The Oman LNG story

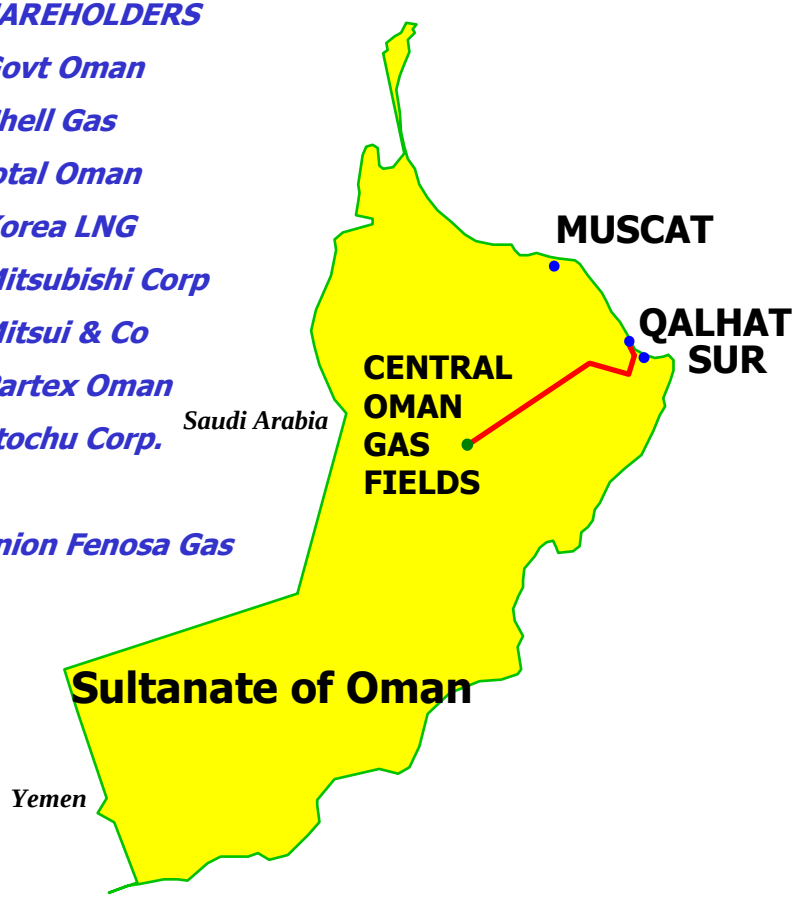
- Oman LNG complex
- SMOC on Main Cryogenic Heat Exchanger
- Conclusions

RS5

Oman and Qalhat LNG complex

SHAREHOLDERS

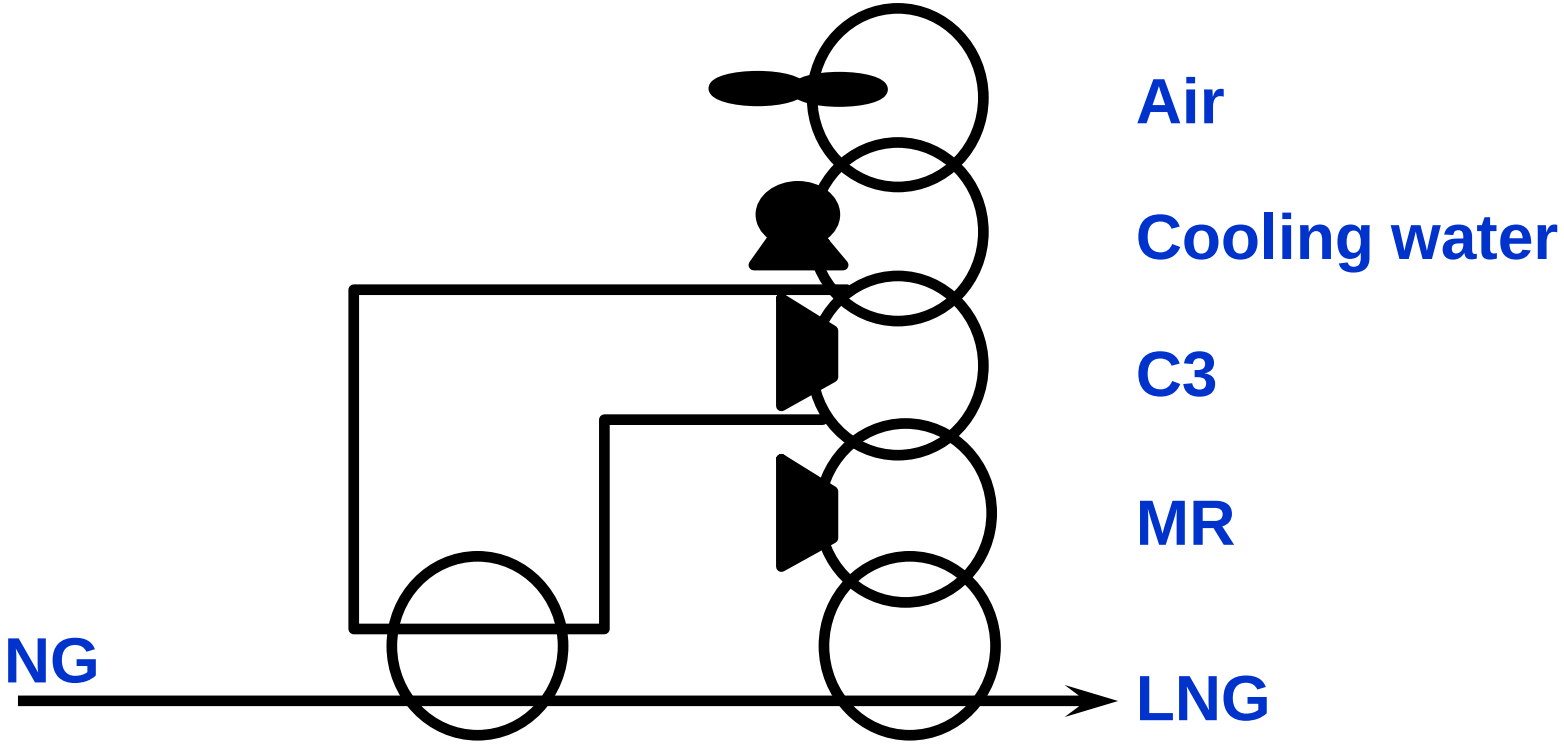
- ***Govt Oman***
- ***Shell Gas***
- ***Total Oman***
- ***Korea LNG***
- ***Mitsubishi Corp***
- ***Mitsui & Co***
- ***Partex Oman***
- ***Itochu Corp.***
- ***Union Fenosa Gas***



Location: Qalhat, near Sur
Product: Liquefied Natural Gas (LNG)
Feed: Natural Gas from Central Oman
Export: 10.4 mtpa LNG / 3 trains
Markets: Korea, Japan, Europe, US
Transport: by Ship

RS5 two first trains started in 2000
3rd train started end 2005
Roland Silve; 30-4-2006

Cooling cycles

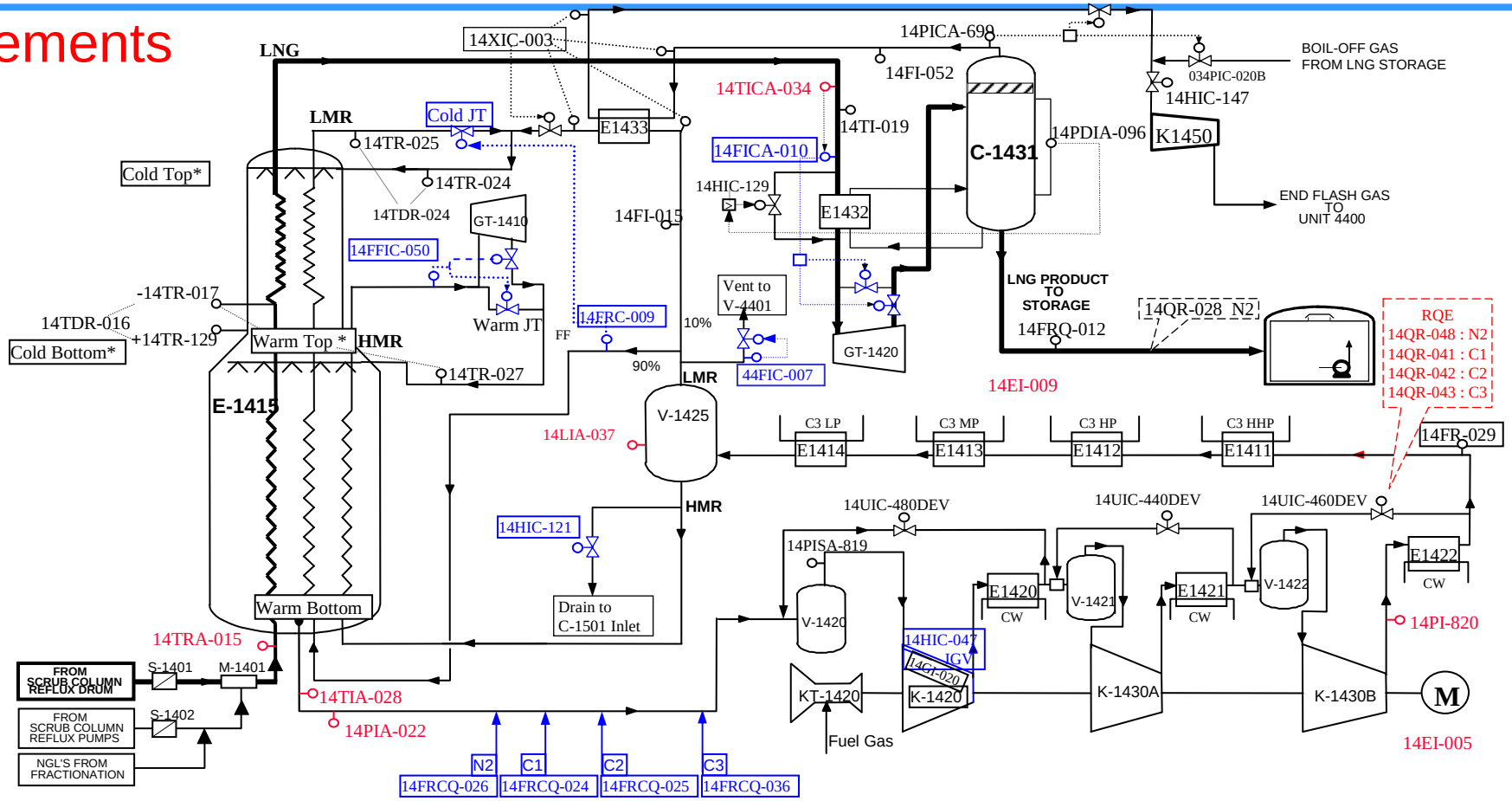


RS2

Liquefaction

Measurements

Outputs

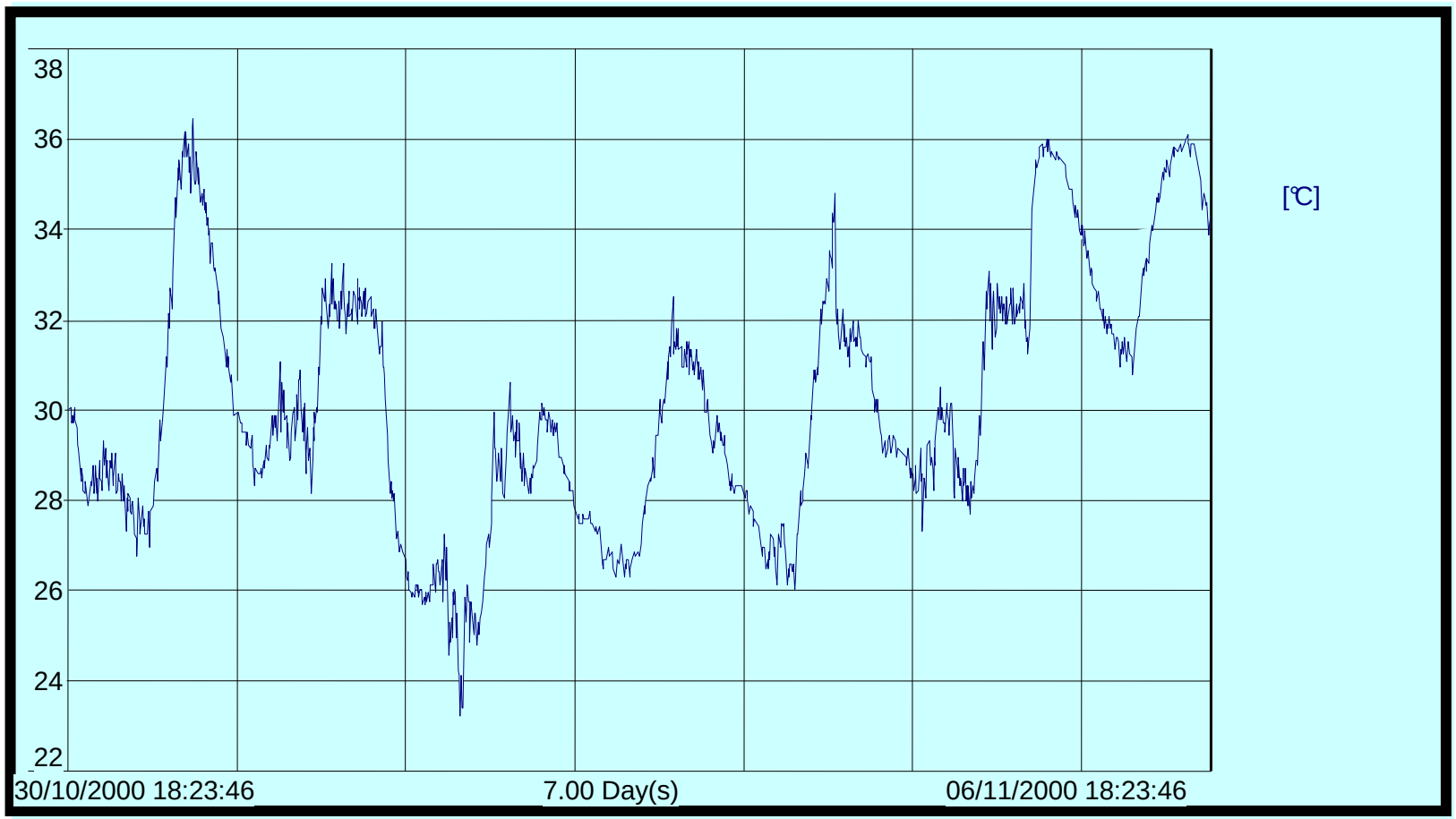


RS2

works like a big refrigerator
NG stream
cooling system : NG cooled by MR, MR cooled by C3, C3 cooled by SCW

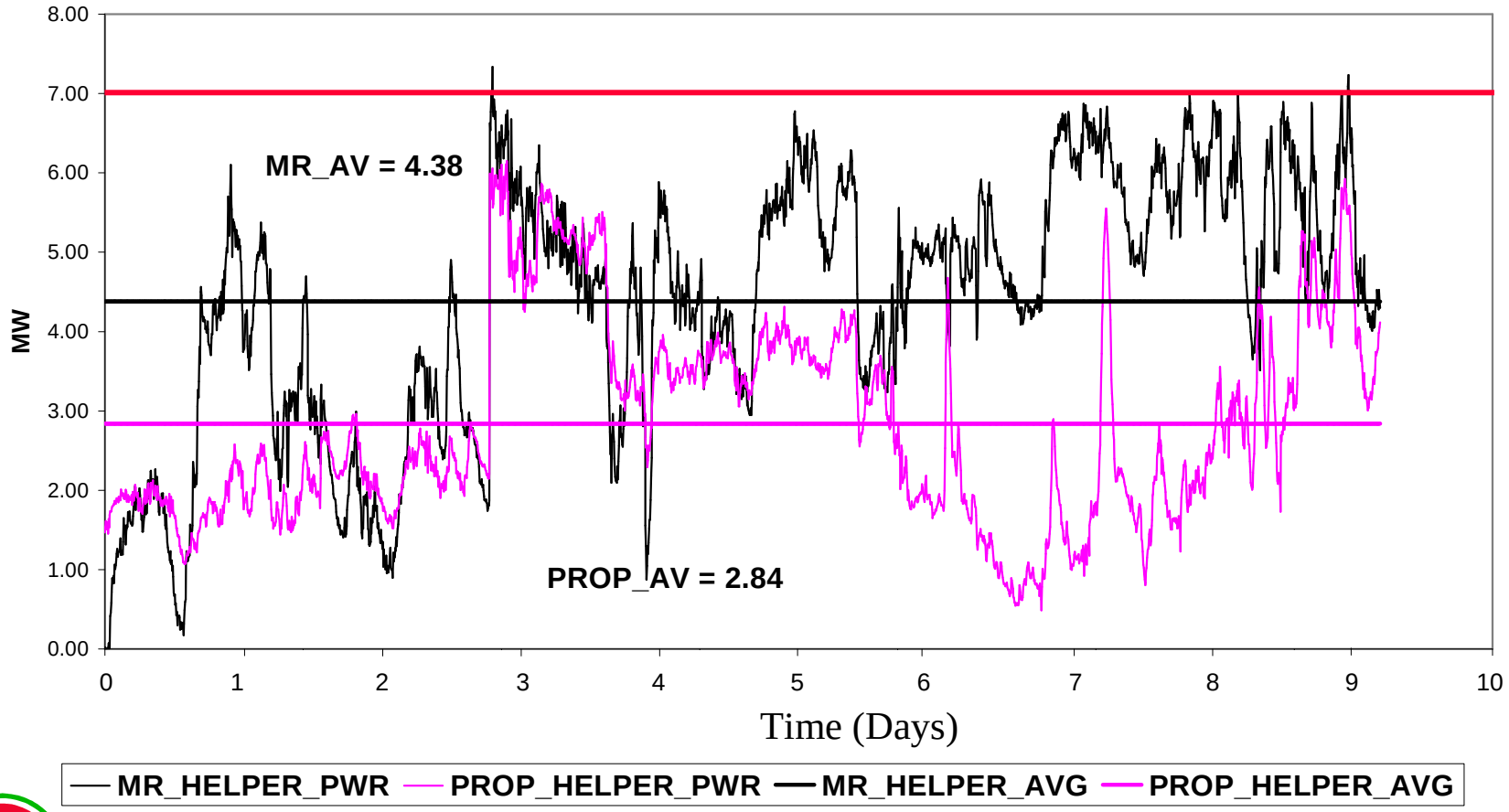
Complexity
13 CV
10 MV
Maximun LNG production given by maximum refrigeration capacity (maximum shaft power)
=>Push to maximum helper motor power
Roland Silve; 30-4-2006

Ambient air temperature (diurnal effect)



RS4

Constraint pushing without APC

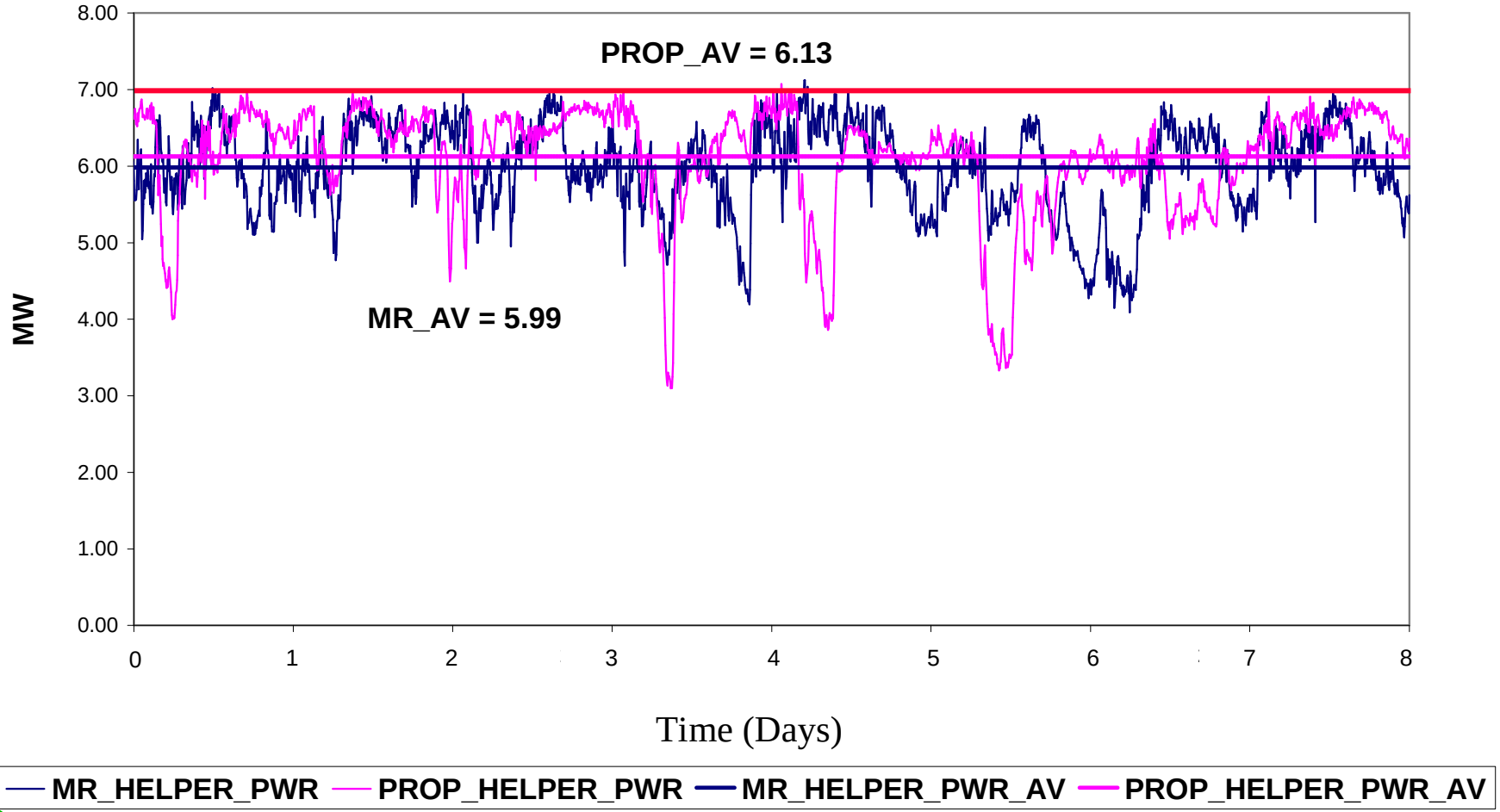


RS4 Controlled by operator

Roland Silve; 29-4-2006

RS11

Constraint pushing with APC (SMOC)

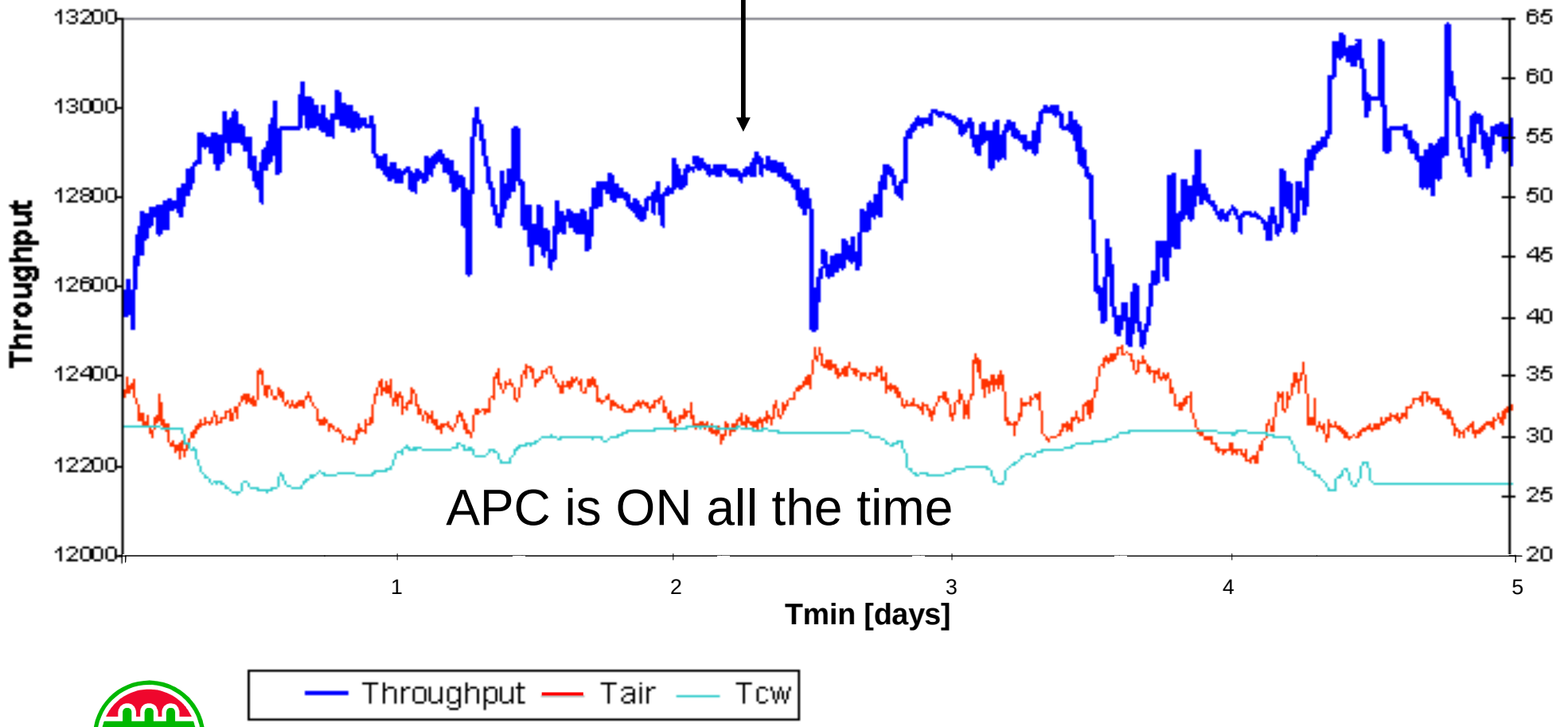


RS11

Controlled by SMOC
Below the limit
Close to the limit
Roland Silve; 3-5-2006

SMOC Pro performance

Throughput is maximised under fluctuating ambient conditions



RS8

Conclusions Oman LNG project

- Main benefit is maximisation LNG production (result: 2 extra cargos per year).
- Improved quality control and efficiency of fractionation unit.

Dia 9

RS8

SMOC discussions about overall philosophy led to a change on base layer Process Control :
BOG & EFG control scheme in combination with FGB recycle to feed.
- Reduction of 150 t/d of quench.

Roland Silve; 1-5-2006

RS9

Additional Benefits

- Less operator interventions – less risk of human error.
- Under unstable conditions, one operator can operate two trains.
- Under normal conditions, more time for operators to optimise.
- SMOC implementation required detailed review of base layer control resulting in improvements.

RS9

Facility of increasing throughput of the plant by adjusting one single parameter

SMOC discussions about overall philosophy led to a change on base layer Process Control :
BOG & EFG control scheme in combination with FGB recycle to feed.
- Reduction of 150 t/d of quench.

Roland Silve; 3-5-2006

Final remarks

- LNG operations can be improved by applying APC.
- Most significant benefits are more LNG & LPG production, higher efficiency and more reliability.
- Projects show a 6 month return on investment or better.
- All Shell Global Solutions advised plants have APC implemented or under development.
  Oman LNG is an illustrative example of a possible result.
- APC aims at automatic online control of a total unit or LNG train 24 hours a day, every day in day out….

Thank You!