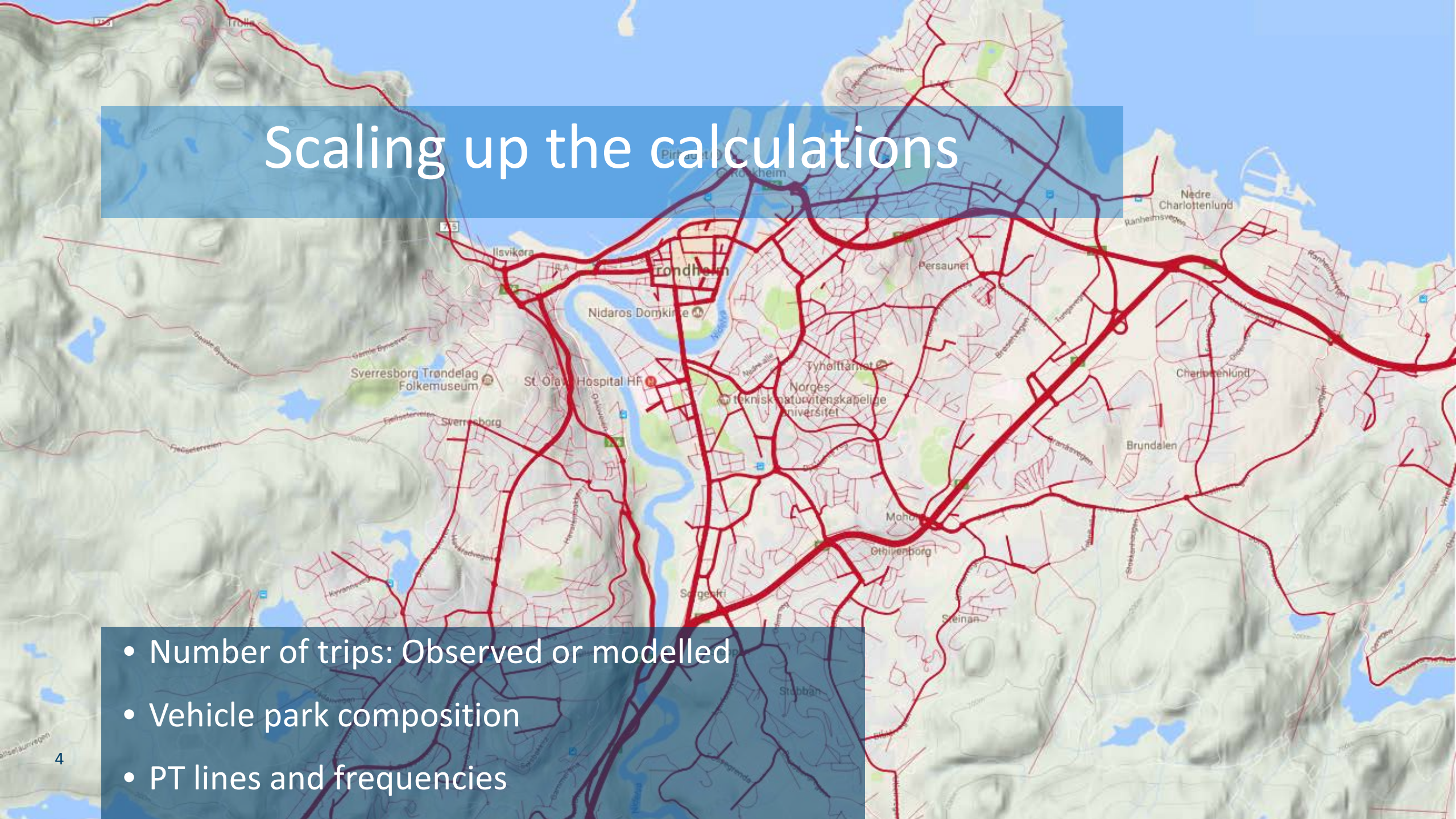
Foto: Trondheim kommune

Calculating the energy demand

- Comparable energy units
- Speed and energy model
- Calculated for road network

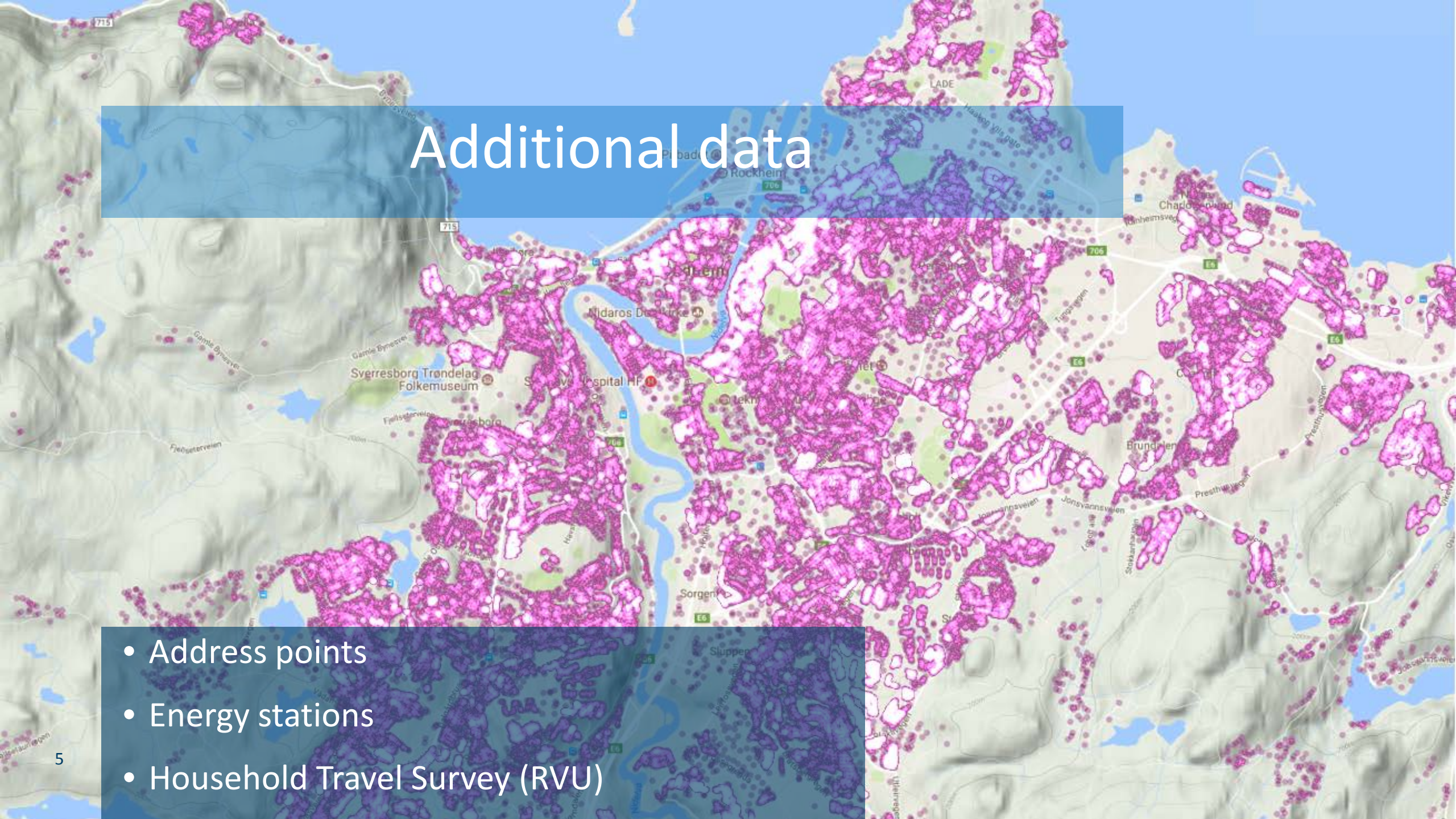


Scaling up the calculations



- Number of trips: Observed or modelled
- Vehicle park composition
- PT lines and frequencies

Additional data



- Address points
- Energy stations
- Household Travel Survey (RVU)


Visualization of data

Country	Number of People using rail transport (not including metro) (in million)	Passenger kilometres per head of population	Cargo carried (billions of tons)
Malaysia	5.9	770	22.2
Canada	0.3	80	28.20
China	27	1980	23.01
UAE	5.5	8	6

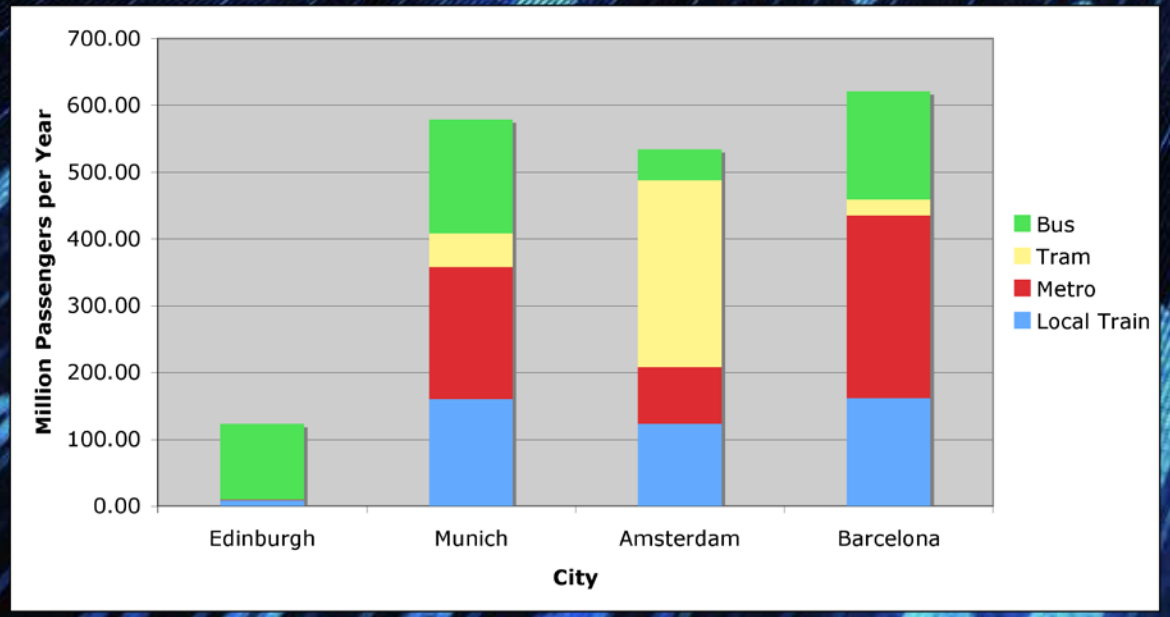
..instead of communication through words

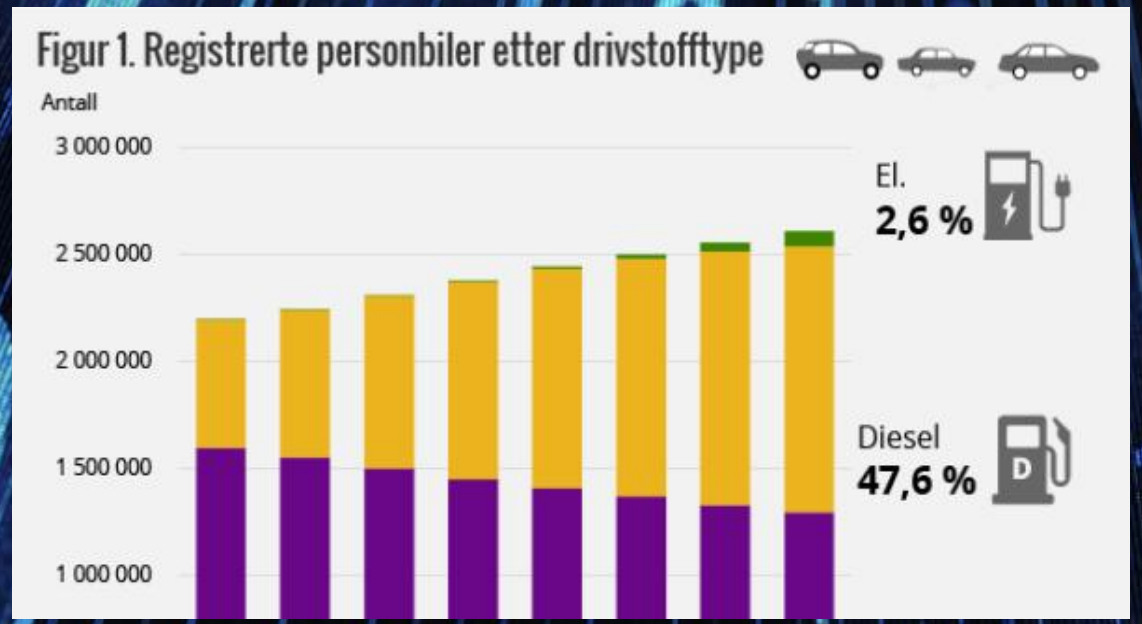
	1985	20[illegible]
Walking	255	2[illegible]
Bicycle	51	41
Car	3199	4806
Local bus	429	274
Local distance bus	54	124
Train	239	366
Taxi	13	42
Other	450	585
All modes	4740	6475

Method	Variables	n	Average	Var. coef. (%)
Ultrasound	V_{ult} (m s^{-1})	312	5305.89	3.87
	E_{ult} (MPa)	312	10,181.6	13.10
Induced vibration	V_{vib} (m s^{-1})	312	4880.96	4.38
	E_{vib} (MPa)	312	7363.07	14.7
[illegible]	[illegible]	[illegible]	7044.65	16.24
			(7044.65)[a]	
[illegible]	[illegible] (MPa)	312	36.88	27.47
			(21.69)[a]	
Density at 12% EN 408:2004	ρ_{12} (kg m^{-3})	312	361.29	10.88
			(315.30)[a]	
Moisture content EN 13183	Moisture (%)	312	9.71	7.49
Ring width	*Rw* (cm)	312	1.08	21.39

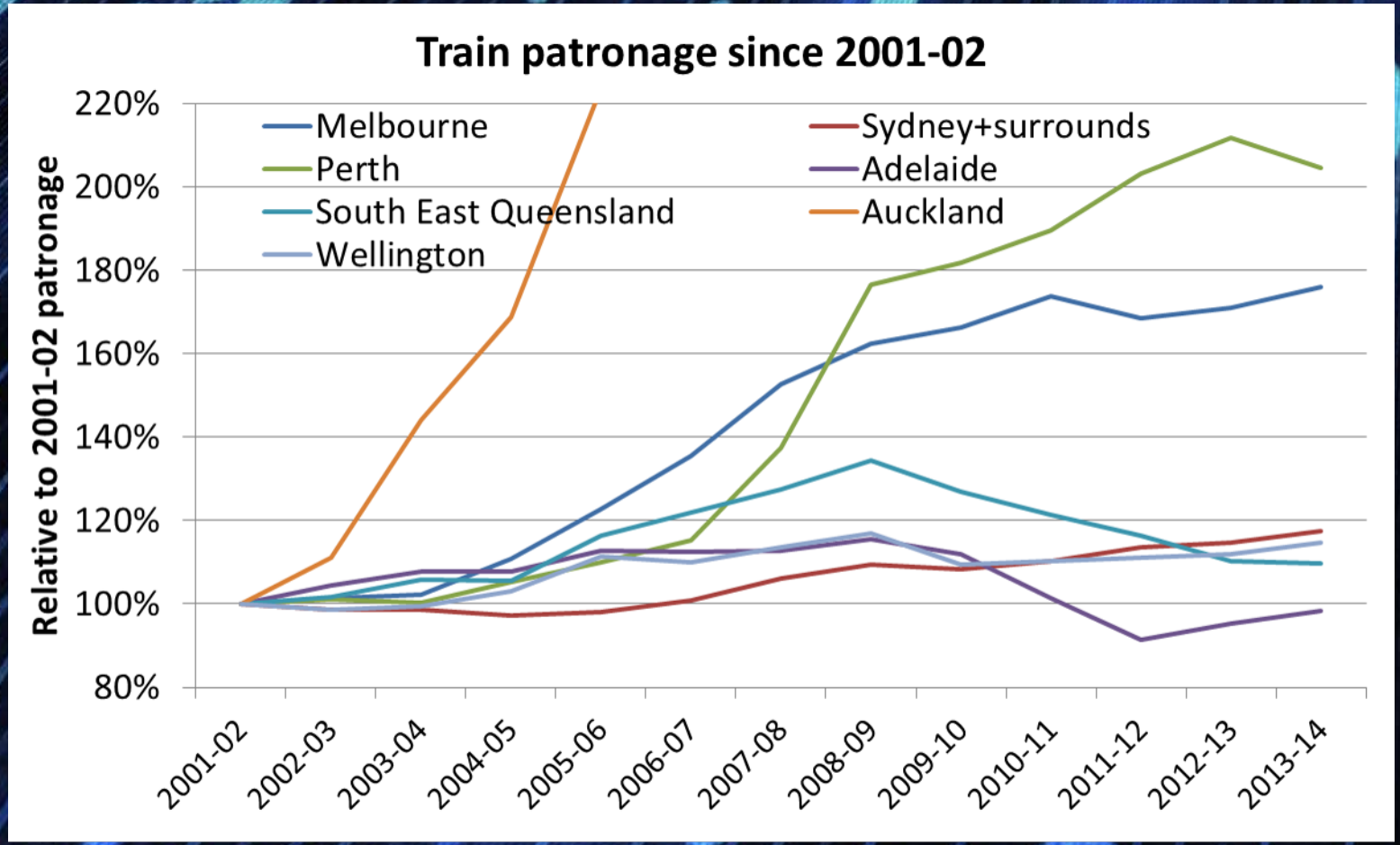
[a]Characteristic value.

Examples of visualization: Charts





Examples of visualization: Time series



Examples of visualization: 3D-charts and models

Foto: Trondheim kommune

Examples of visualization: Heatmaps

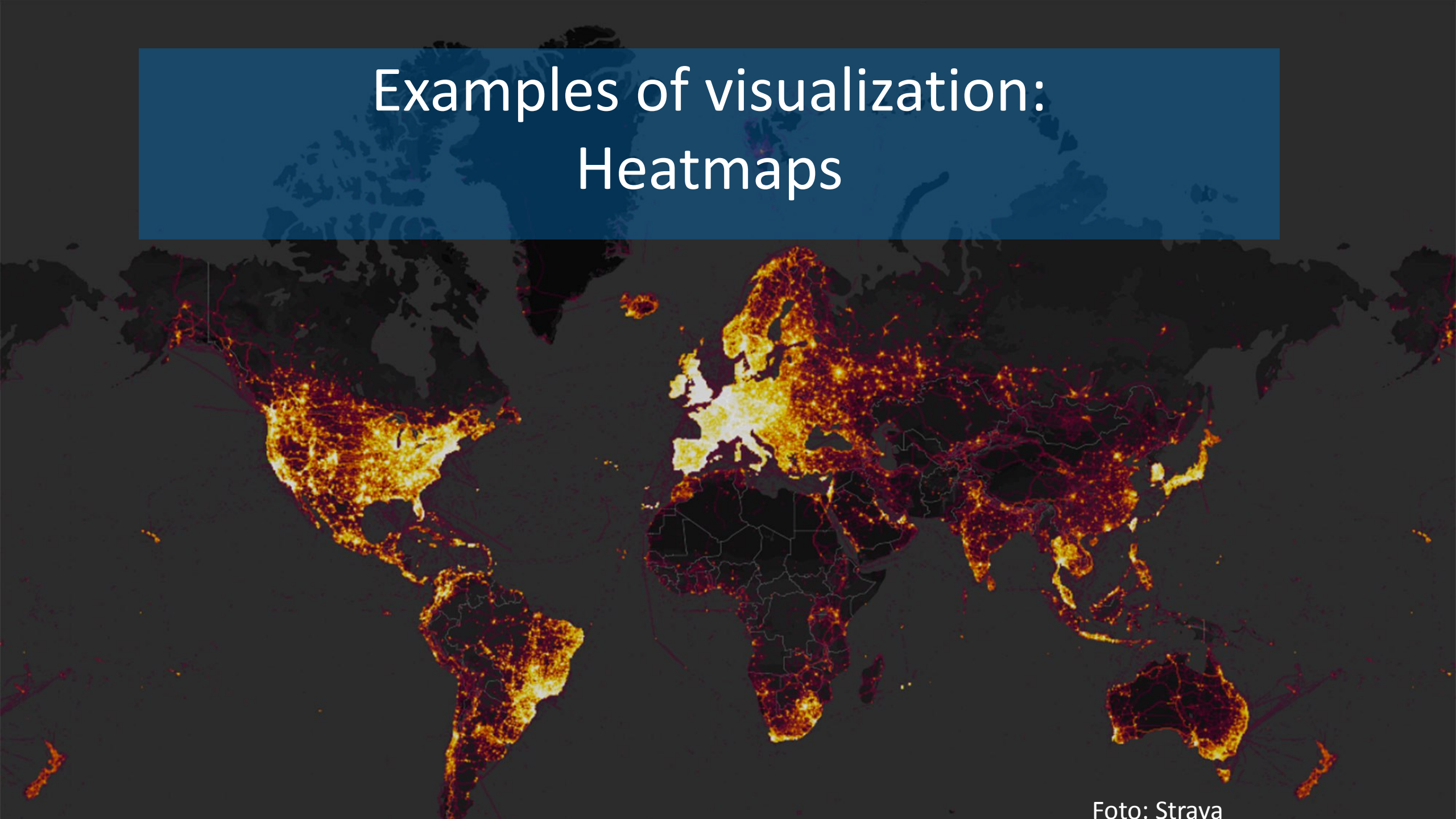
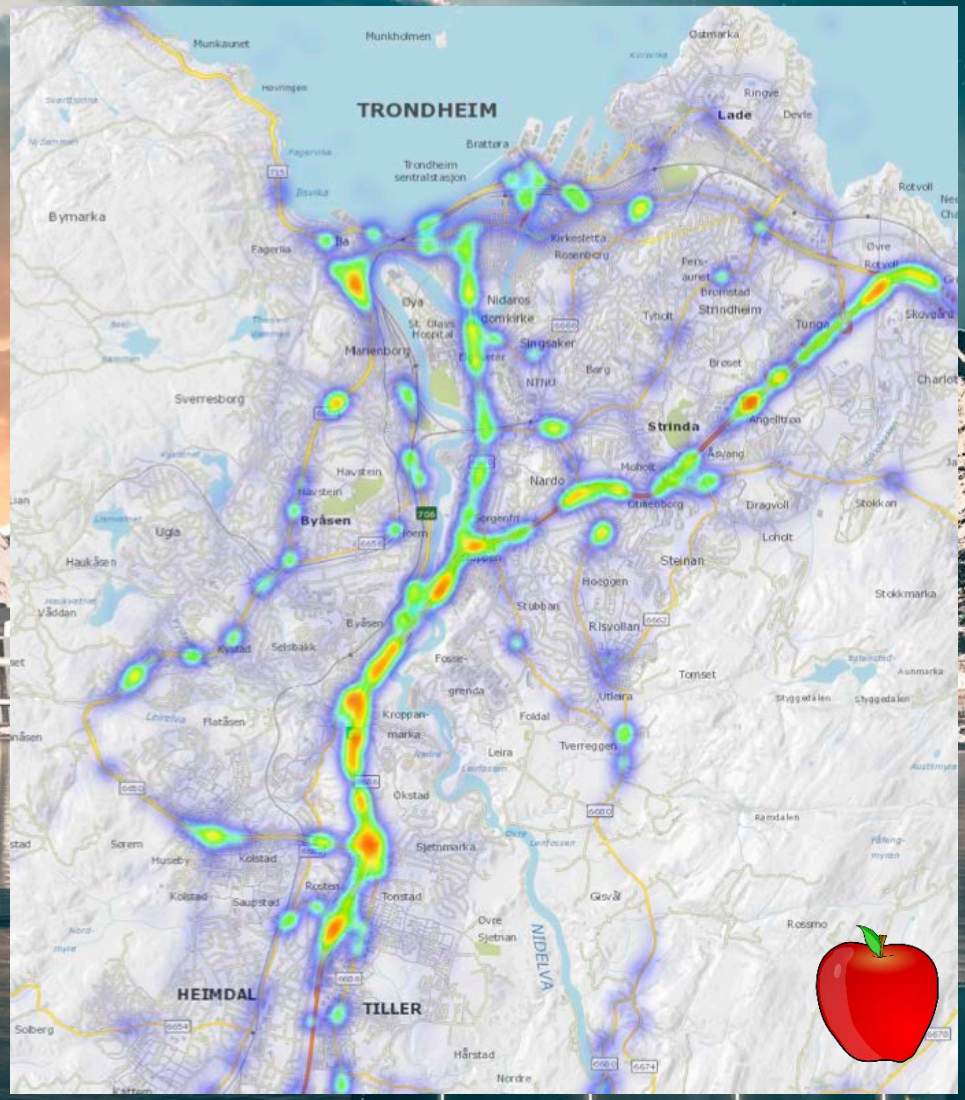


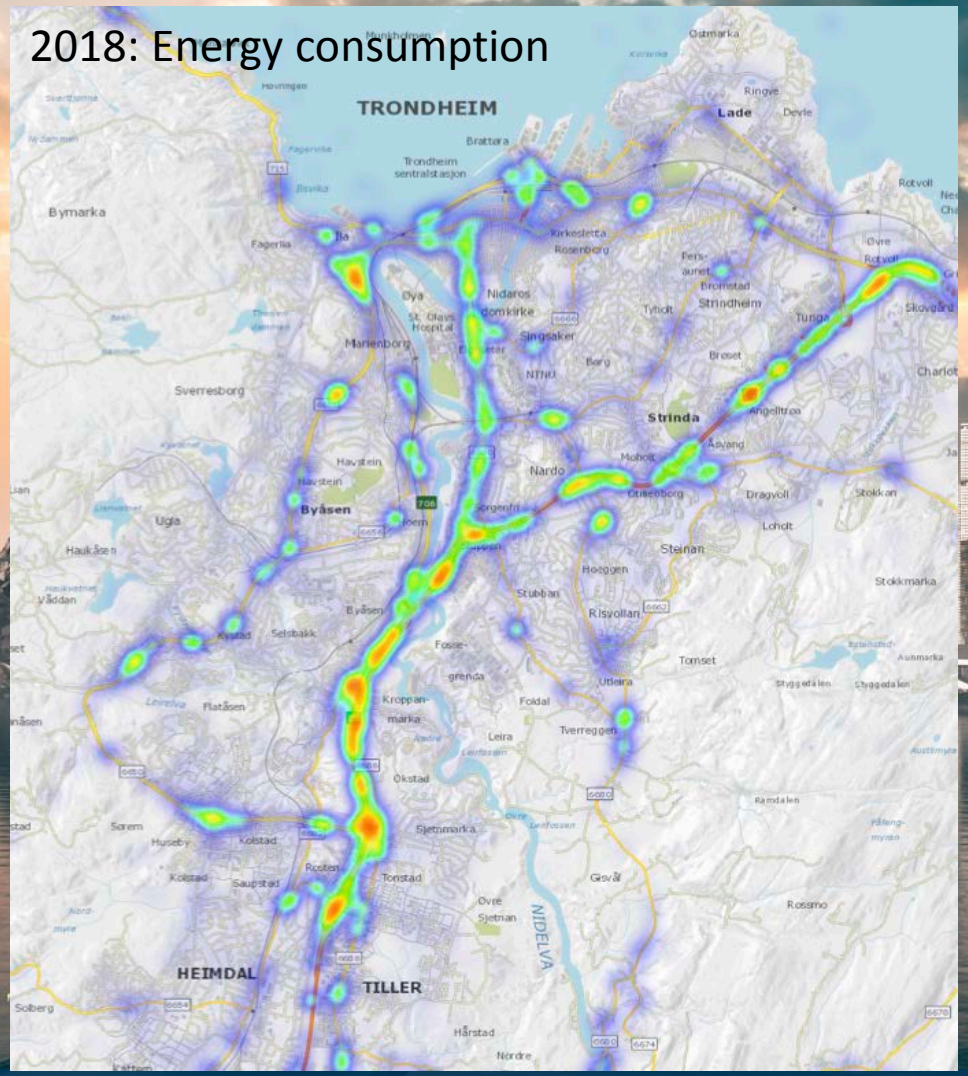
Foto: Strava

Examples of visualization: Animations

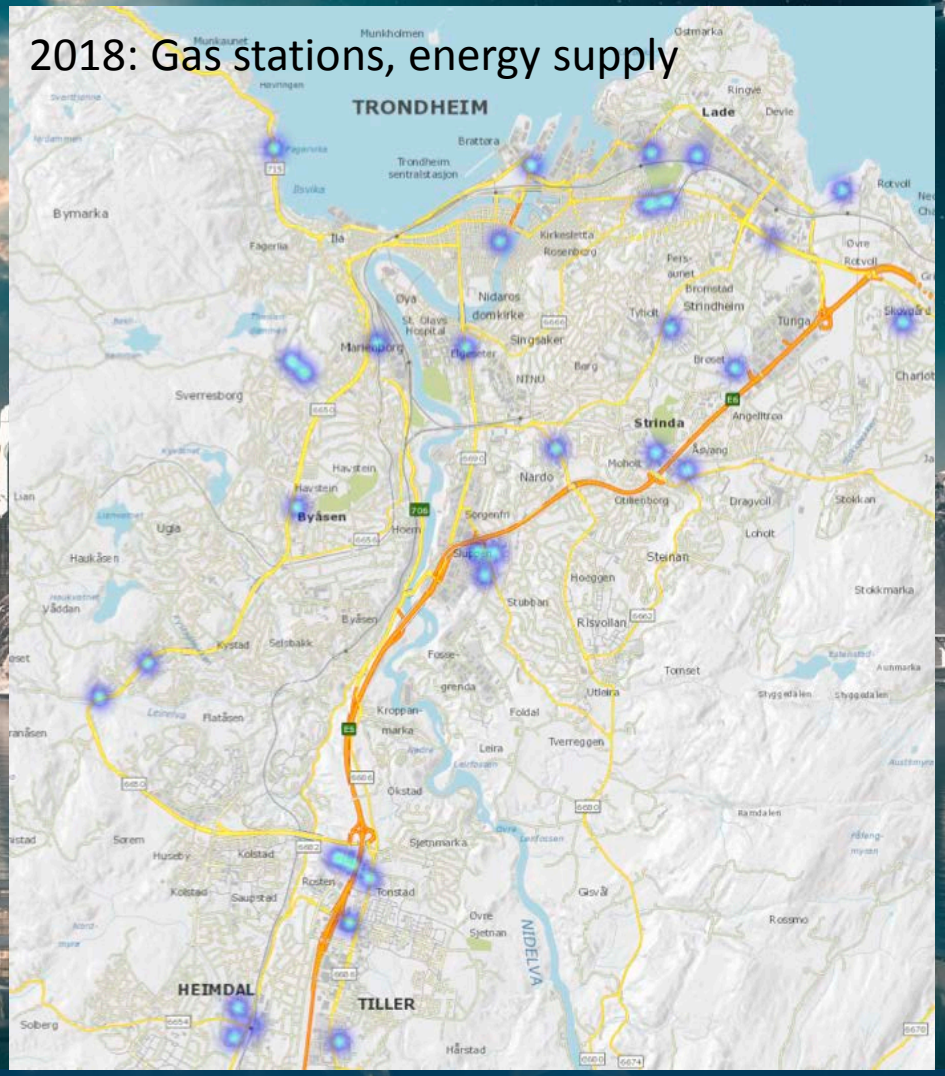


What is the energy consumption today?

2018: Energy consumption

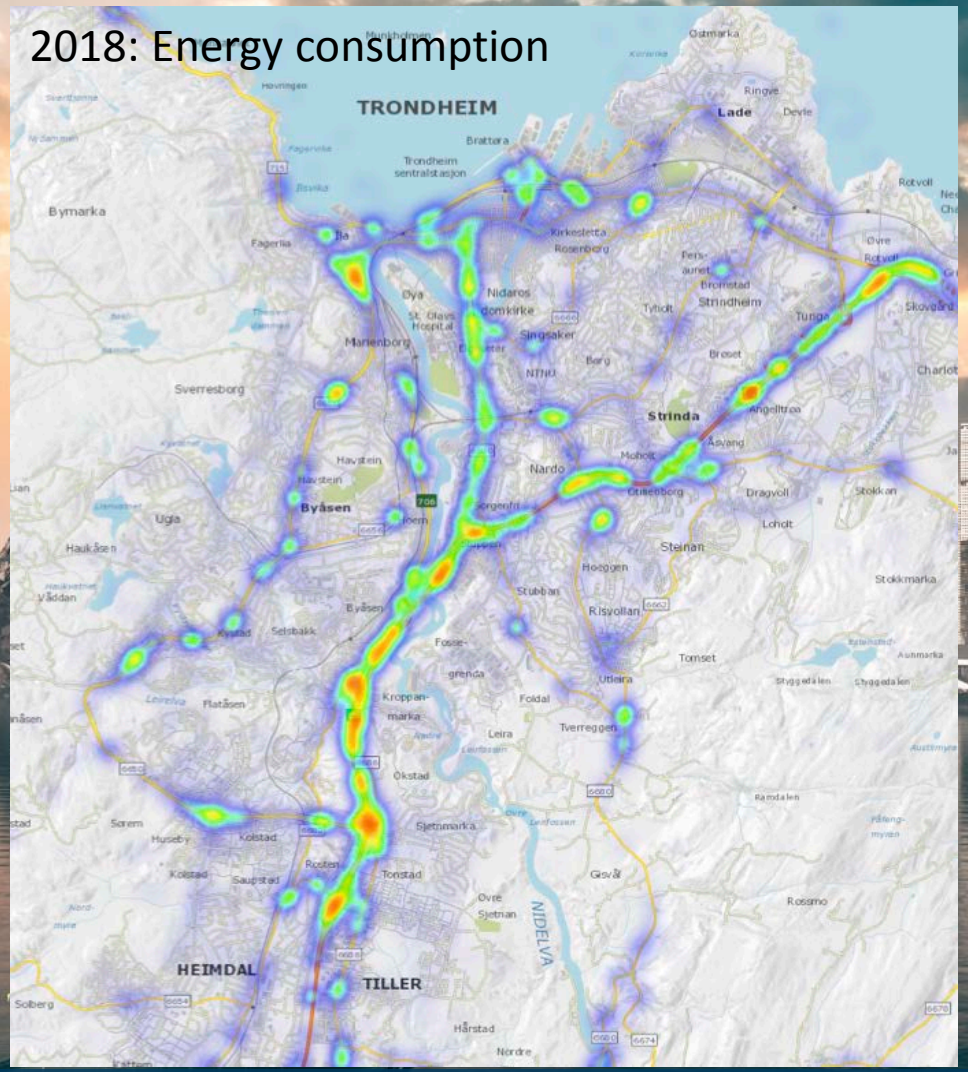


2018: Gas stations, energy supply

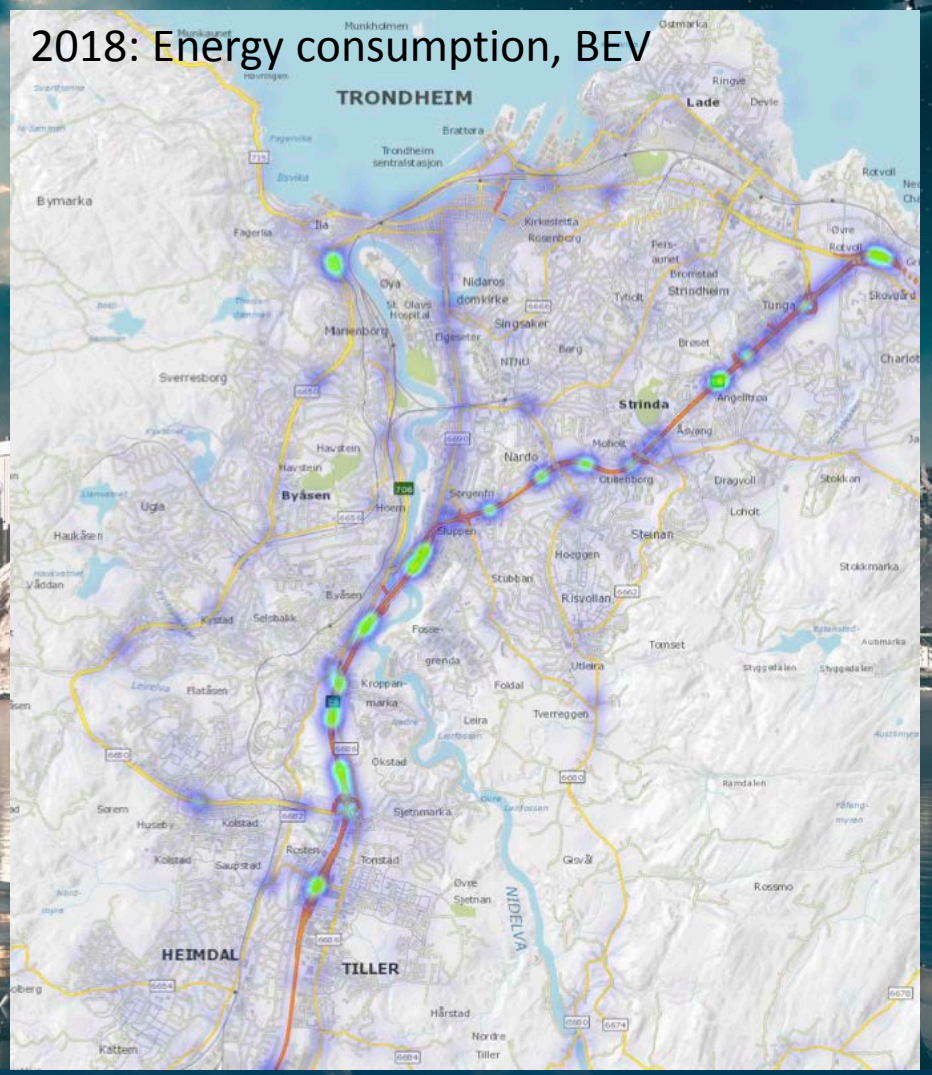


Energy source: gas stations

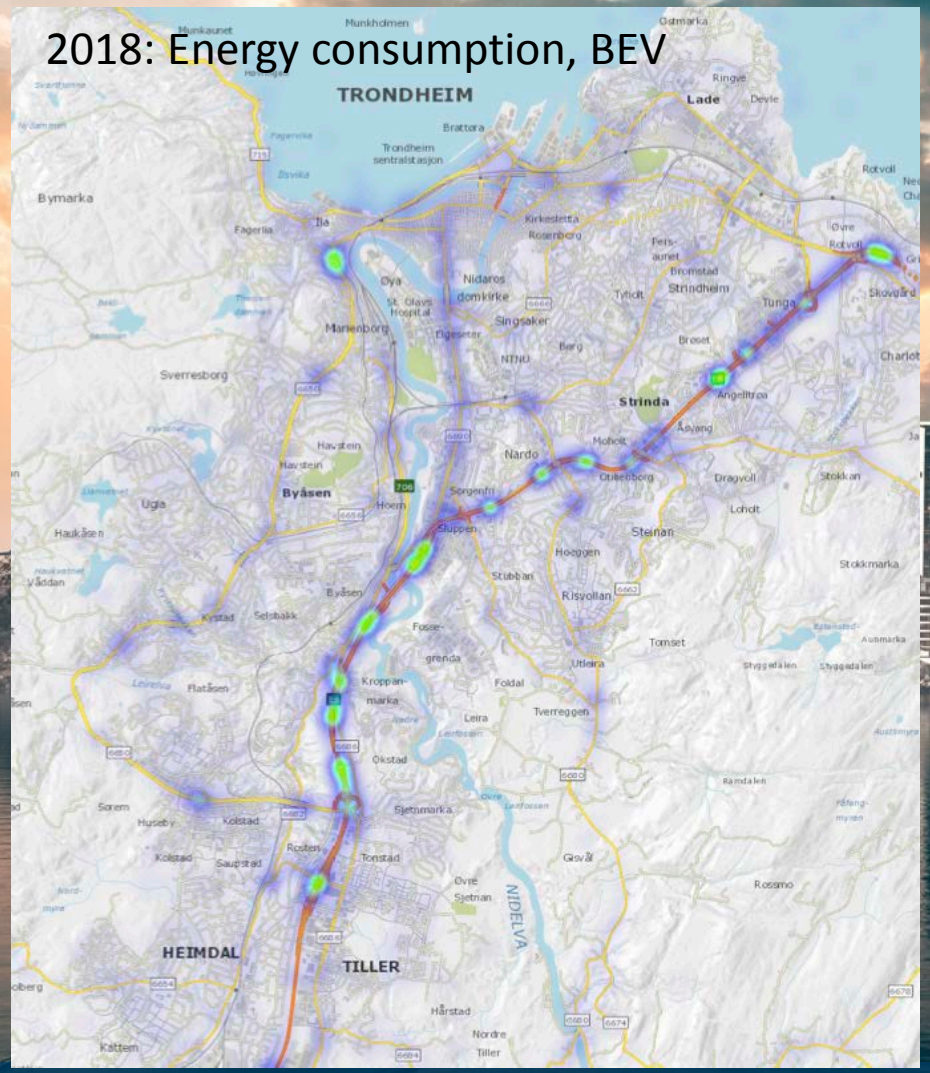
2018: Energy consumption

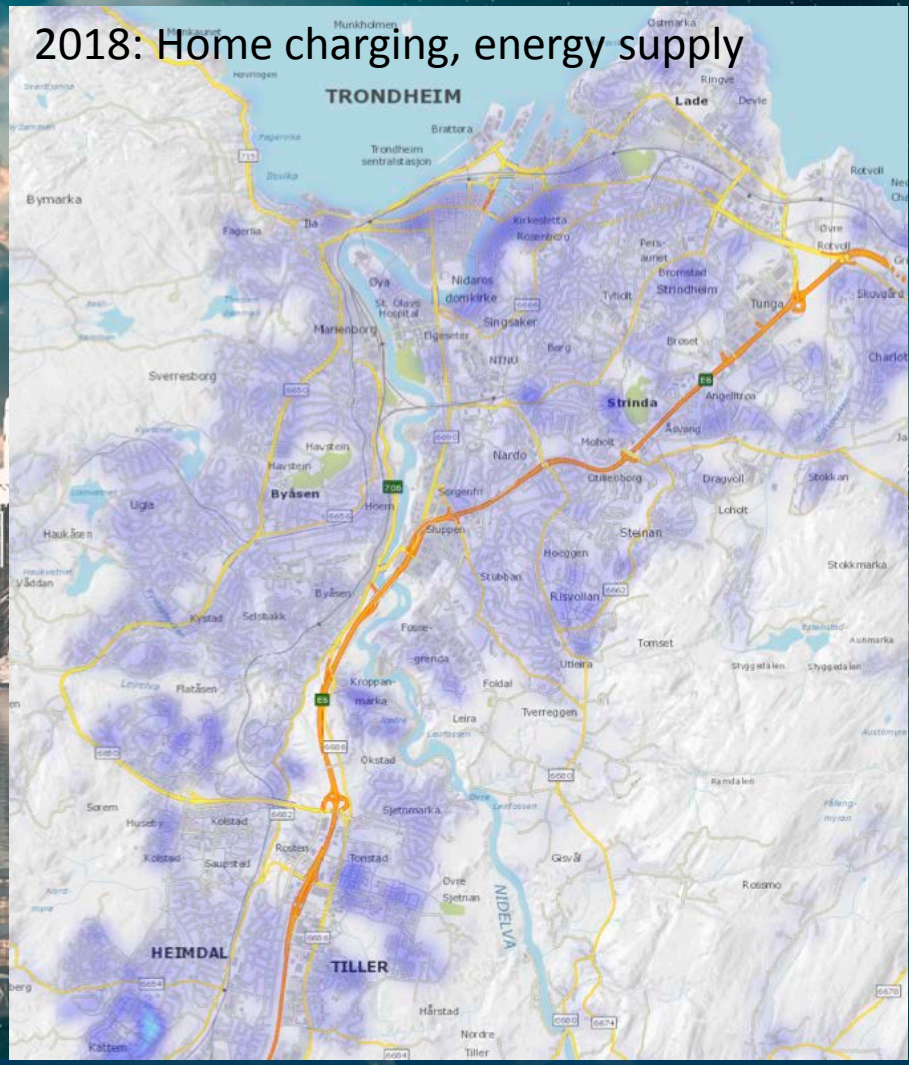


2018: Energy consumption, BEV

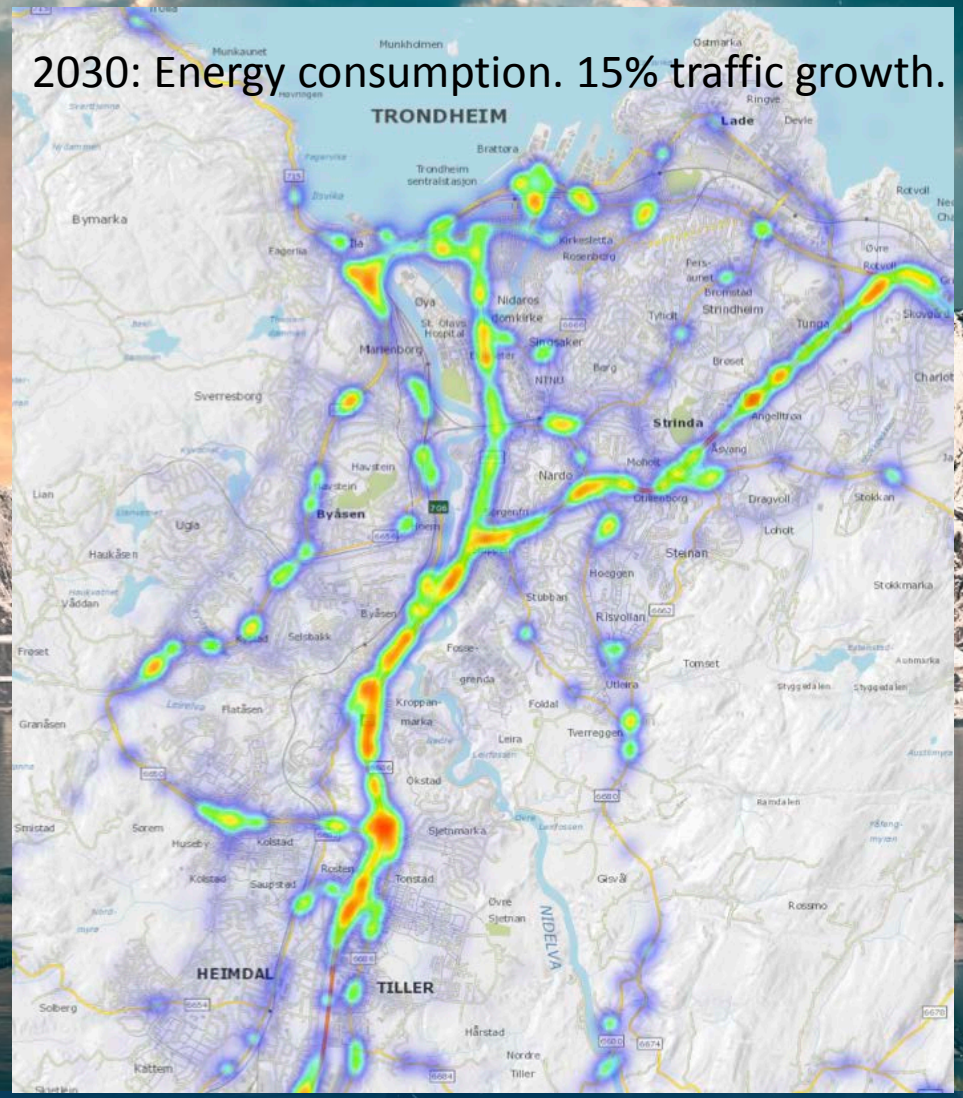


What if all vehicles were electric?



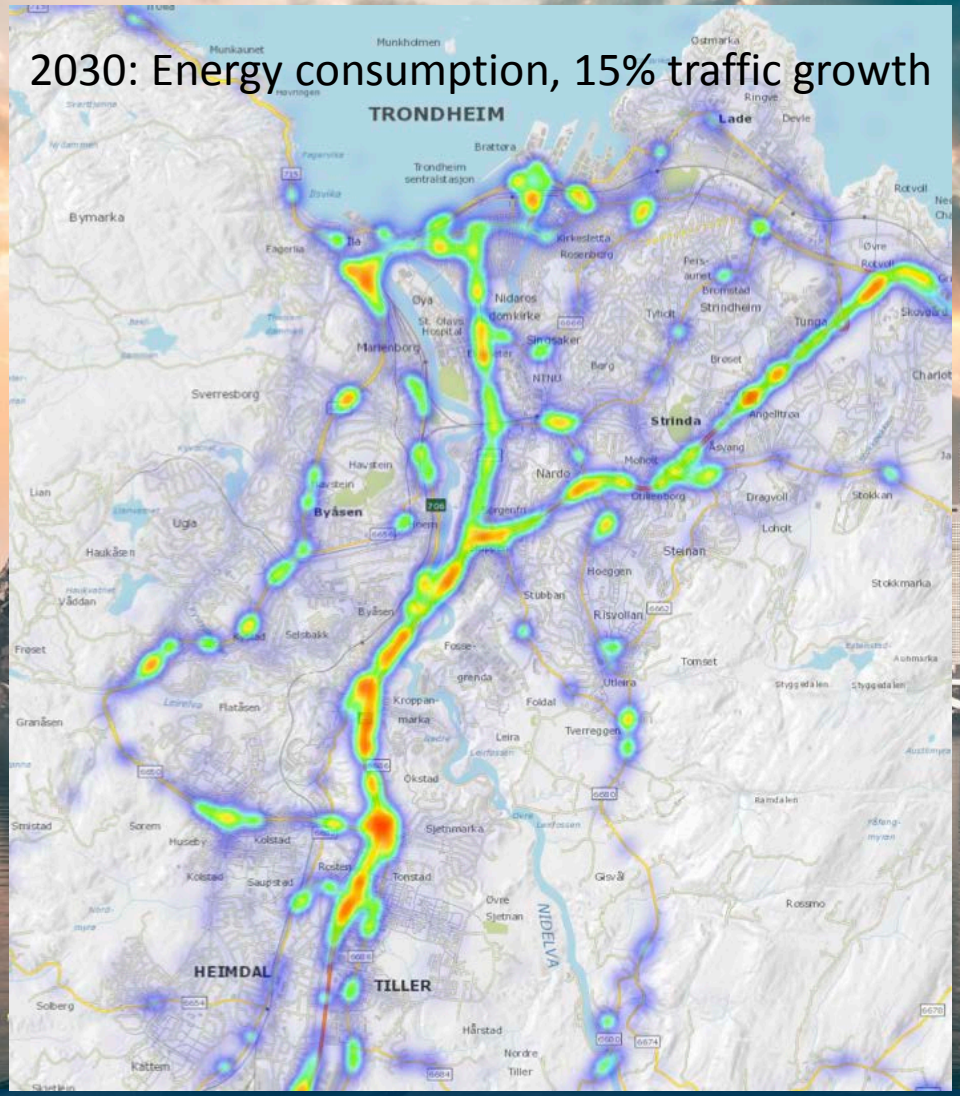


Energy source: home charging

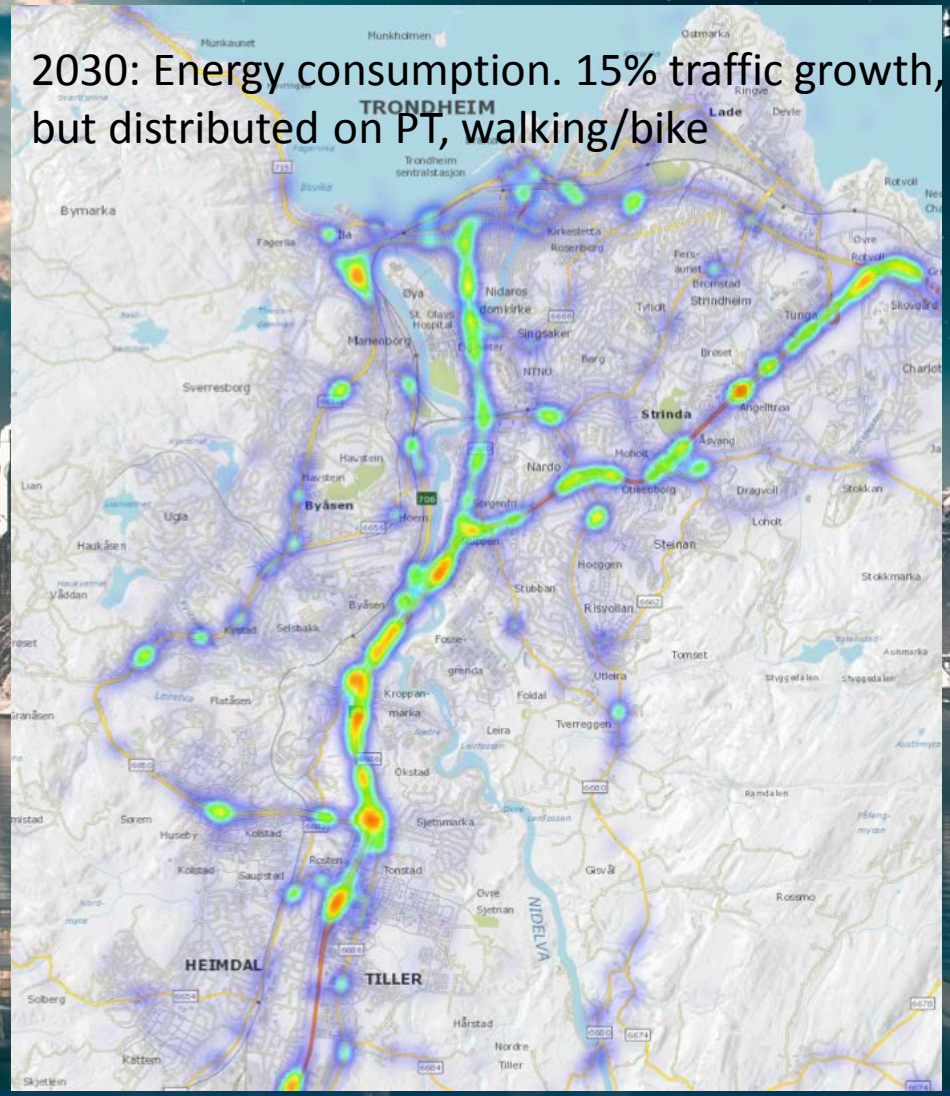


What is the energy demand in 2030?

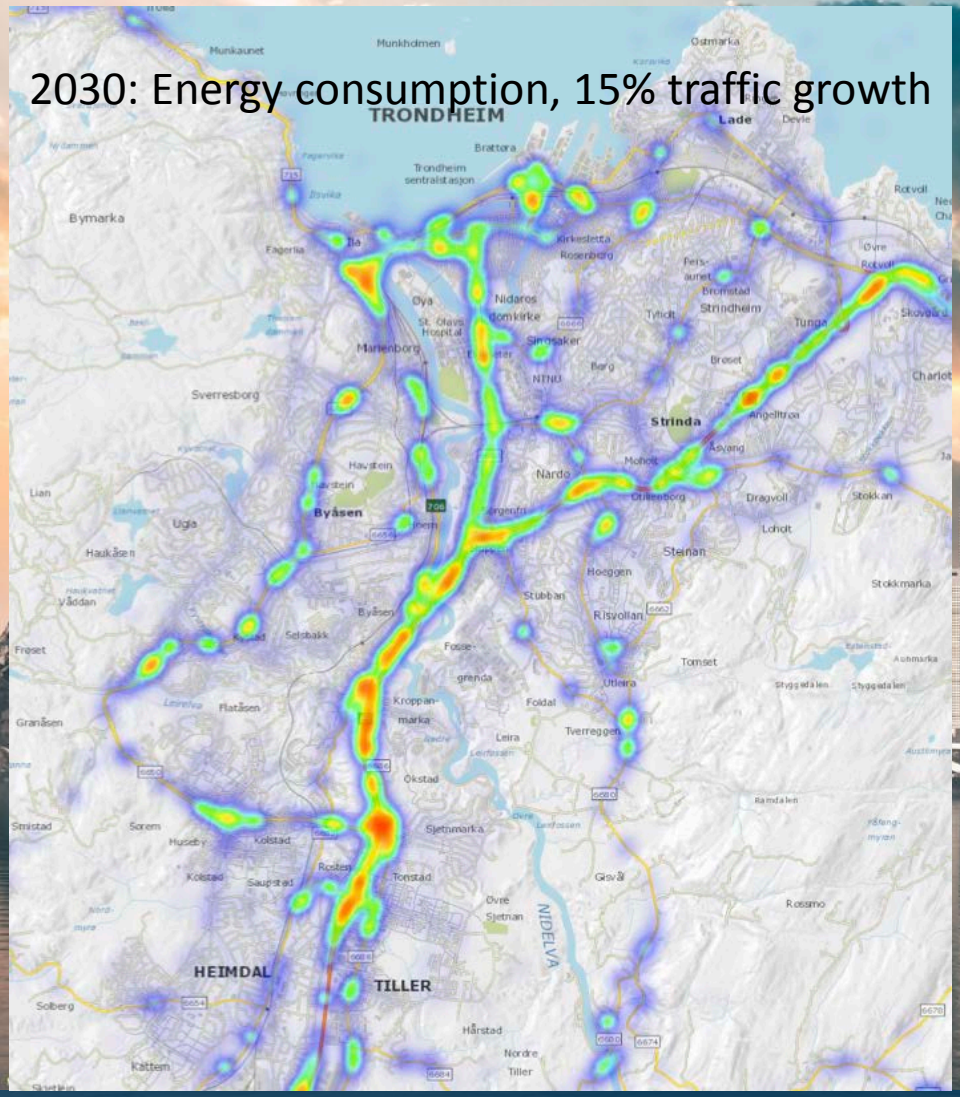
2030: Energy consumption, 15% traffic growth

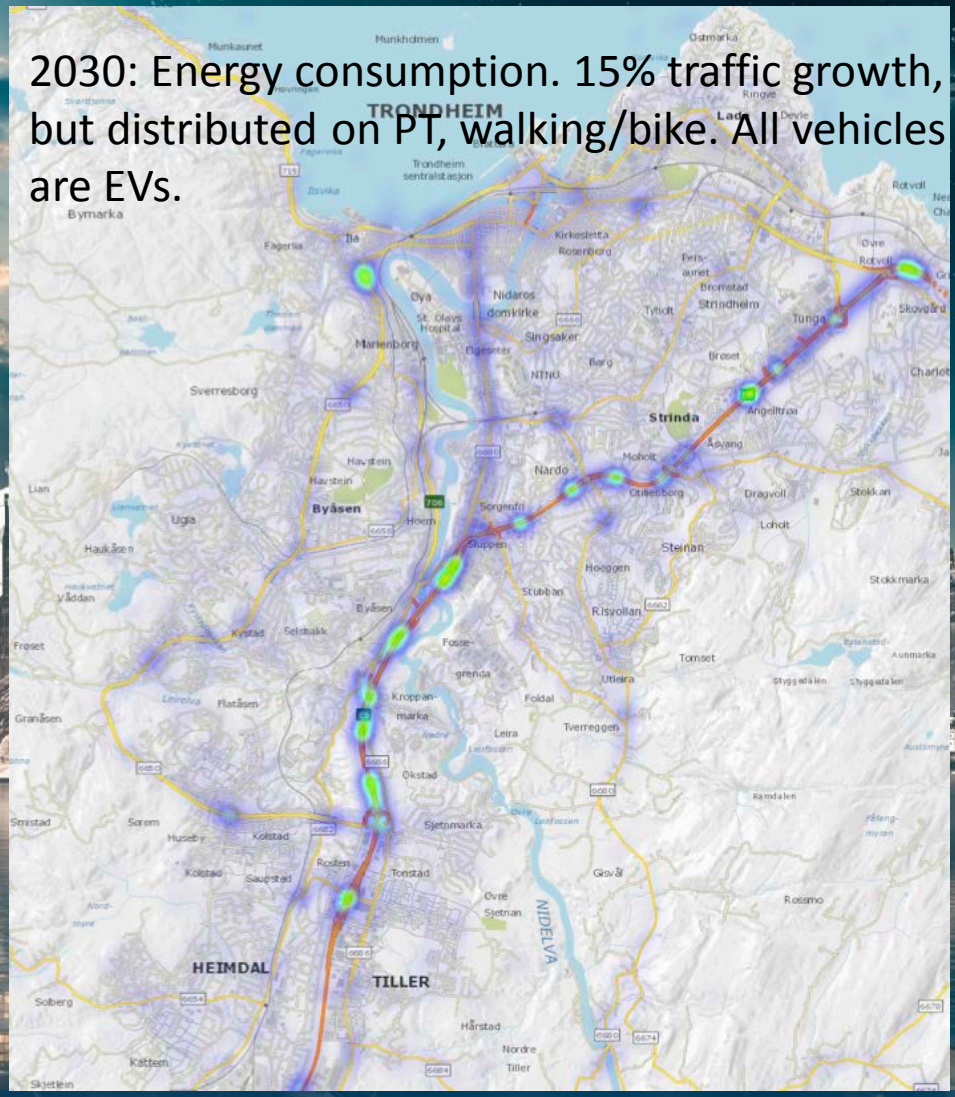


2030: Energy consumption. 15% traffic growth, but distributed on PT, walking/bike



What if there is no increase in "vehicle" traffic?





What if there is no increase in "vehicle" traffic, *and* all vehicles are electric?


What if..

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