

The Power of Simplicity

Ser : energy[®]

Methanol Fuel Cells

- DMFC – Direct Methanol
- SOFC – Solid Oxide
- RMFC – Reformed Methanol
 - LT PEM based
 - HT PEM based

SerEnergy – Fischer Group



SerEnergy

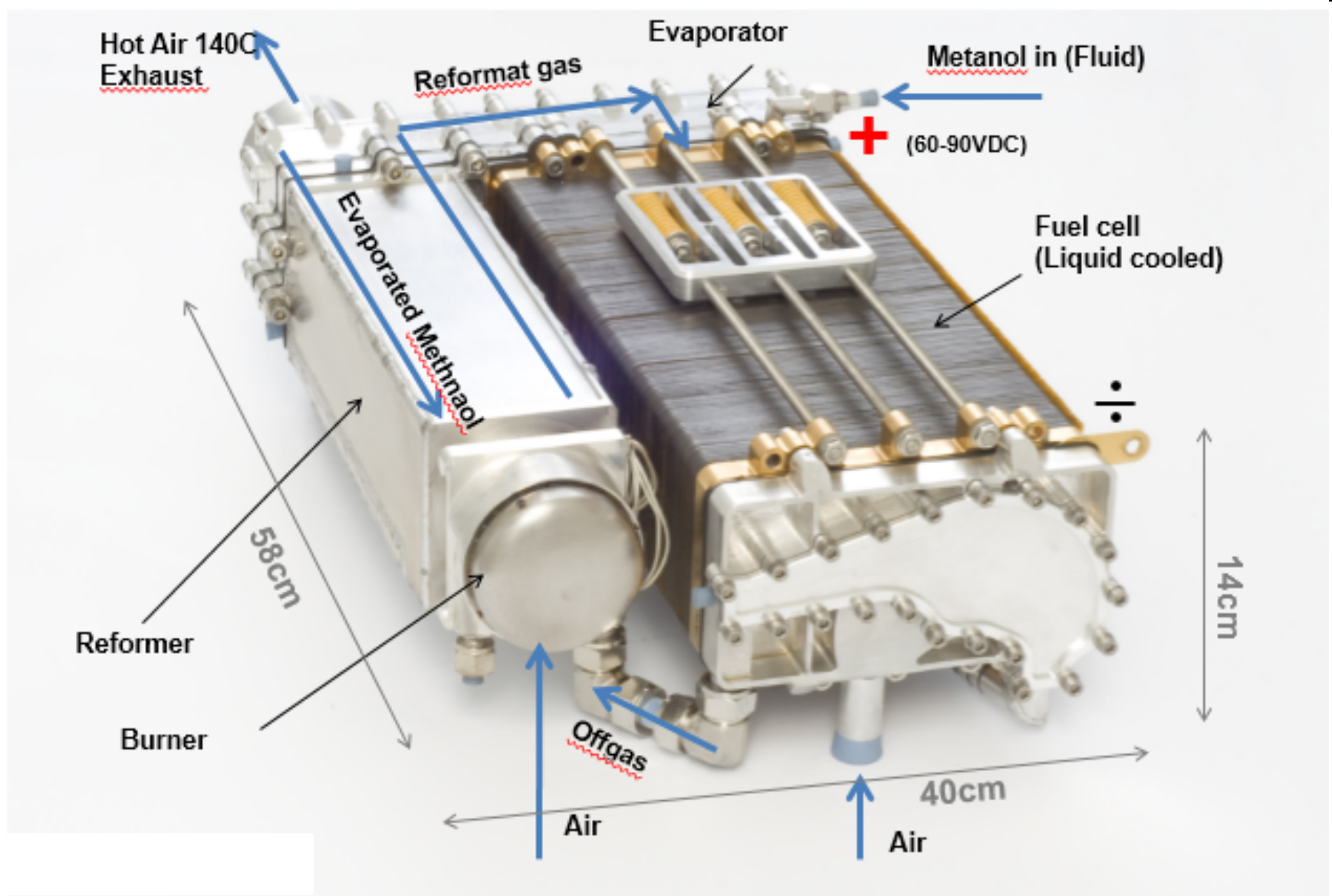
- 50 people
- Making it work

Fischer Group

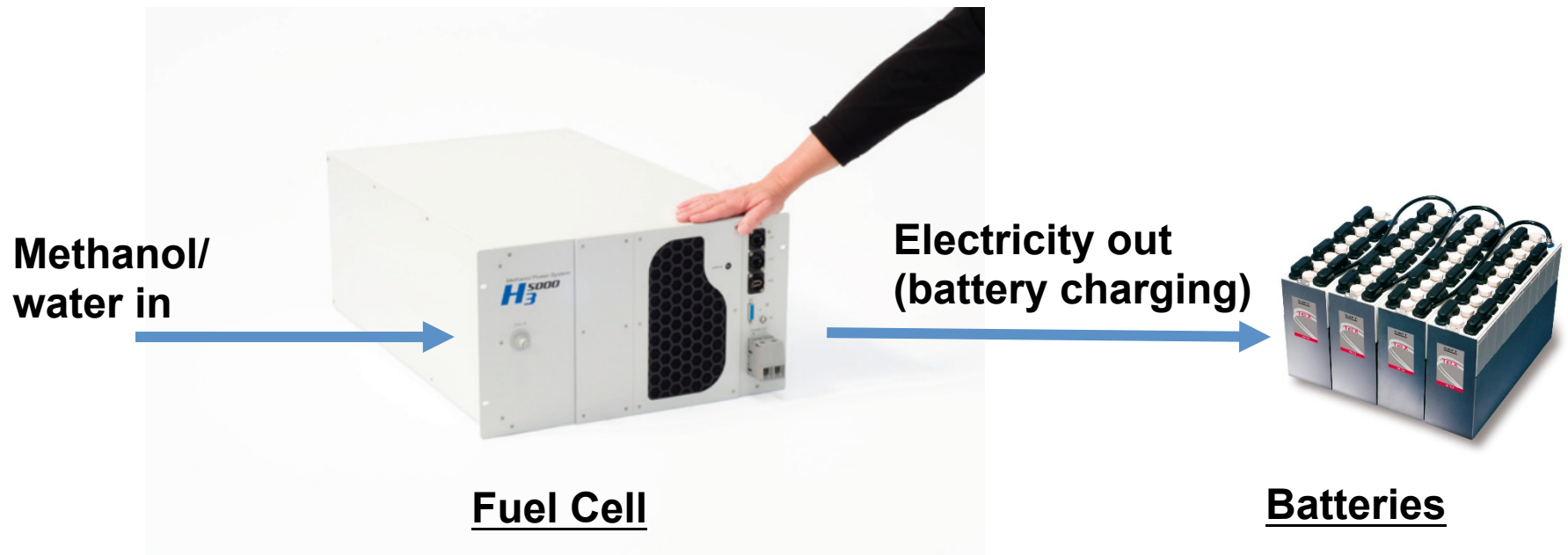
- 2000 people
- Making it big



Core engine



Product offering



- ✓ 50% fuel savings compared to Diesel engine
- ✓ 40-50% electrical efficiency
- ✓ No harmful emissions (NOX or particle)
- ✓ No (Low) noise (<62dB)

Markets

Diesel Genset replacement



EV range extension



H3-5000

5kW methanol module

- Electric power: 5kW
- Elec. efficiency(LHV): 40-50%
- Weight: 70kg
- Dimensions:
 - Width: 19"/430mm
 - Length: 700mm
 - Height (6U/253mm)
 - Volume: 77L
- DC/DC: integrated – bat charging capability
- Output voltages: 48/250/350/700 VDC
- Startup electric energy consumption: <0.2kWh
- Preheating time: ~30min
- Ambient temperature: -30 to 50C



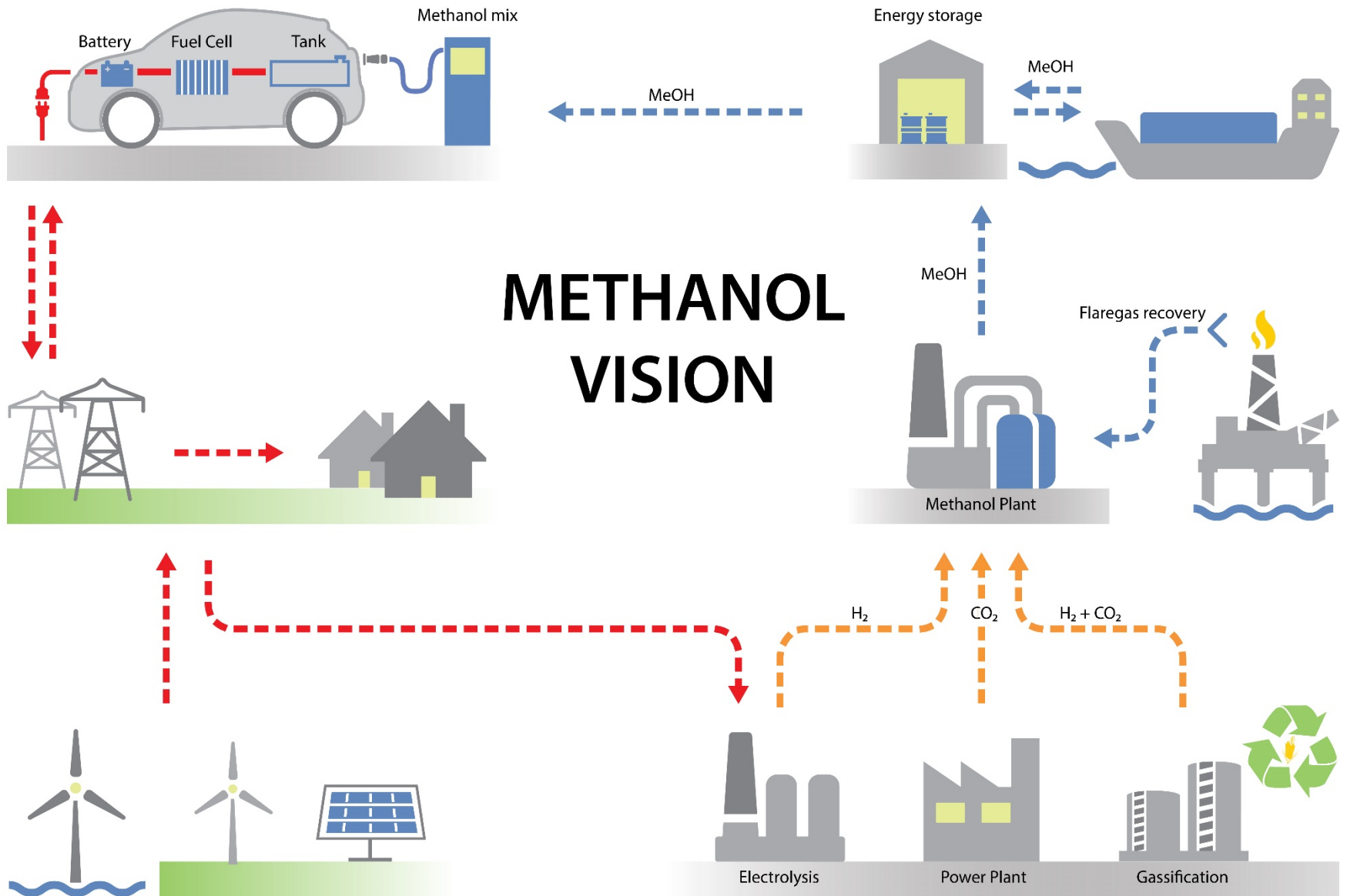
H3-rack

Telco Cabinet - Front

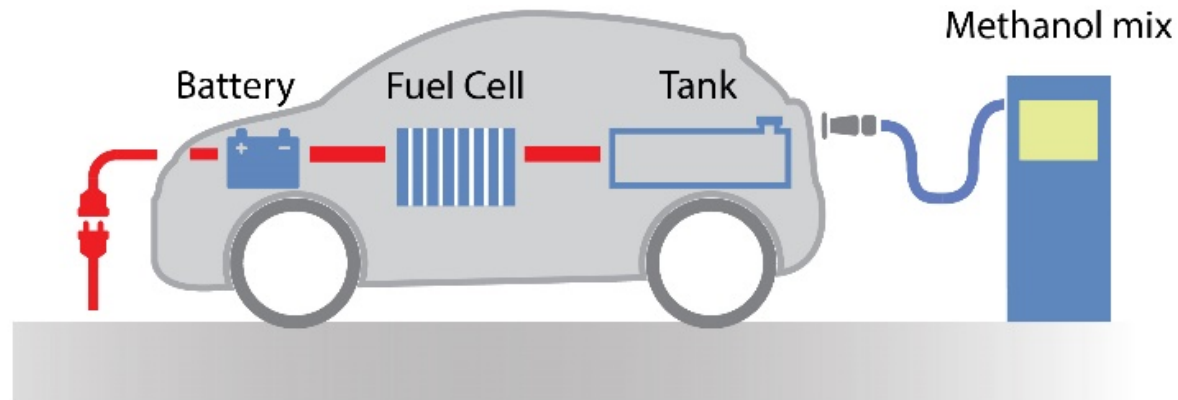
- 2.5/5 or 10 kW option
- Option for integrated 48V battery pack
- Integrated 250L fuel tank
- Integrated air and fuel filtration
- Integrated 3G modem for remote support and monitoring



Methanol vision



Methanol Fuel cell vehicle

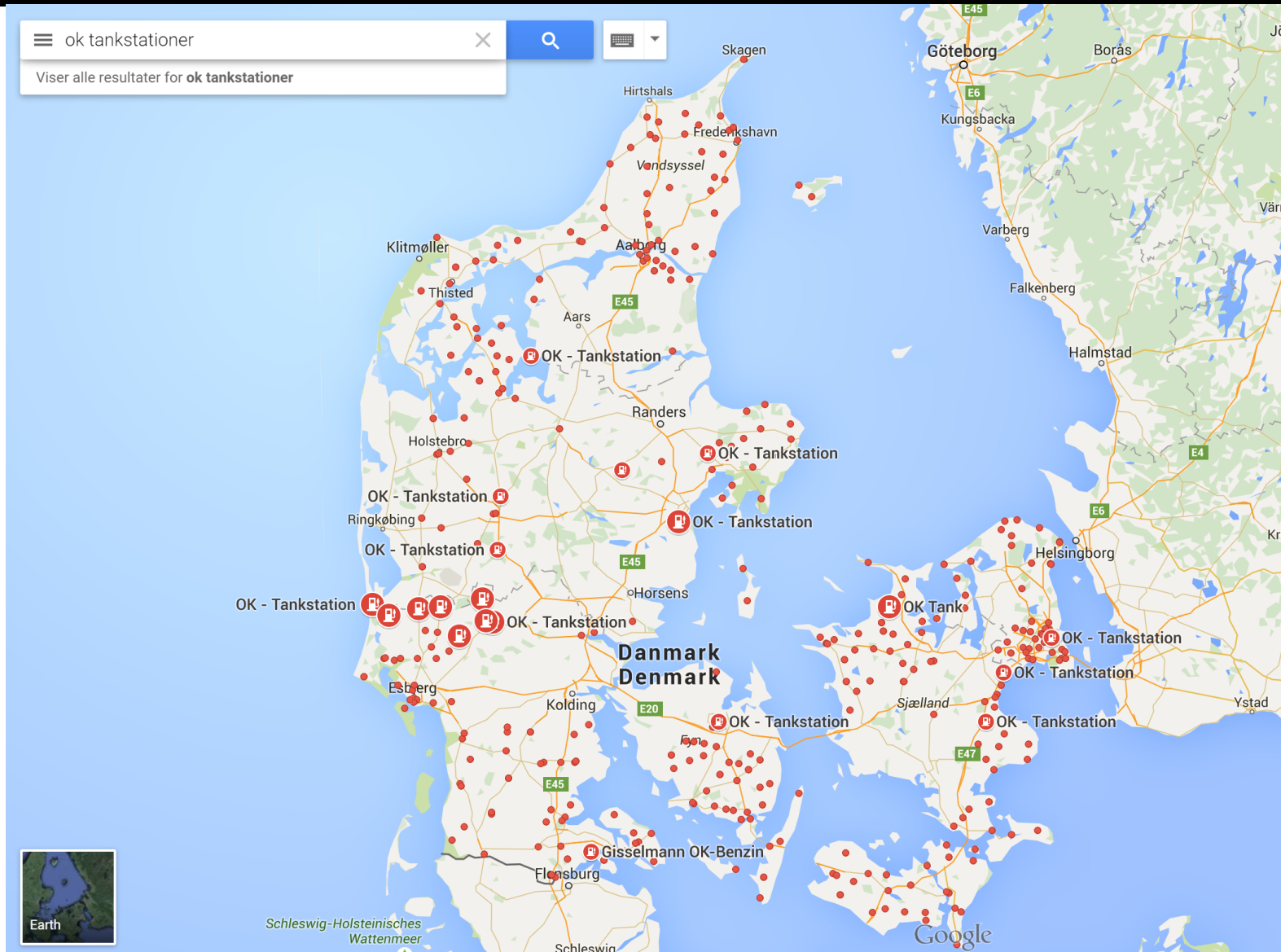


- Reduce battery to 30-50 km of range
- Implement liquid fuel tank
- Integrate heating system (cooling system)
- Adapt operation logic

Step 1



Infrastructure



Step 2



Step 3

Street cleaning vehicle

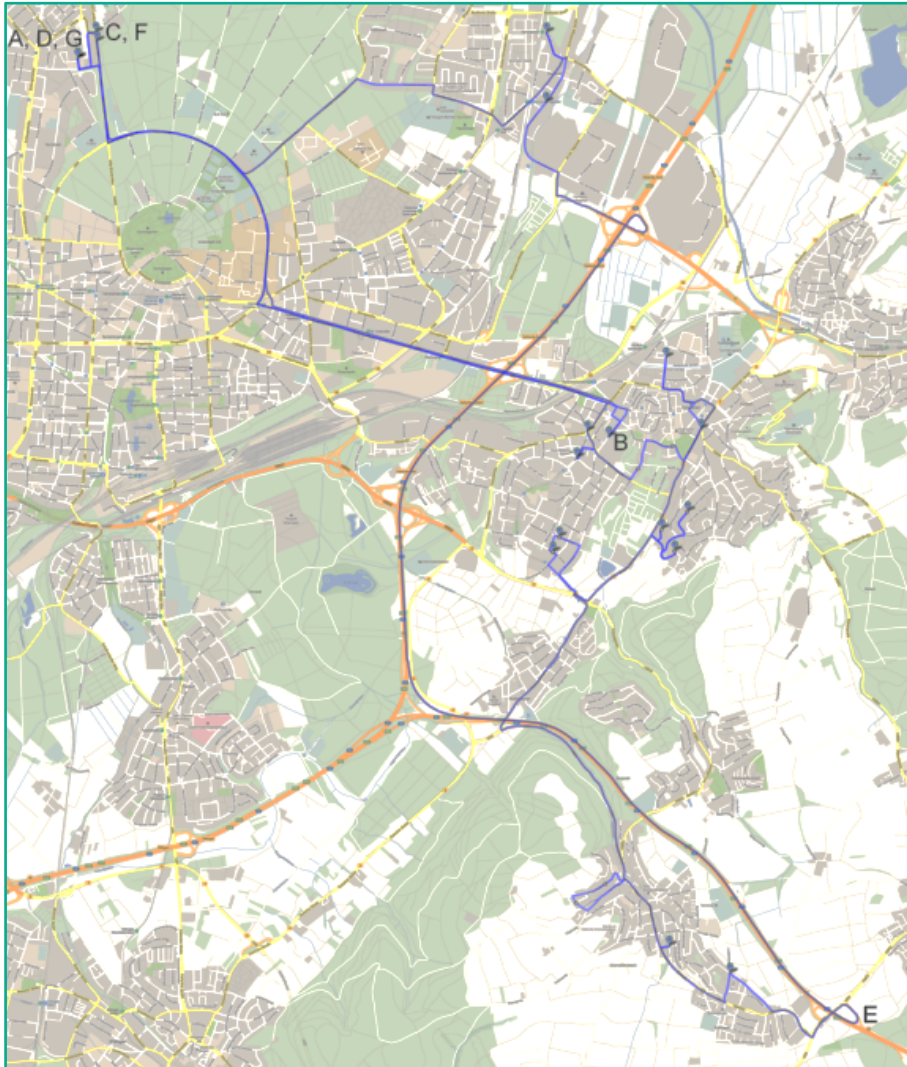
- Battery Methanol fuel cell hybrid
- Extended operation – full day shifts
- 70% Co2 reduction
- Zero particles



REM 2030



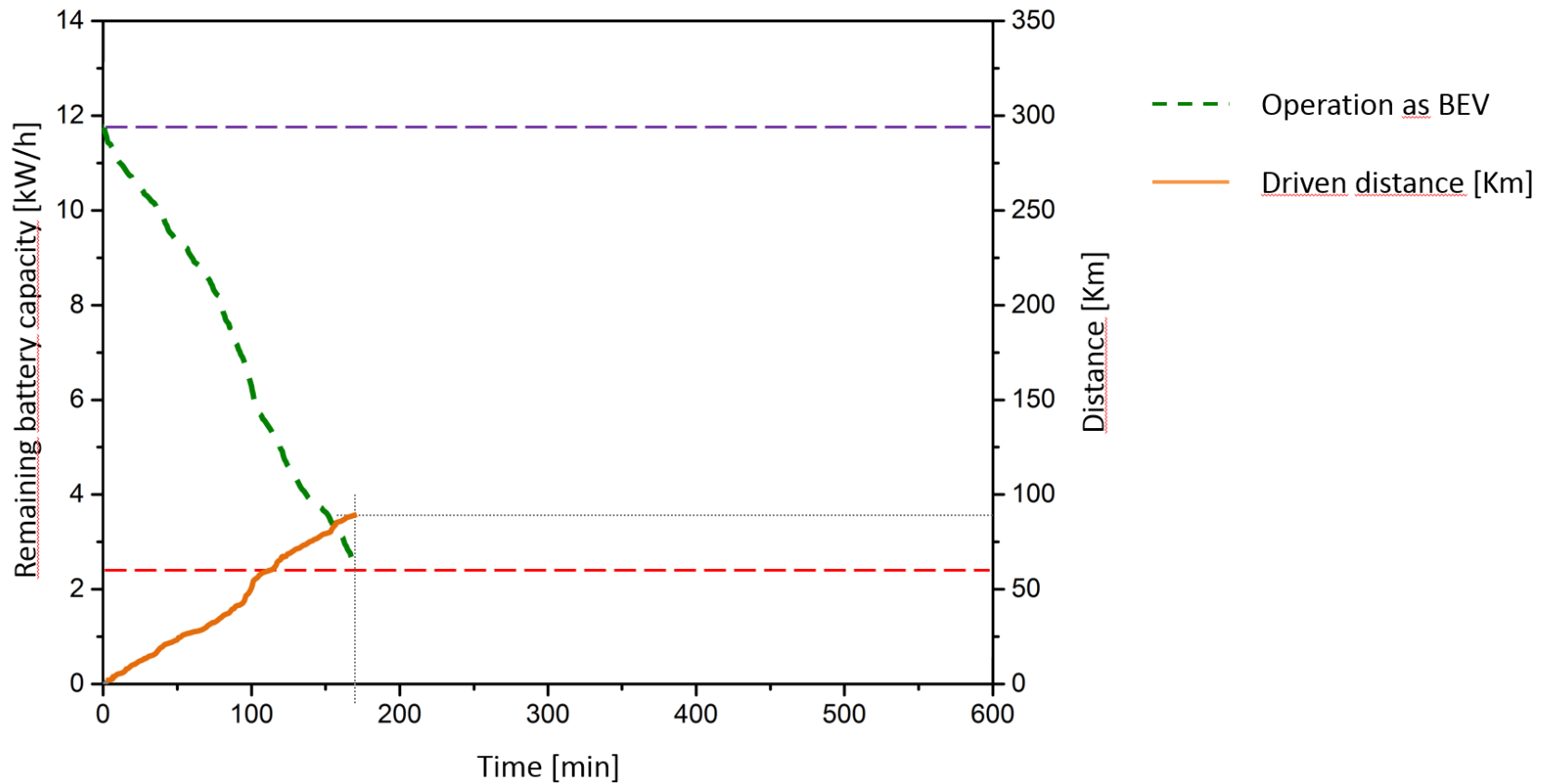
What does it take



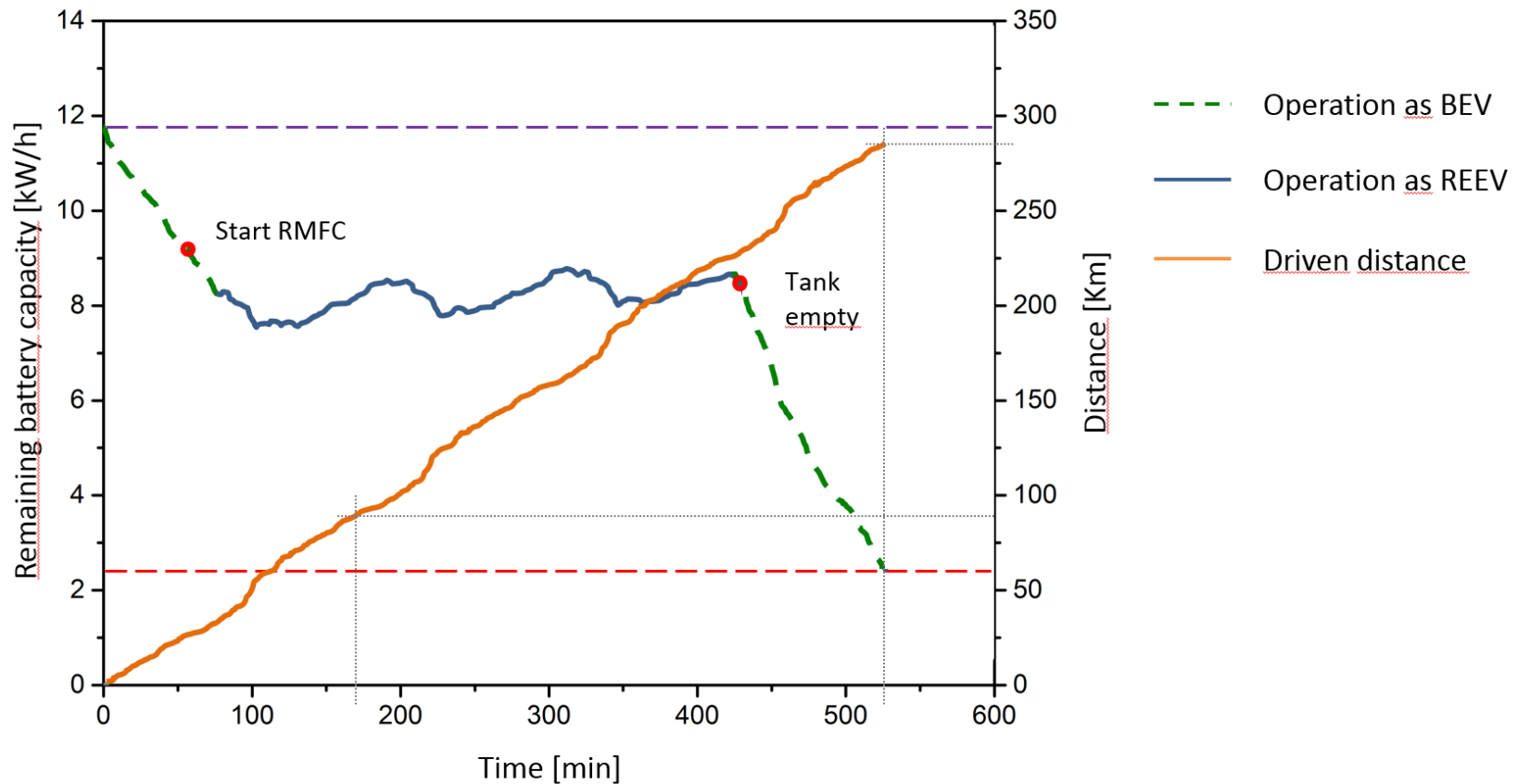
REM 2030 real urban and regional driving cycle

Length	67 km
Average speed	40 km/h
Maximum speed	120 km/h

Battery



With Range extender



Emission

- Tank-To-Wheel Emmission
 - Methanol : 40-60 gCo2/km
 - No particle emission
- Well-To-Wheel CO2 emission

Type	Current status	Green scenario
Diesel	132 g /km	100 g/km
Gasoline	176 g/km	123 g/km
Hybrid	142 g/km	80 g/km
Battery electric	98 g/km	2 g/km
Hydrogen	178 g/km	3 g/km
Methanol	83 g/km	2 g/km

*Source: Alternative drivetrains 2014 – Danish department of energy

Basic fuel economics

	Diesel	Gasoline	Methanol/water Today	Methanol/water Tomorrow
Raw price	4,46	4,55	1,51	1,51
Energy tax	2,66	4,14	2,66	0,70
Co2 tax	0,42	0,39	0,42	
Nox tax	0,047	0,043	0,047	
VAT	1,9	2,28	1,16	0,55
Pump price	9,587	11,40	5,79	2,75
Km/L	28	25	12,5	12,5
DKK/KM	0,33	0,45	0,46	0,22
Energy (kWh/L)	9,9	9,0	2,6	2,6

*Energy adjusted taxation = no diesel taxation of 40% water