The Gothenburg Path

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The Gothenburg case

- A typical average European city - but still very special
  - Half a million people
  - Heavy and light industries
  - Large port
  - Traffic problems
  - Universities
  - The city is set to expand

Gothenburg characteristics (steps 1 & 2)

- Recycled energy dominates the heating sector
- Recycled energy is being introduced to the transport sector
- The ”Gothenburg spirit” enables cooperation between business/municipality/academia
- Gothenburg has been an early mover – few low hanging fruits left

Many targets in place (step 3)

- Local level
  - Reduction of direct CO2 emissions
  - Ambitious building standards
  - Public transport
  - Regional growth
- National level
  - Fossil independent transport sector 2030
- EU Level
  - 20-20-20

Key actors and technologies (step 4 & 5)

- The City of Göteborg and its organisations
  - Owns and develops the district heating system
  - Biogas production and upgrading
  - Building standards
  - Public transport
- Industry
- Academia

Pathways and alternative scenarios (step 6)

Electrifying

–Short term: 1 €cent/kWh
–Mid term: Green electricity bigger than fossil fuels
–Long term: No fossil fuels

A major breakthrough in green power production

–Cheap electricity
–More electric applications (transport, heating/cooling)
–Less demand for fossil fuels
–No nuclear or CCS
–Biomass to chemicals
–Slow development of energy efficiency

Heat wave

–Short term: 500 €/ton
–Mid term: 500 €/ton
–Long term: No CO2 emissions

Dramatic climate change

–Biomass questioned
–CCS and nuclear grows fast
–Energy efficiency even faster
–Geopolitical consequences
–Changes in life style
–May lead to “Electrifying” or other revolutions

Business as usual

–1 % per year

Current trends continue without major disruptions

–Increasing prices of fossil fuels
–All RES are important
–Energy efficiency important
–Economic growth cancels out effects of higher energy prices
–CCS and/or Nuclear important ways of buying time
–Best scenario for Swedish/Gothenburg competetiveness

General conclusion thus far

- No shortage of targets
- No shortage of players
- No shortage of technology

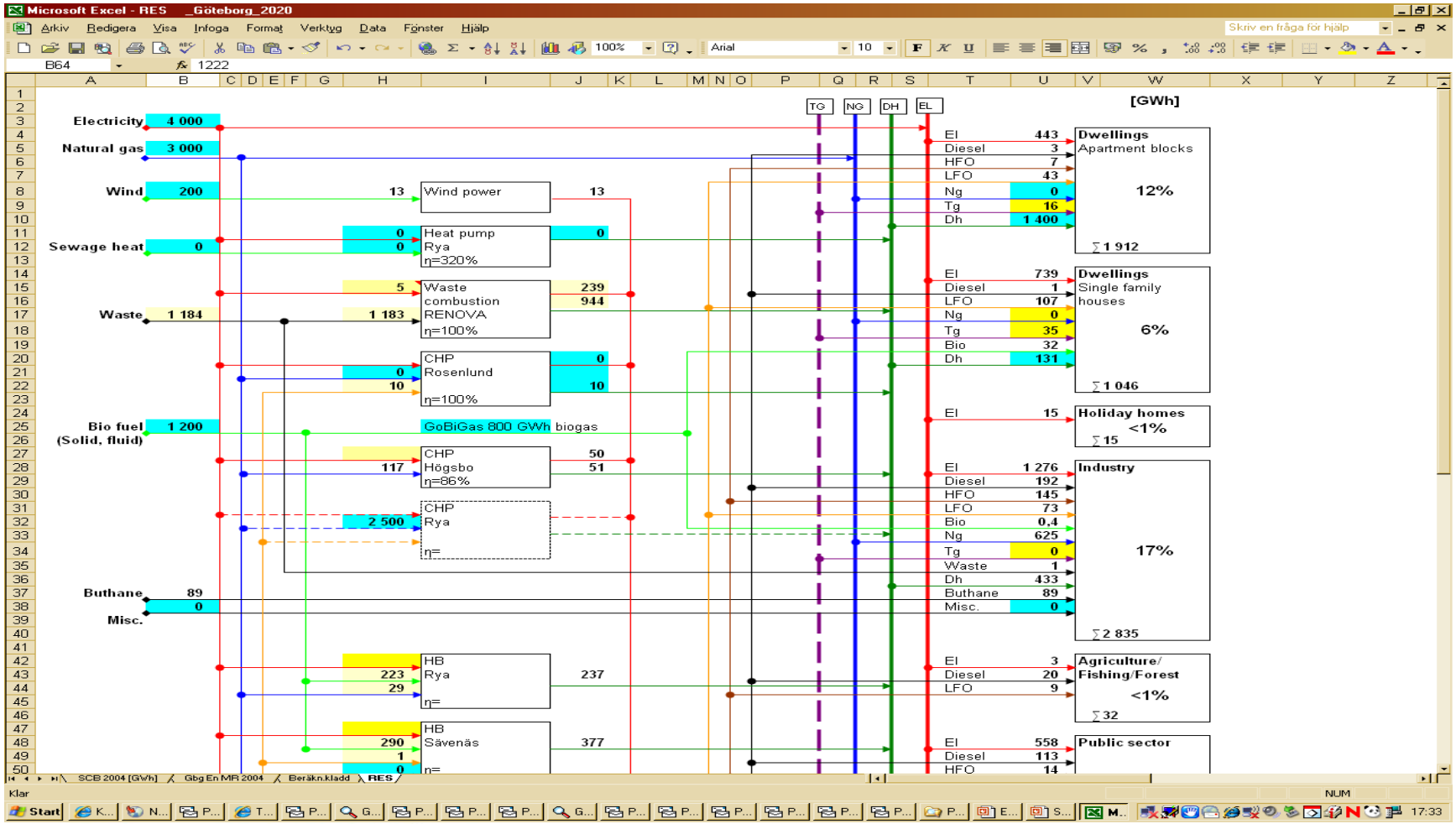
Gothenburg is actually already on its way towards sustainability, hence the name BAU for the chosen scenario. We just have to keep to the path.

So what do we do now?

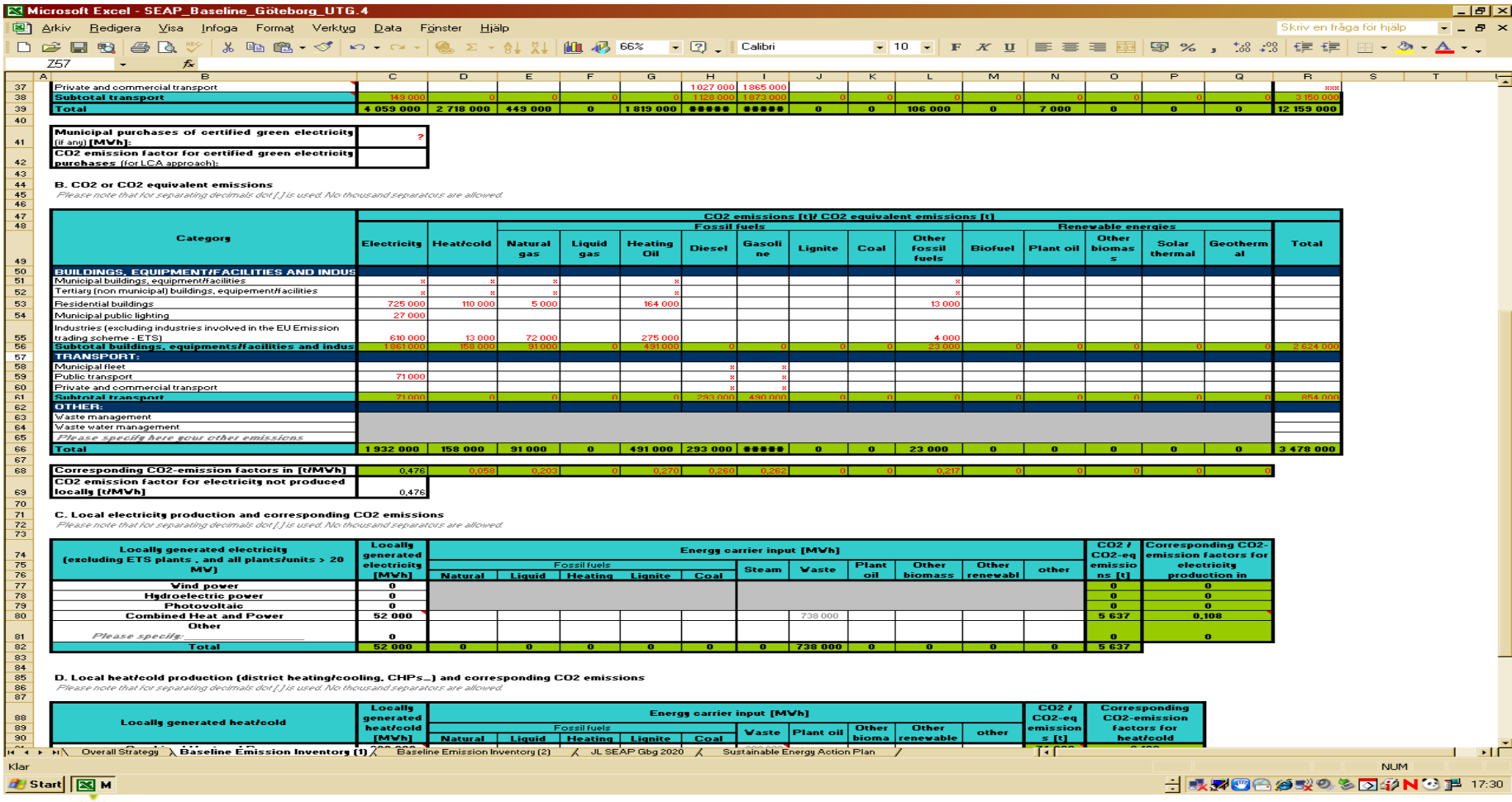
Enter Covenant of Mayors

- An opportunity to test the BAU hypothesis
- A real life test of the seven step method

Path to RES diagram structure



Covenant of Mayors template



Microsoft Excel - SEAP_Baseline_Göteborg_UTG.4

	Private and commercial transport						1 027 000	1 865 000									
	Subtotal transport	149 000	0	0	0	0	1 128 000	1 873 000	0	0	0	0	0	0	0	0	3 150 000
	Total	**4 059 000**	**2 718 000**	**449 000**	**0**	**1 819 000**	#####	#####	**0**	**0**	**106 000**	**0**	**7 000**	**0**	**0**	**0**	**12 159 000**

	Municipal purchases of certified green electricity (if any) **[MWh]:**	?
	CO2 emission factor for certified green electricity purchases (for LCA approach):	

B. CO2 or CO2 equivalent emissions

Please note that for separating decimals dot [.] is used. No thousand separators are allowed.

	Category	**CO2 emissions [t]/ CO2 equivalent emissions [t]**															
				Fossil fuels								**Renewable energies**					
		Electricity	**Heat/cold**	**Natural gas**	**Liquid gas**	**Heating Oil**	**Diesel**	**Gasoline**	**Lignite**	**Coal**	**Other fossil fuels**	**Biofuel**	**Plant oil**	**Other biomass**	**Solar thermal**	**Geothermal**	**Total**
	BUILDINGS, EQUIPMENT/FACILITIES AND INDUS																
	Municipal buildings, equipment/facilities	x	x	x		x					x						
	Tertiary (non municipal) buildings, equipement/facilities	x	x	x		x					x						
	Residential buildings	725 000	110 000	5 000		164 000					13 000						
	Municipal public lighting	27 000															
	Industries (excluding industries involved in the EU Emission trading scheme - ETS)	610 000	13 000	72 000		275 000					4 000						
	Subtotal buildings, equipments/facilities and indus	1 361 000	158 000	91 000	0	491 000	0	0	0	0	23 000	0	0	0	0	0	2 624 000
	TRANSPORT:																
	Municipal fleet						x	x									
	Public transport	71 000					x	x									
	Private and commercial transport						x	x									
	Subtotal transport	71 000	0	0	0	0	293 000	490 000	0	0	0	0	0	0	0	0	854 000
	OTHER:																
	Waste management																
	Waste water management																
	Please specify here your other emissions																
	Total	**1 932 000**	**158 000**	**91 000**	**0**	**491 000**	**293 000**	#####	**0**	**0**	**23 000**	**0**	**0**	**0**	**0**	**0**	**3 478 000**

	Corresponding CO2-emission factors in [t/MWh]	0,476	0,058	0,203	0	0,270	0,280	0,262	0	0	0,217	0	0	0	0	0	
	CO2 emission factor for electricity not produced locally [t/MWh]	0,476															

C. Local electricity production and corresponding CO2 emissions

Please note that for separating decimals dot [.] is used. No thousand separators are allowed.

	Locally generated electricity (excluding ETS plants , and all plants/units > 20 MW)	**Locally generated electricity [MWh]**	**Energy carrier input [MWh]**											**CO2 / CO2-eq emissions [t]**	**Corresponding CO2-emission factors for electricity production in**
			Fossil fuels					**Steam**	**Waste**	**Plant oil**	**Other biomass**	**Other renewabl**	**other**		
			Natural	**Liquid**	**Heating**	**Lignite**	**Coal**								
	Wind power	0												0	0
	Hydroelectric power	0												0	0
	Photovoltaic	0												0	0
	Combined Heat and Power	52 000							738 000					5 637	0,108
	Other *Please specify:*	0												0	0
	Total	**52 000**	**0**	**0**	**0**	**0**	**0**	**0**	**738 000**	**0**	**0**	**0**	**0**	**5 637**	

D. Local heat/cold production (district heating/cooling, CHPs...) and corresponding CO2 emissions

Please note that for separating decimals dot [.] is used. No thousand separators are allowed.

	Locally generated heat/cold	**Locally generated heat/cold [MWh]**	**Energy carrier input [MWh]**										**CO2 / CO2-eq emissions [t]**	**Corresponding CO2-emission factors for heat/cold**
			Fossil fuels					**Waste**	**Plant oil**	**Other bioma**	**Other renewable**	**other**		
			Natural	**Liquid**	**Heating**	**Lignite**	**Coal**							

Overall Strategy | Baseline Emission Inventory (1) | Baseline Emission Inventory (2) | JL SEAP Gbg 2020 | Sustainable Energy Action Plan

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Conclusions

- The seven steps method is valid
- The chosen pathway is compatible with the CoM commitment
- The choices of system boundaries has a paramount influence of the results (emission factor for electricity, ETS, geographical boundaries)

- It doesn't help to be an early mover!

Questions, comments:

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