Copenhagen January 2022

Project proposals by Niels Hansen, Technical Director at Future Energy,

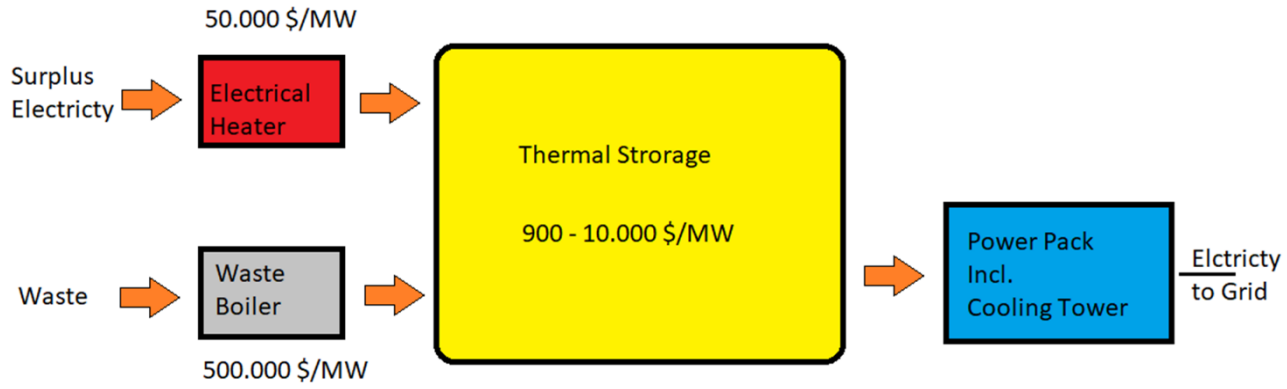
for improving the infrastructure (water, sewer, electricity, internet, and transport) in Lebanon

Private enterprise and cooperatives:

In connection with the realization of these projects, efforts will be made to establish a strong foothold among the local population by aiming for a large degree of local business and employment around the development initiatives. Efforts will be made for an ongoing process for creating businesses in Lebanon, around engineering businesses. Developed around actual production of parts for e.g. the power plants, the thermal storage, and the entire dual mode transport system is thought to be produced in Lebanon. Services and productions which in the end provides a basis for export. A goal will be that, as much as possible will be done locally in Lebanon in collaboration with large companies such as MAN-es, Maersk, Airbus (dual mode system) and Yara which together will give rise to a high degree of solidity and transparency.

Power plants with thermal storage for battery performance:

Power plants with thermal storage which can operate a city in an off-grid state see.



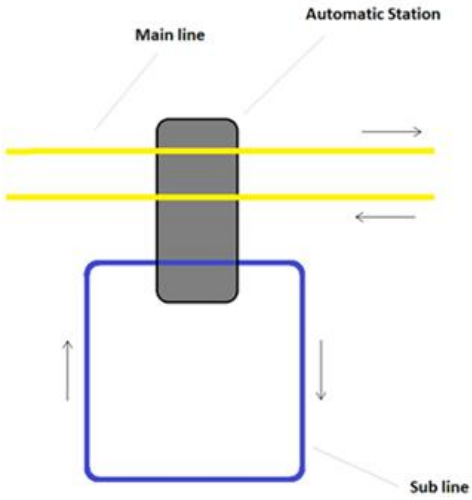
A plant can in interaction with wind and solar supply the entire city with all the electricity needed.

The storage fully developed by Yara, the price can come down and maybe as low as 900 $/MWh. And a battery capacity for supplying for a week or more will then be achievable. The total cost for the battery/power plant service for a larger city (>50,000 inhabitants) will be between 1-2 cents/KWh, and this will be realistic (a fraction of lithium batteries). And with electricity from turbines and solar parks at 2 - 3 cents/KWh, then the total electricity price from the overall system will be less than 5 cents/KWh.

Dual Mode Transport system where the rail is used to distribute water, electricity, sewer, and internet:

University of Washington: the Benefit of the Dual Mode Transportation System See Link The Danish Technical University (DTU) and Palle Jensen's Dual Mode RUF-system see Link The Cabin dual mode bicycle system se Link

Princip in the system for a city like Beirut, which is an issue here see



A main line with driving in 2 directions and connected to many sublines which run in circles and passengers is moved from and to the main line. A passenger sits on a tray or chair and is automatically moved between headlines and underlines. At terminals, passengers are quickly moved automatically from and to the carriages, so the stopping time for the carriages is down to a few seconds..

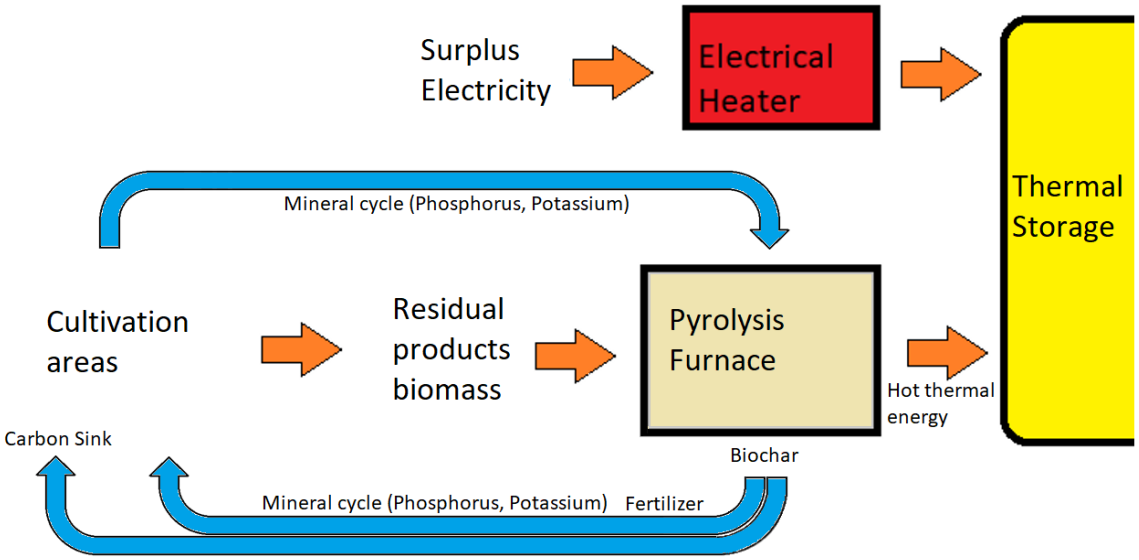
When the system is laid out for a city, electricity, internet, water, and sewage are conveyed in the rail. There is great expertise at DTU in Copenhagen to develop such a dual mode system.

A price as low as 500,000 $/km rail is possible, when the plant is developed and made locally.

Pyrolysis from biomass for recycling minerals from cultivation land along with a negative CO2 footprint:

Frichs Pyrolysis see Link and a very informative video around the subject see Link

The mineral and carbon cycle around the pyrolysis furnace in interaction with the power plant see



Residual products from agricultural cultivation are burned in the pyrolysis furnace and the minerals are returned to the cultivation soil via the biochar. 30 - 40% of the carbon in e.g. straw ends up as soil-improving carbon for the soil. 1 ton of straw will normally provide 4 MWh of energy and 1.5 ton of CO2. Now only 2.5 MWh of energy is released for the thermal storage and carbon from 600 kg of CO2 is stored in the soil through the biochar and 900 kg of CO2 is released into the atmosphere. Via the photosynthesis that takes place during the cultivation in the fields, 600 kg of CO2 has now actually been extracted from the atmosphere and storage in the cultivation areas - or real carbon capture and storage cycle.

When the power plant together with the turbines supply electricity to the region then there will become a negative co2-footprint, when large amounts of carbon are stored in the cultivation soil. Enormous amounts of carbon can be stored in the cultivation soil.

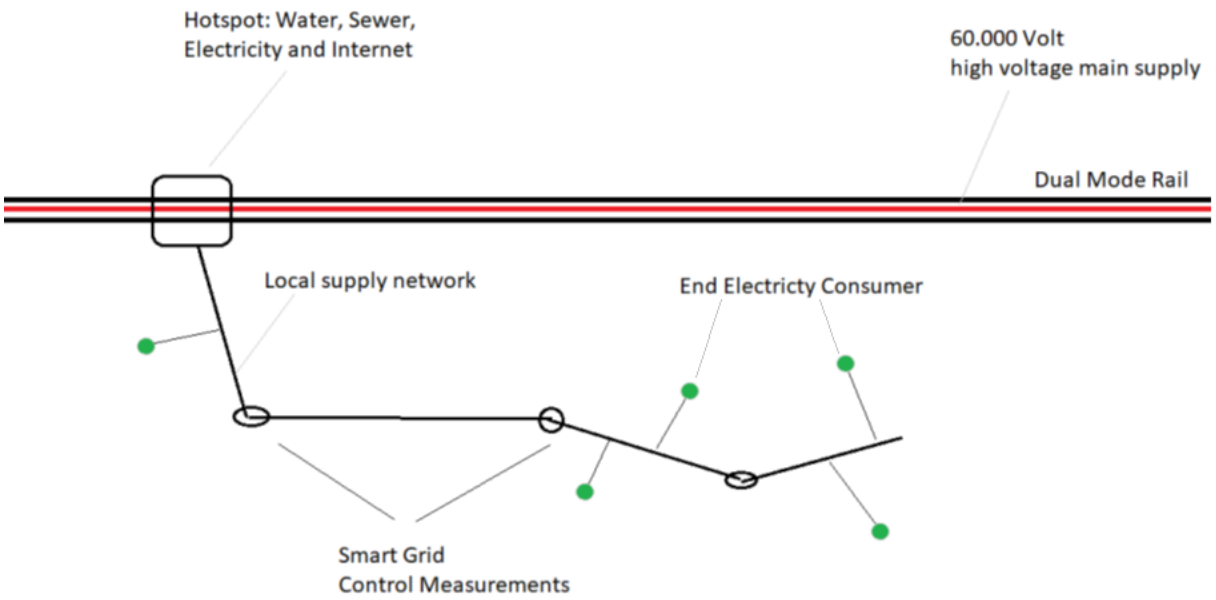
And agriculture can 100% farm the fields with 'locally' produced fertilizer.

Smart Grid together with locally based ownership:

Smart grid systems will be developed that perform the normal performance of planning consumption according to RE production, and also especially in a way where consumption is minimized when power plants produce electricity.

And a high degree of local ingenuity and production and development of the electronic components becomes necessary when the full potential of smart grid system is to be achieved.

This could be a solution for a district in Beirut with 500 - 1000 households. A 'hotspot' in connection with the Dual Mode rail, where there can be connection to water, sewer, internet, and electricity see



A cooperative owned by the local homeowners, owns the electricity grid in the District, and the smart grid system can, in interaction with the buildings' smart grid
units and measuring points in the electricity grid, quickly determine whether electricity is being stolen and were. AND the ownership of the grid, the continuous control function from the smart grid system, and local ownership and thereby responsibility will ensure that no electricity is stolen.