

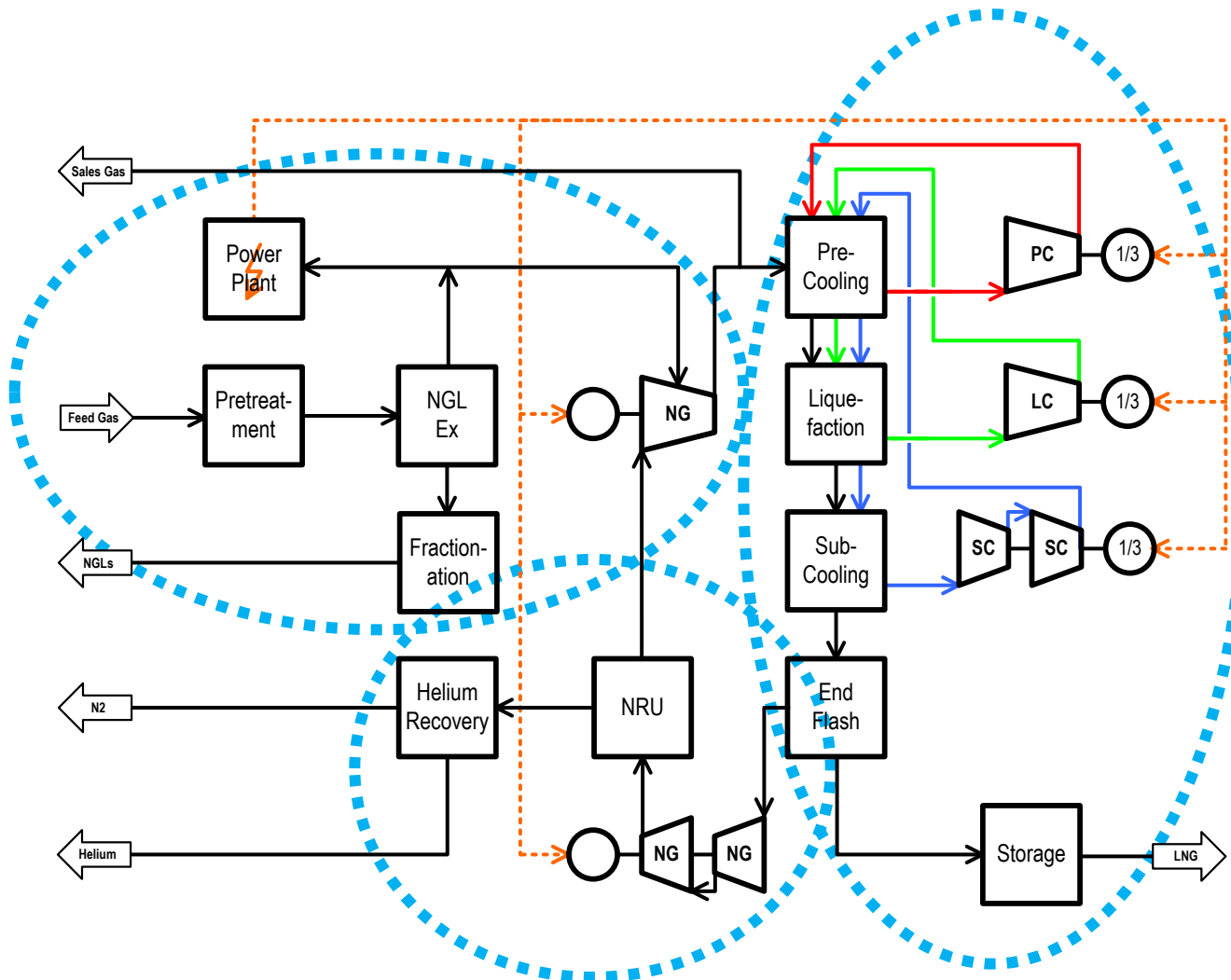
# Natural Gas Liquefaction Technology for Land Based and Floating LNG Facilities

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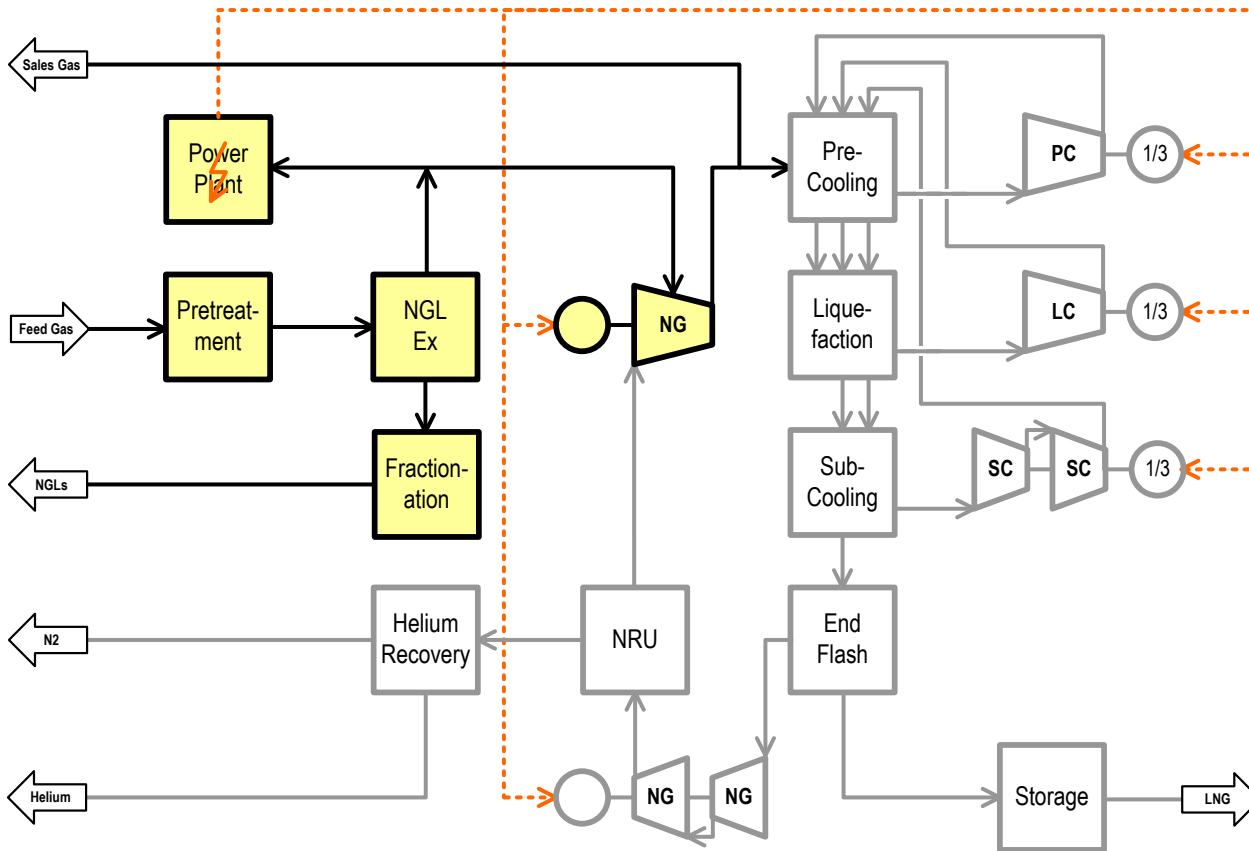
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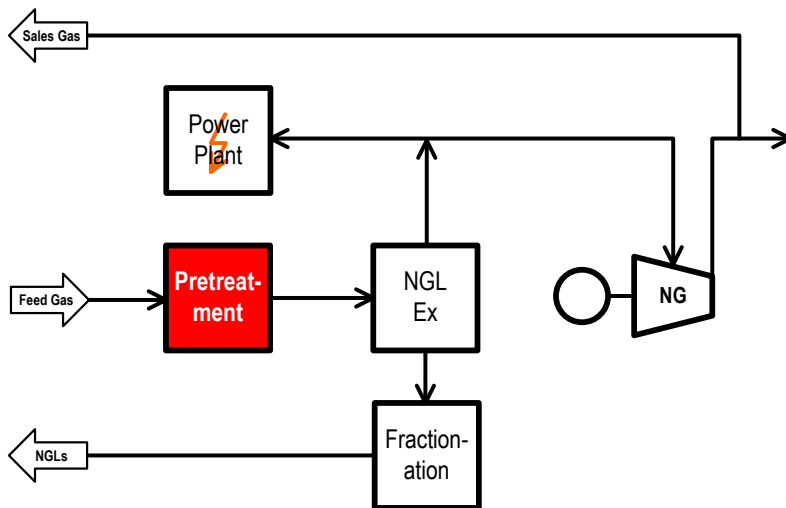
## Main Process Groups

- Pretreatment  
NGL Extraction  
Fuel Gas System
- Liquefaction  
End Flash  
Storage
- Light Ends  
Handling



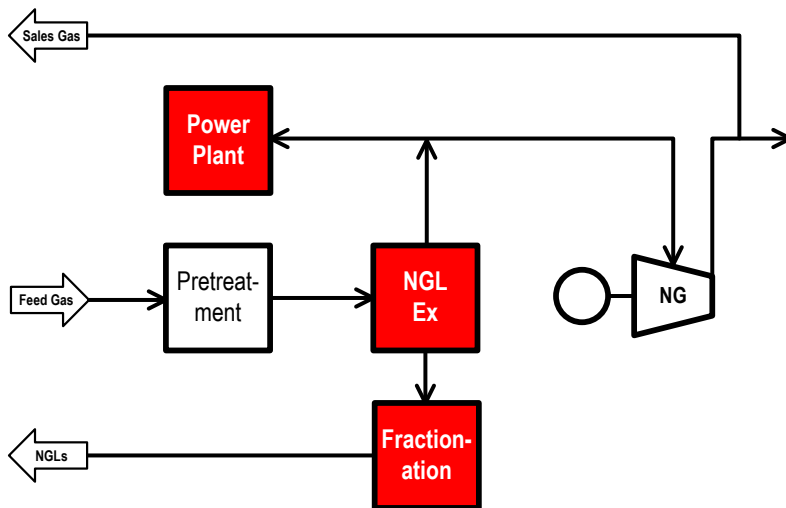
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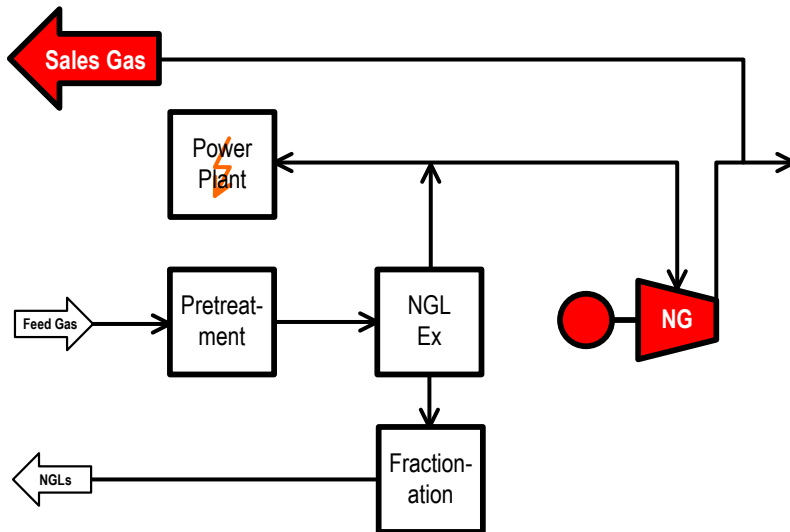
## Hg Adsorber

- new adsorbent based on metal sulphides instead of activated carbon
- metal sulphides on zeolitic base material tolerate water
- recommended location upstream of amine system
- protects not only equipment, but also people (e.g. during maintenance of amine and dehydration systems)



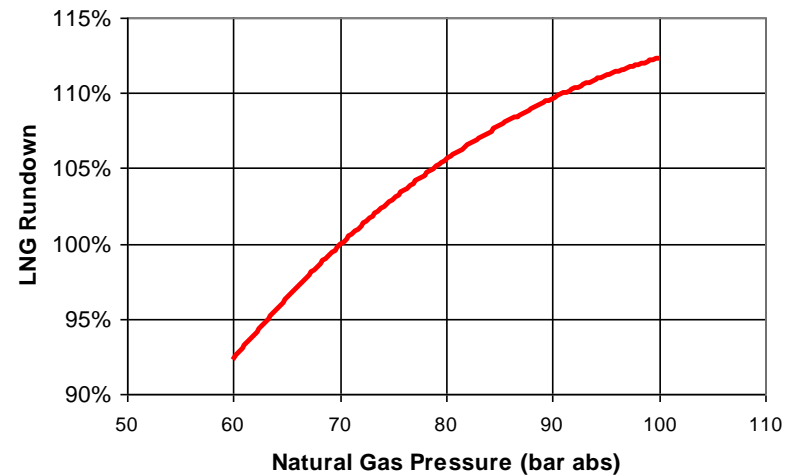
## Ethane and/or LPG Extraction

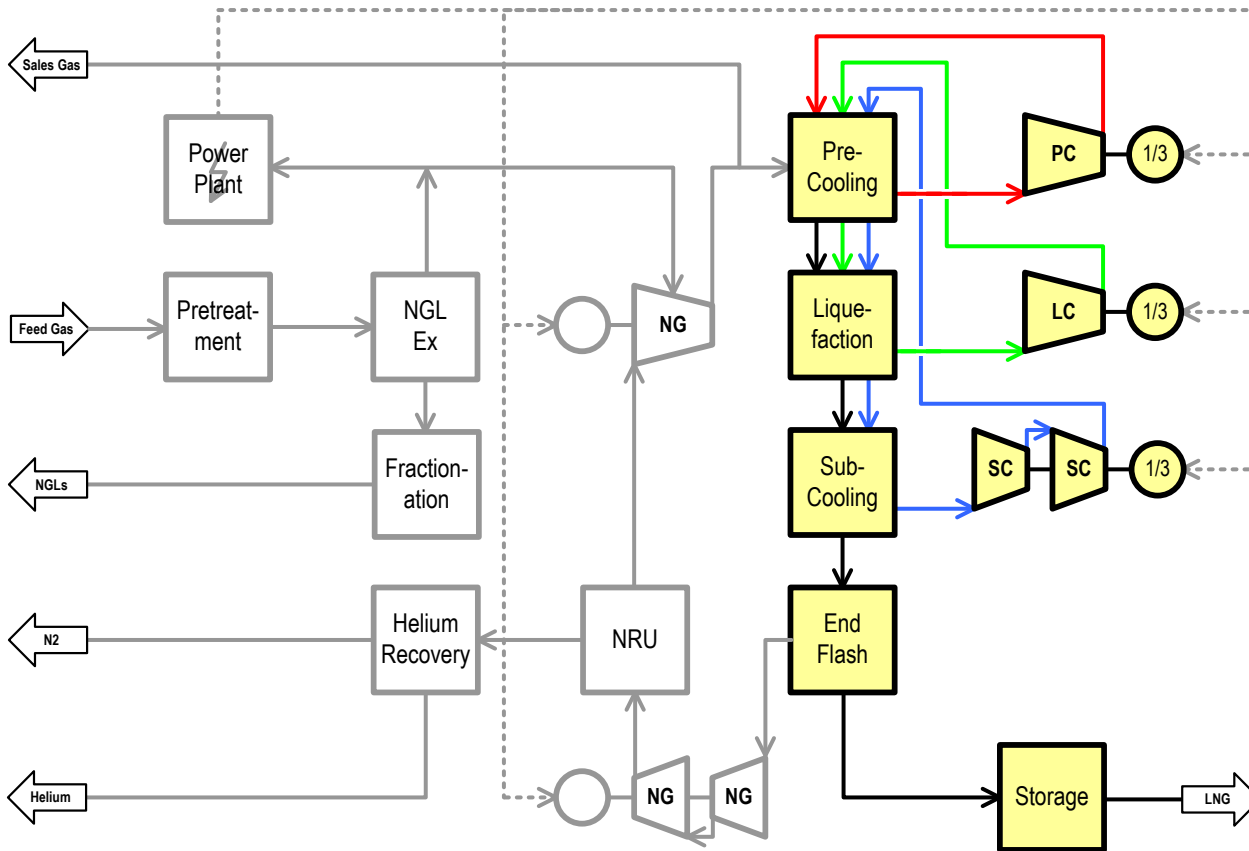
- efficient and deep recovery of NGL's requires advanced process concepts, as they are known from natural gas processing
- a scrub column design extracts too much unwanted methane
- a demethanizer or deethanizer limits the operating pressure to 30-35 bar
- lean natural gas downstream NGL extraction is a perfect fuel for gas turbines (end flash handling will be discussed later)



## Lean Gas Compression

- export of sales gas can be integrated easily
- efficiency of natural gas liquefaction system can be increased significantly

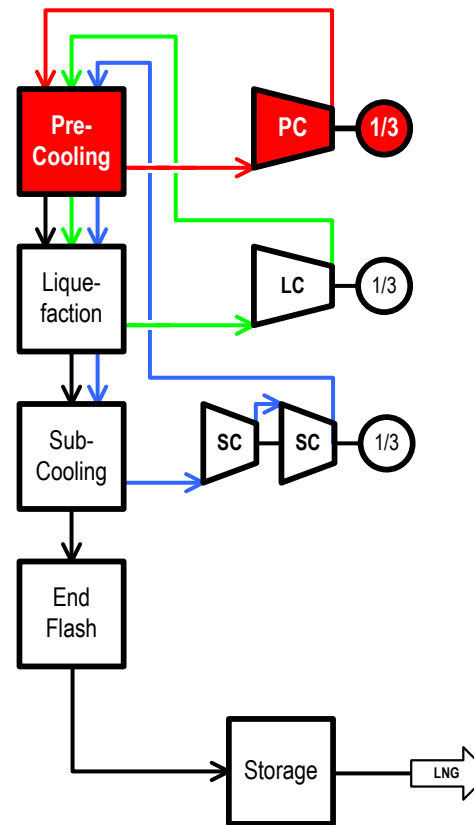
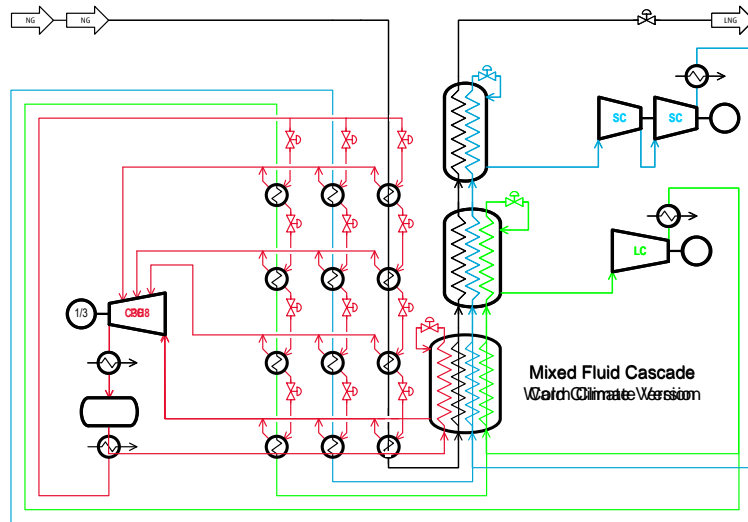




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# Natural Gas Liquefaction

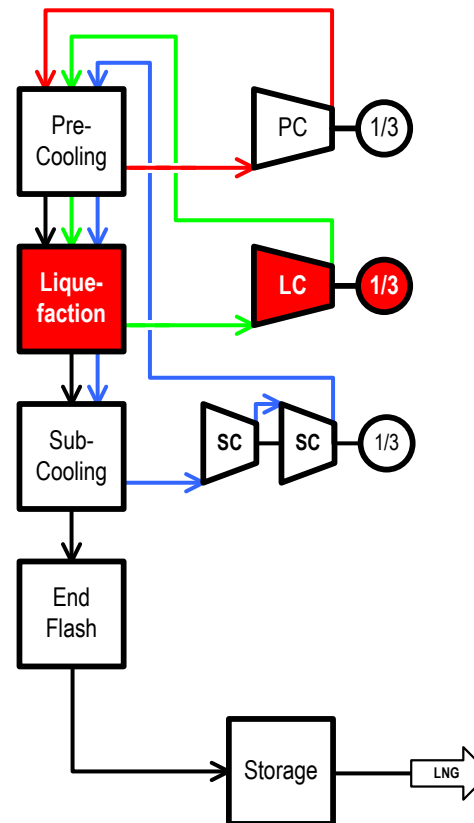
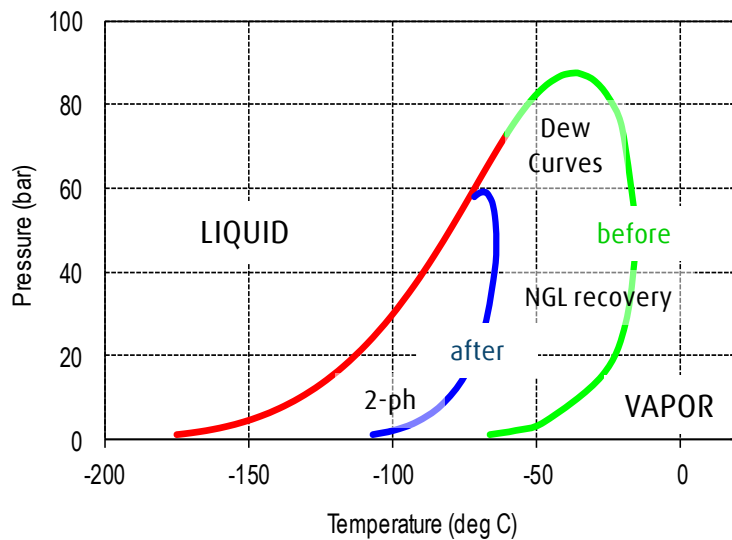


## Precooling

- multi stage propane precooling is the best choice in a warm or in a moderate climate
- cold climate favors a mixed refrigerant precooling systems to achieve balanced refrigeration compressor loads



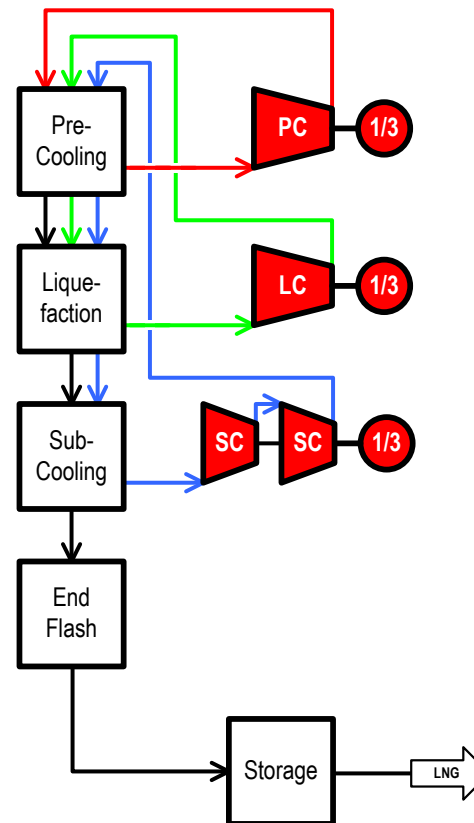
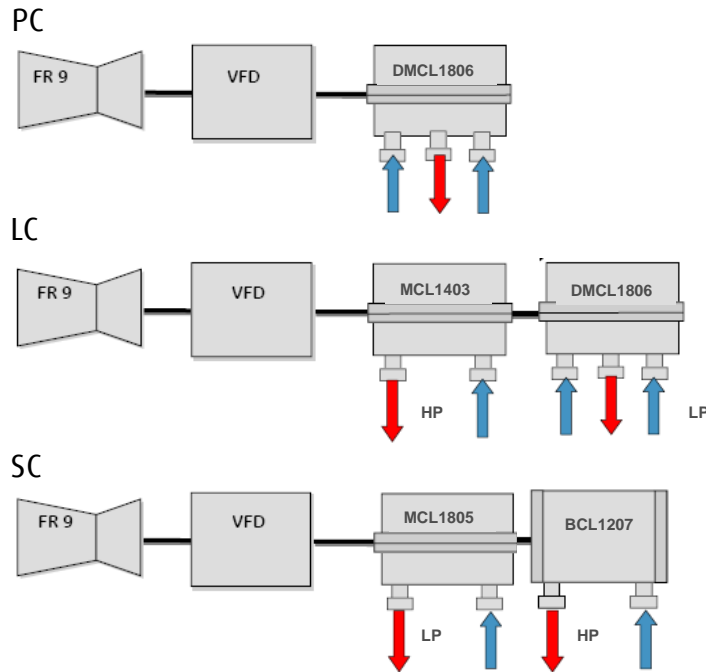
# Natural Gas Liquefaction



## Liquefaction

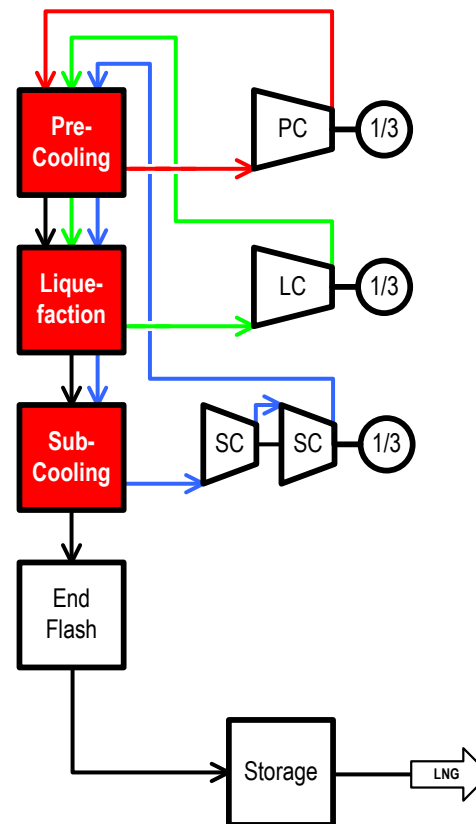
- if NGL's have been recovered and
- if the operating pressure is sufficiently high (>80 bar),
- 2-phase conditions can be avoided during 'liquefaction'
- improved start-up and turn-down operation

# Natural Gas Liquefaction



## Load Balancing

- if NGL's are recovered before liquefaction and
- if 2-phase conditions during 'liquefaction' are avoided,
- a perfect load balance between the refrigeration compressors can be achieved

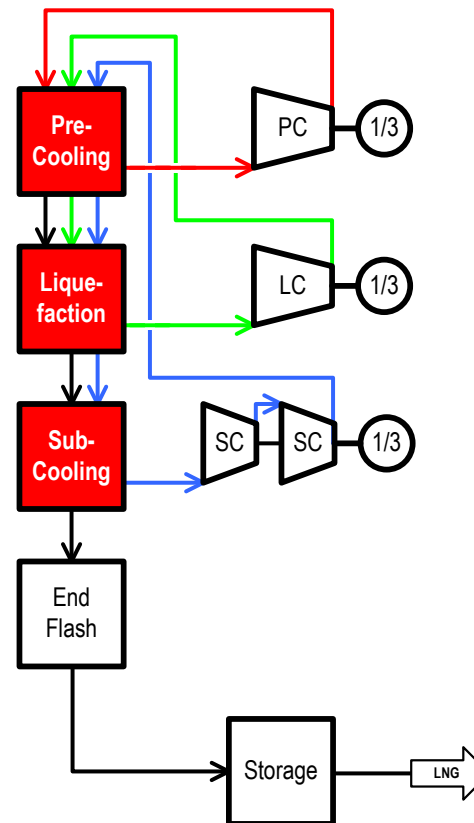


## Coil Wound Heat Exchangers

- tested in the lab under motion

# Natural Gas Liquefaction

Mid Scale LNG Plant (0.3 mtpa)  
all SS 3-bundle CWHE  
Stavanger /Norway



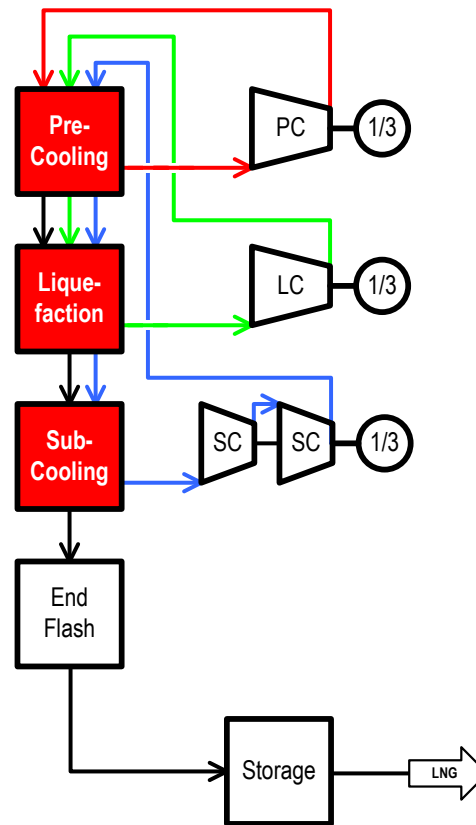
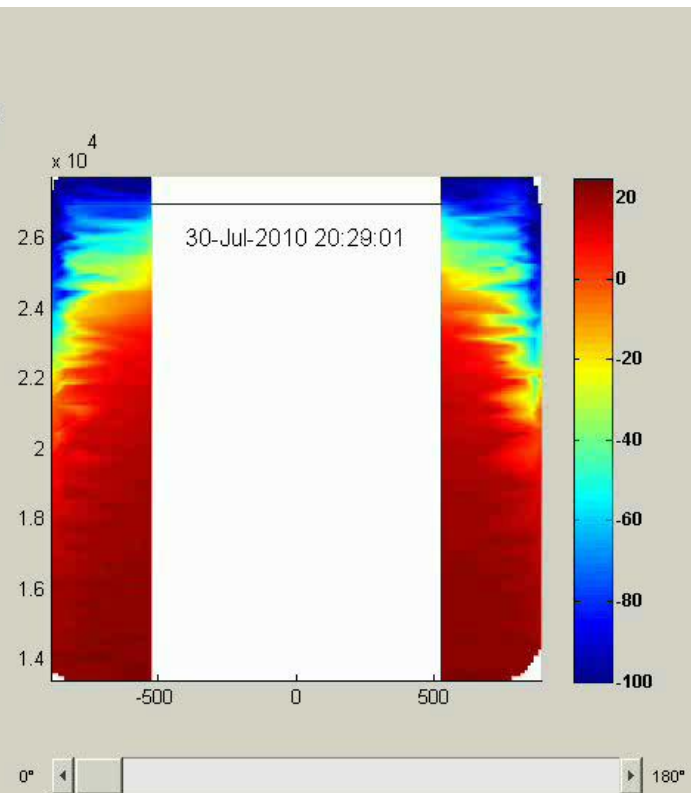
## Coil Wound Heat Exchangers

- tested in the lab under motion
- optional design in all stainless steel (shell and bundle)

# Natural Gas Liquefaction

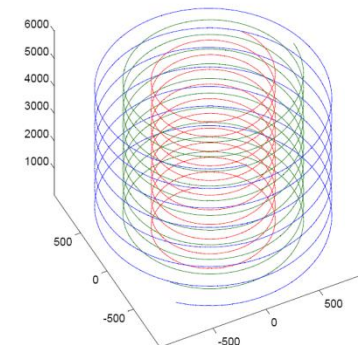


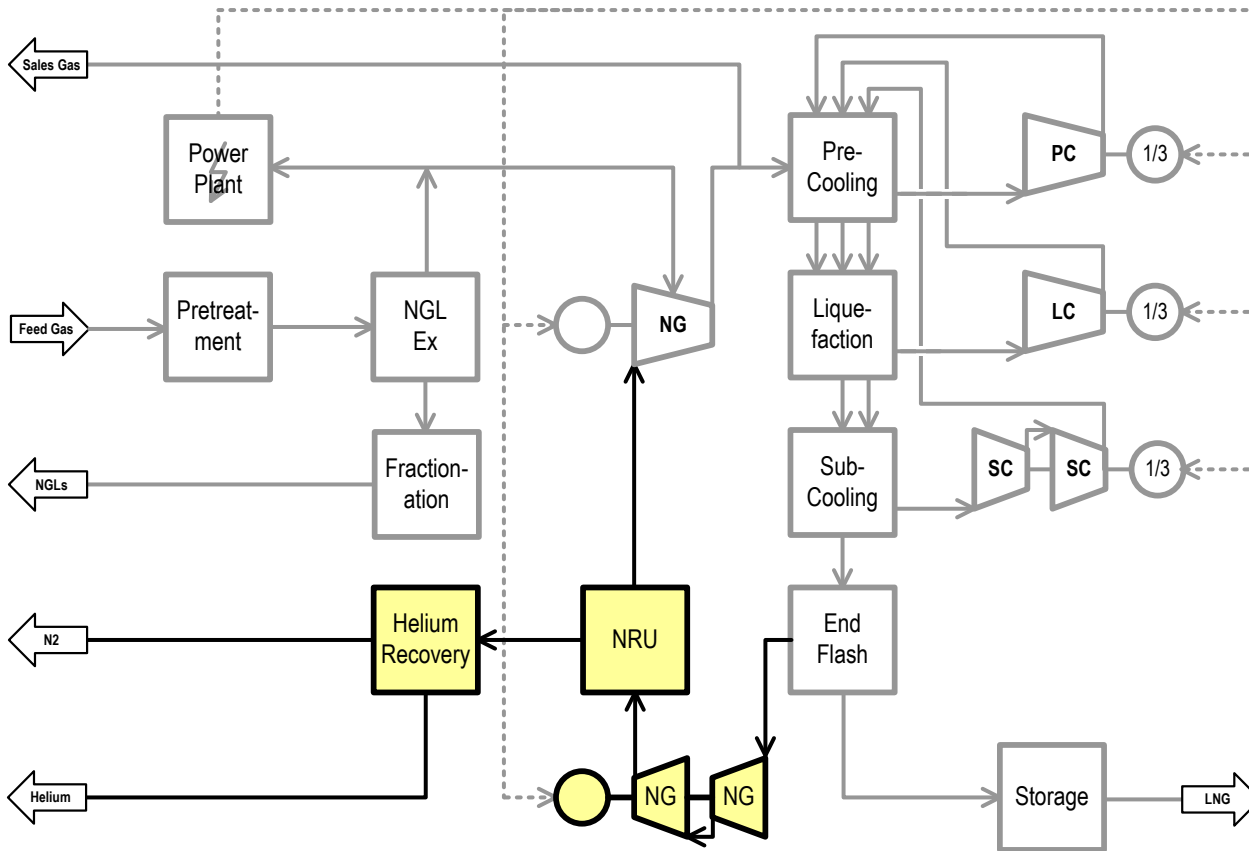
Raman scattering (inelastic interaction between photons and electrons) in a fiber optic is used to measure the temperature along the heat exchanger tubes with a resolution of <1m and <3 deg C.



## Coil Wound Heat Exchangers

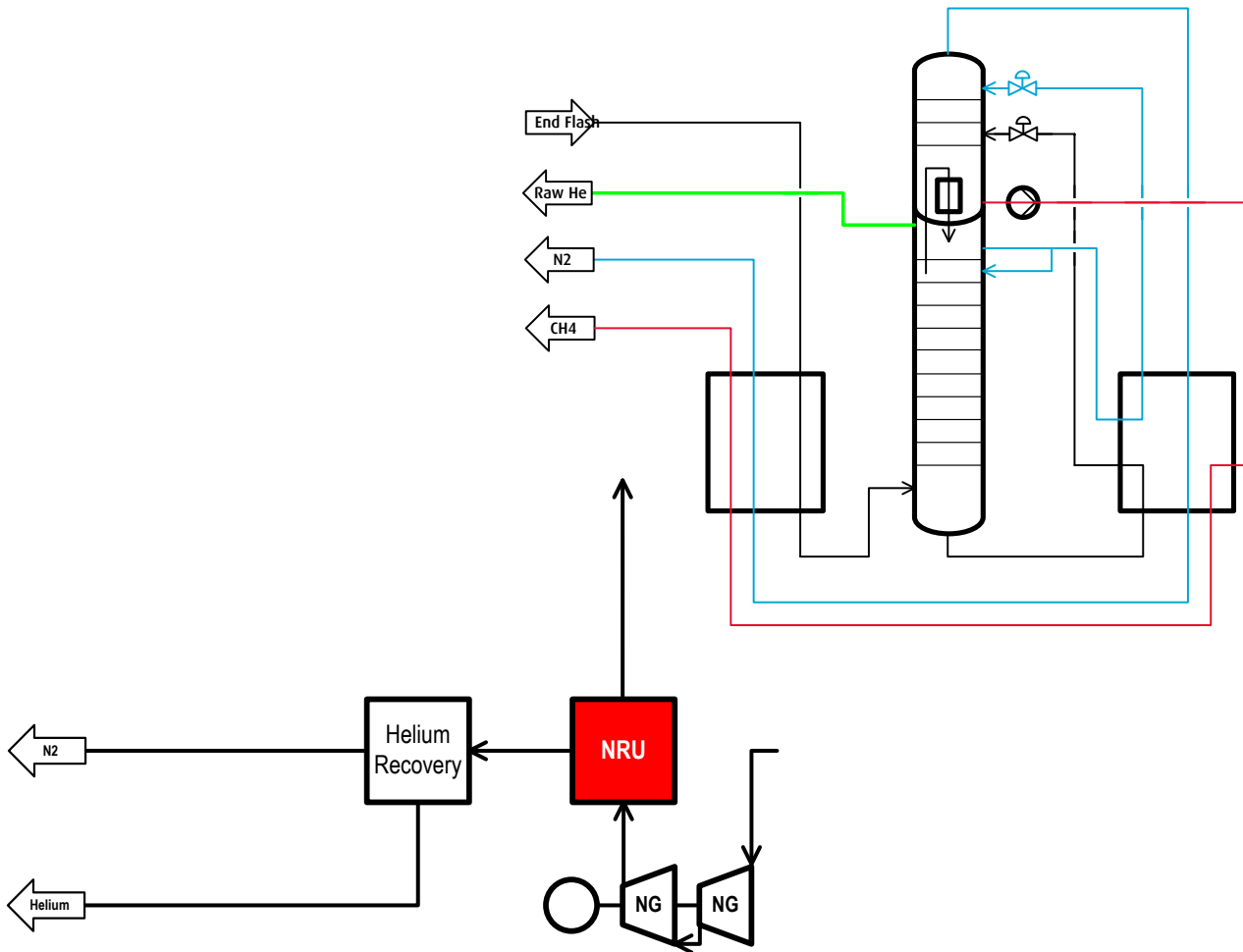
- tested in the lab under motion
- optional design in stainless steel (shell and bundle)
- 3D temperature monitoring





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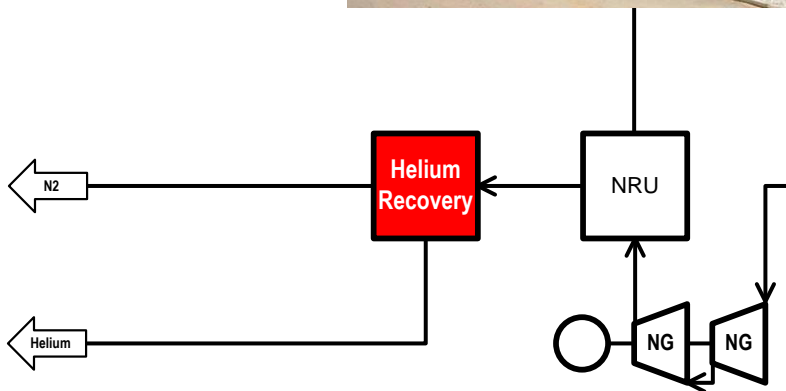
## N<sub>2</sub> Rejection

- N<sub>2</sub> fraction with <1 mol% CH<sub>4</sub> is sent to atmosphere
- hydrocarbon fraction with low N<sub>2</sub> content is NOT used as fuel, but recycled to the feed gas,
- NRU can operate in island mode
- excellent tap point for raw helium

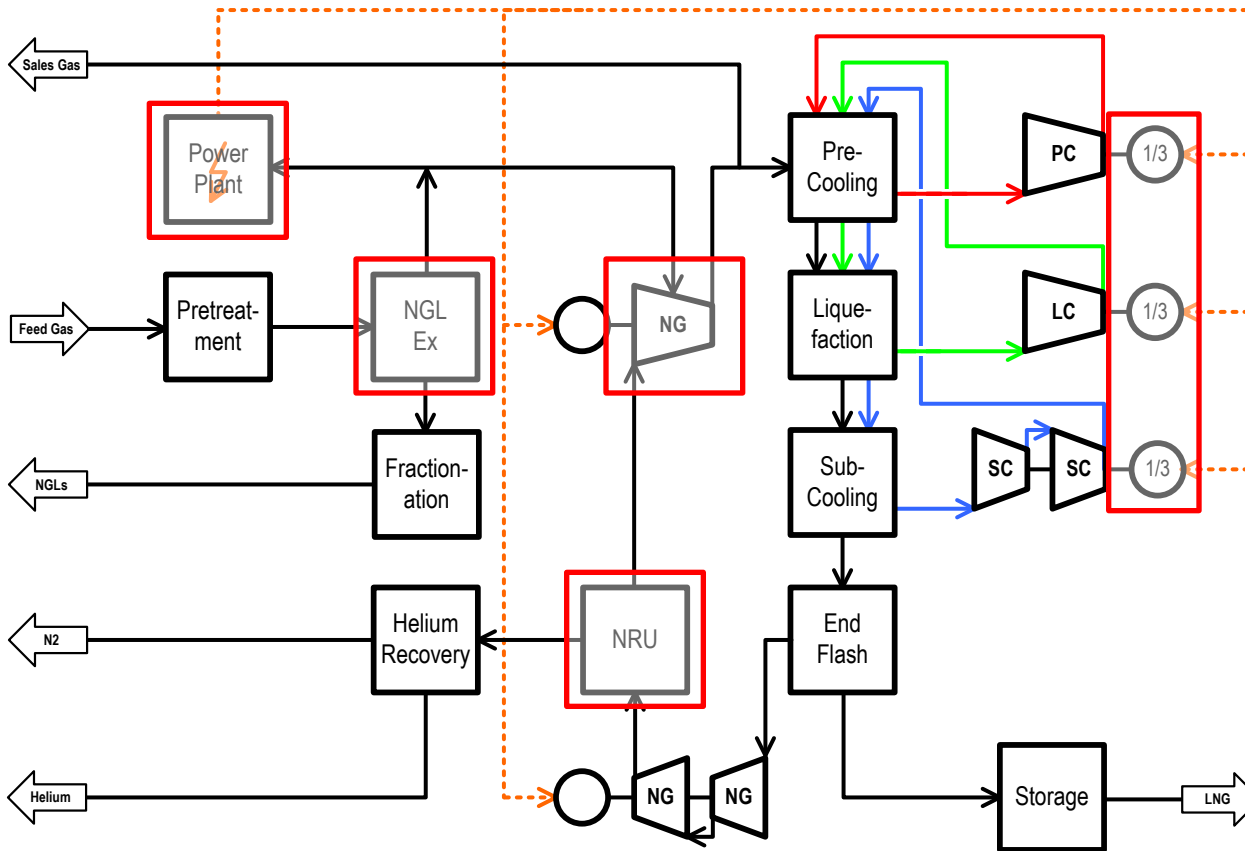


## Helium Recovery

- purification of raw helium
- liquefaction and storage







## Main Features

- stand-alone NGL extraction
- high liquefaction pressure
- load balanced refrigerant compressors
- flexible fuel gas concept
- integrated NRU with HeRU option

Thank you  
for your attention.

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