

Short session 04.04.2016 :

Cont. Production enhancement techniques :

Subsea processing $\rightarrow$ perform processing

- $\rightarrow$ sep oil, gas, water subsea
- $\rightarrow$ water processing disposal
- $\rightarrow$ gas treatment and reinjection
- $\rightarrow$ more.....

advantages

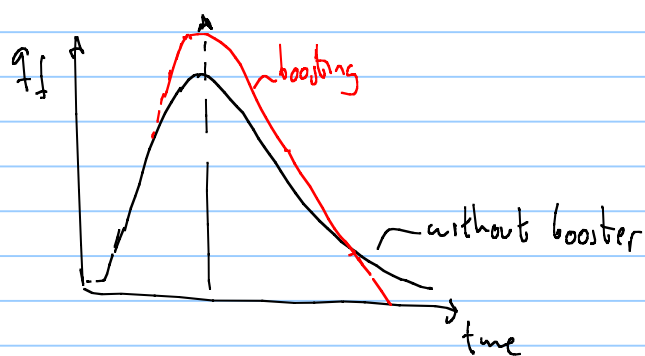
- mitigate flow assurance
- reduce or eliminate unnecessary transportation of fluids (water)
reduces back-pressure.
- allows to implement single phase boosting $\rightarrow$ liquid
 $\rightarrow$ gas

reduce separator pressure (first stage high pressure separator)

Snghuit Lower sep pressure 2020



Prod mode B



include booster in the field design phase

Prod mode A



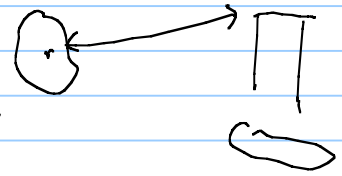
booster engineering and logistics can be delayed in time.

Subsea boosting

↳ compressors

→ advantages:

- Increase production / maintain
- increase tie-back distances
- multiphase boosting: no need for pre-separation of fluids
- real state is cheap subsea than topside.
- Low cost compared with other production enhancement alternatives.



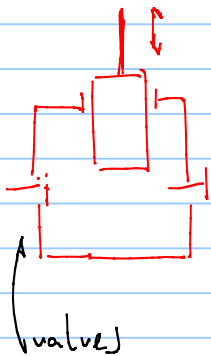
disadvantages

- cost of units, deployment, modification of existing production system
- maintenance (accessibility, cost ↑, reliability)
- multiphase: uncertainty on the performance

in general, there are two boosting principles:

positive displacement

formation of cavities
that carry the fluid
from inlet to outlet



↑
twin-screw pumping

rotodynamic (hydrodynamic booster)

it is constituted by a stage

- impeller
- diffuser

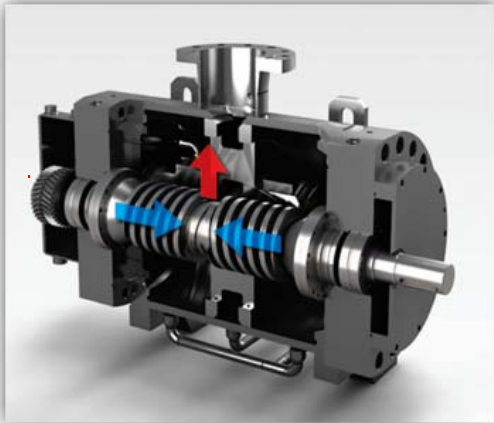
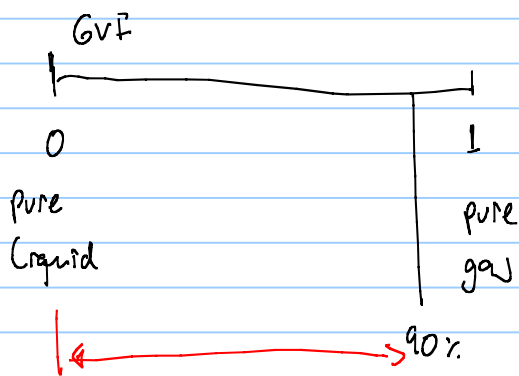
sequence:

1: accelerate the fluid in
the impeller → increase
 E_k kinetic energy

2: Change kinetic energy E_k
to potential energy (pressure)

$$1 \rightarrow 2 \quad P_2 > P_1 \quad V_2 < V_1$$

- low rates than hydrodynamic pumps
- Δp higher than hydrodynamic pump
- slightly affected by μ
- needs some liquid for cooling (not good for high GVFs)
- doesn't tolerate solids (sand)

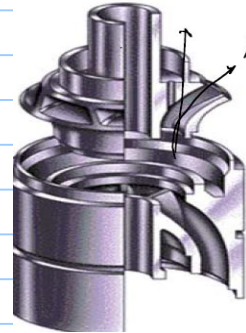


radial
impeller



$GVF < 10\%$

mixed flow
impeller



$GVF < 30\%$

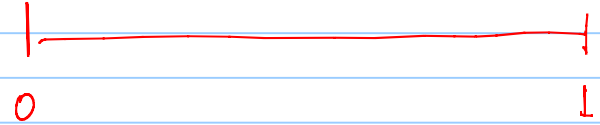
axial
impeller



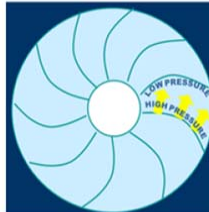
$0 < GVF < 1$

$\Delta p_{axial} \ll \Delta p_{radial}$
 Δp_{mixed}

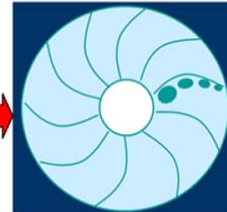
GVF



Different pressure
area created inside
the vane cavity



Gas accumulates in
low pressure area



Gas occupies the
entire vane cavity



(Courtesy of Schlumberger)

multiphase pumping: helico-axial pump
HAP



(a) Impeller



(b) Diffuser

