Small details, big impact

Practical examples of commercial and technical drivers in allocation

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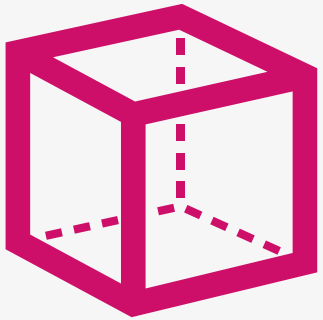
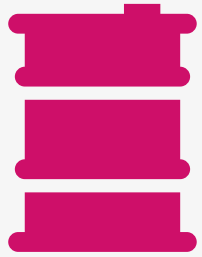
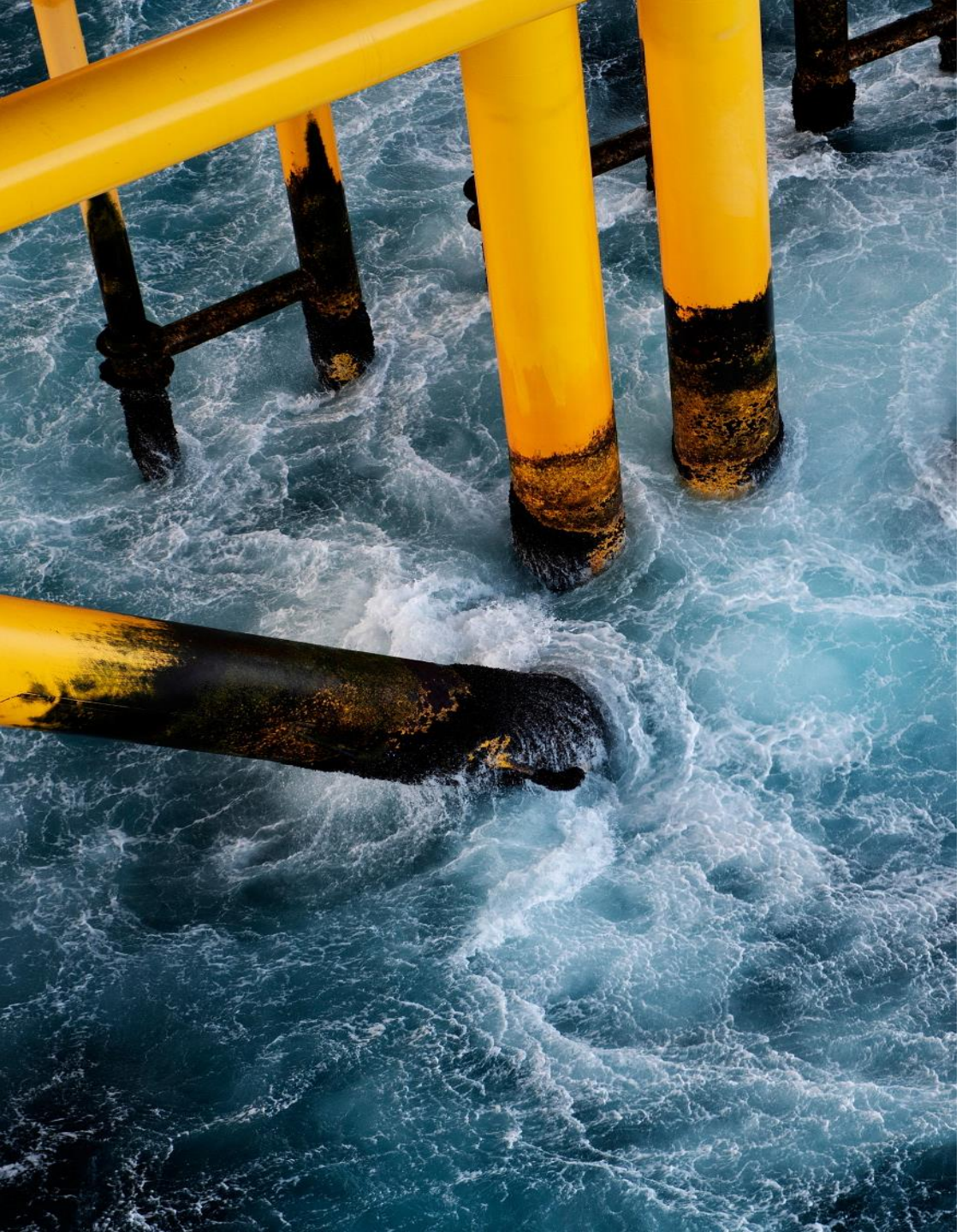
To barrel or not to barrel…

- BOE
- OE
- Which unit did you express the tariff basis in in your last agreement?
  - 1 Sm^3 water [BOE] = 0 MJ
  - 1 Sm^3 water [OE] = 1 Sm^3
  - 1 Sm^3 water [OE in barrels] = 6.29 bbl
- …or did you *forget* water in your tariff agreement?







Who will pay the water bill?

- Tariff per redelivered oil and gas volumes, not throughput
- Water production can vary gravely across fields
- WLR of a stream becomes considerable with field's age
- Processing of produced water is resource-demanding
  - One of the highest specific heat capacity of any liquid on Earth
  - Temperature of well streams from same reservoir can span over 80°C
  - Major driver of electrical power consumption: heating and injection
- Example:

	Sm^3	OE	OE in bbl	Water Liquid Ratio
Oil export	150 000	150 000	943 500	65%
Gas export	35 000 000	35 000	220 150	
Prod. water	280 000	280 000	1 761 200	

To muddy the waters…

	Sm^3	OE in bbl	Tariff 1	Invoice 1	BOE	Tariff 2	Invoice 2
Oil export	150 000	943 500	15 NOK/**bbl**	14 152 500	943 500	15 NOK/**BOE**	14 152 500
Gas export	35 000 000	220 150		3 302 250	277 713		4 165 695
Prod. water	280 000	1 761 200		26 418 000	0		0
SUM [NOK]				**43 872 750**			**18 668 040**

A cube is not just a cube…

Allocated values
Gas: 35 000 000 Sm^3
Oil: 150 000 Sm^3

	Sm^3 normalized to 40 GCV	Sm^3 enriched with NGL to 55 GCV	Sm^3 @ 820 kg/Sm^3	Sm^3 Cru… va…	Diff volume	BOE	Diff value
Gas	42 475 213	-				277 713	**0%**
Gas	-	34 190 711	-			307 377	**+11%**
Oil	-	-	153 65…		…%	966 512	**+2%**
Oil	-	-	-		**+25%**	1 179 375	**+25%**

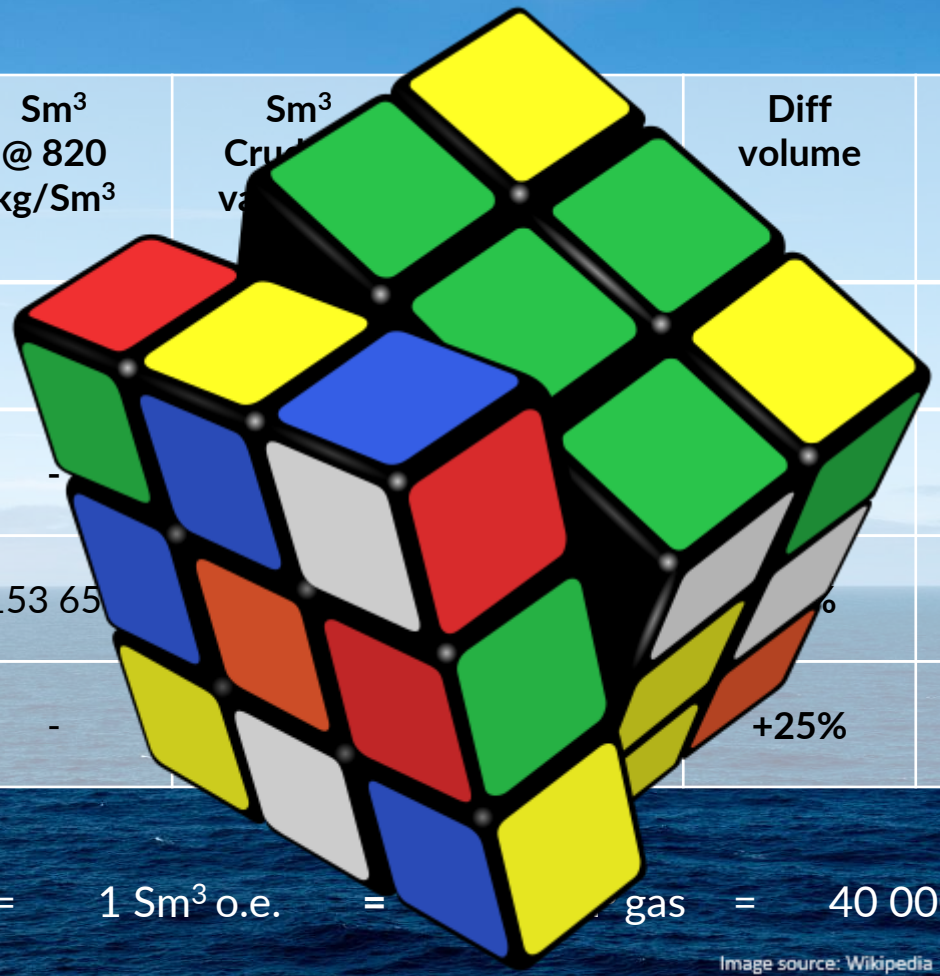


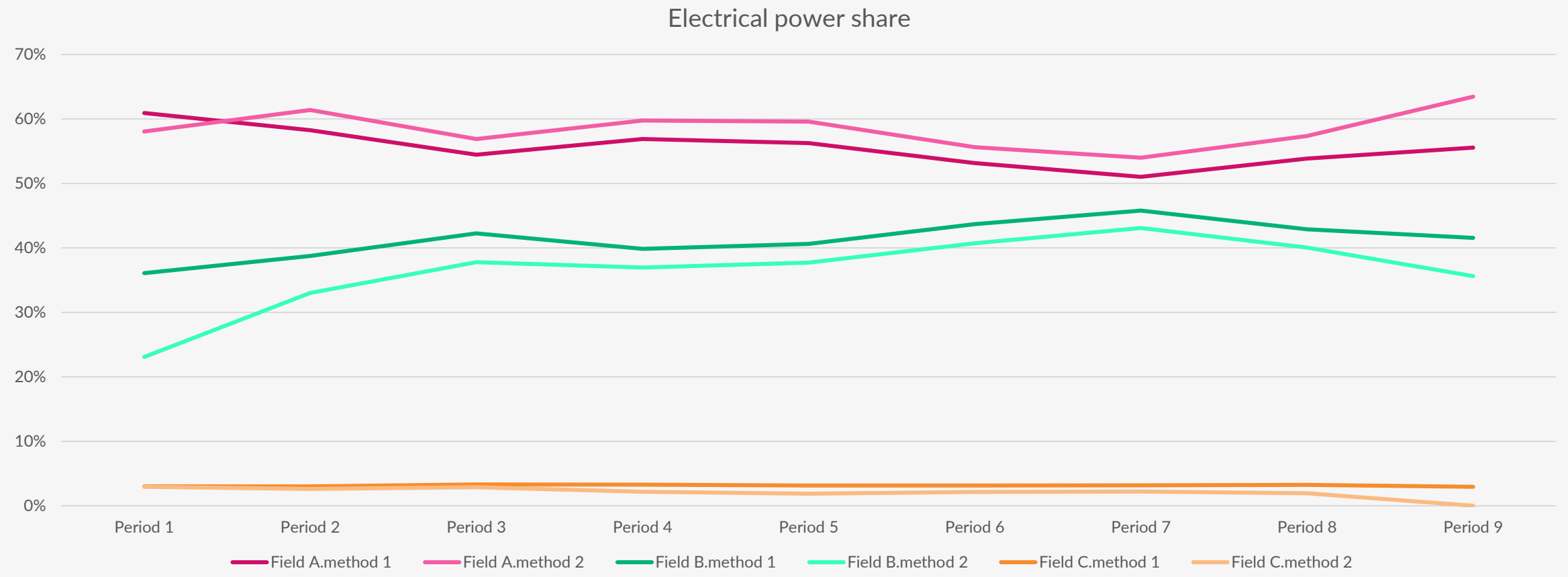
Image source: Wikipedia

1 Sm^3 oil = 35 500 MJ = 1 Sm^3 o.e. = … gas = 40 000 MJ

35 500 MJ ≠ 40 000 MJ

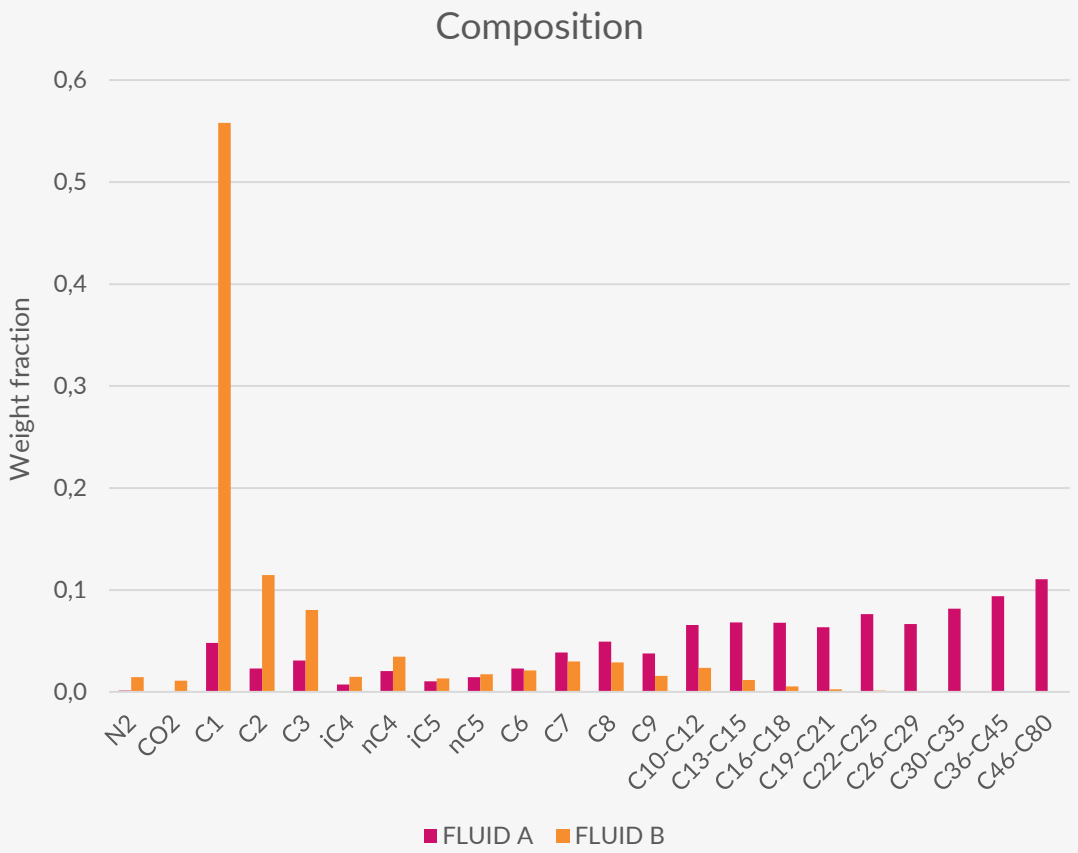
Electrical power allocation

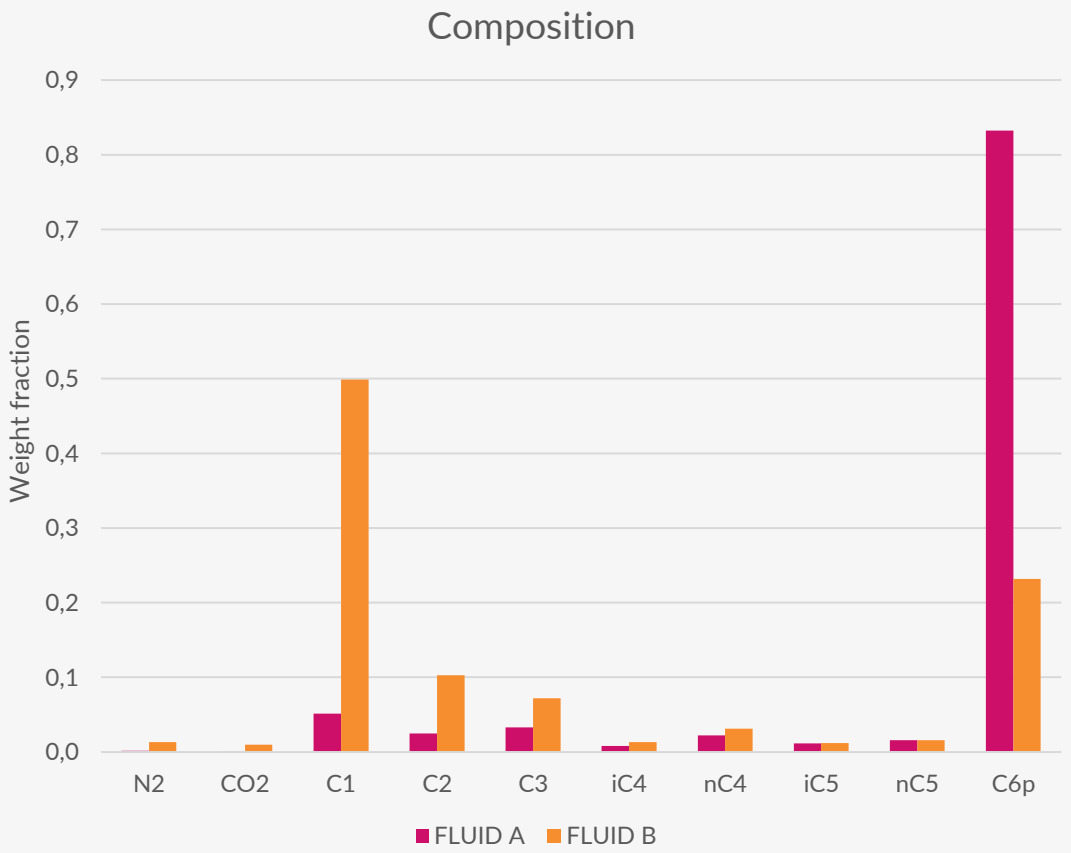
Detailed vs. simplified calculations



Component Oil Recovery Factor simulation

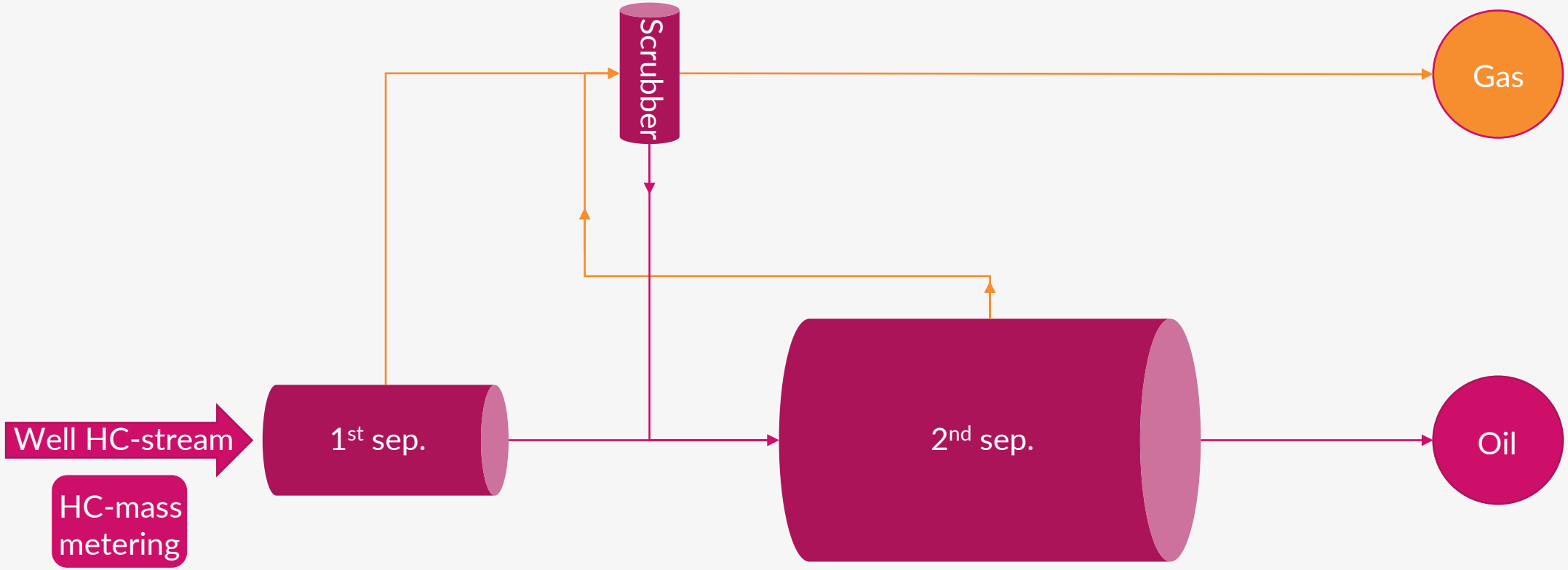
Ref. Folgerø, K., et al. (2021, Oct 25-29) *Influence of fluid compositions and process parameters.* NSFMW 2021: Tønsberg, Norway.





Component Oil Recovery Factor simulation

Process



CORF vs. component lumping to C6p

Observations

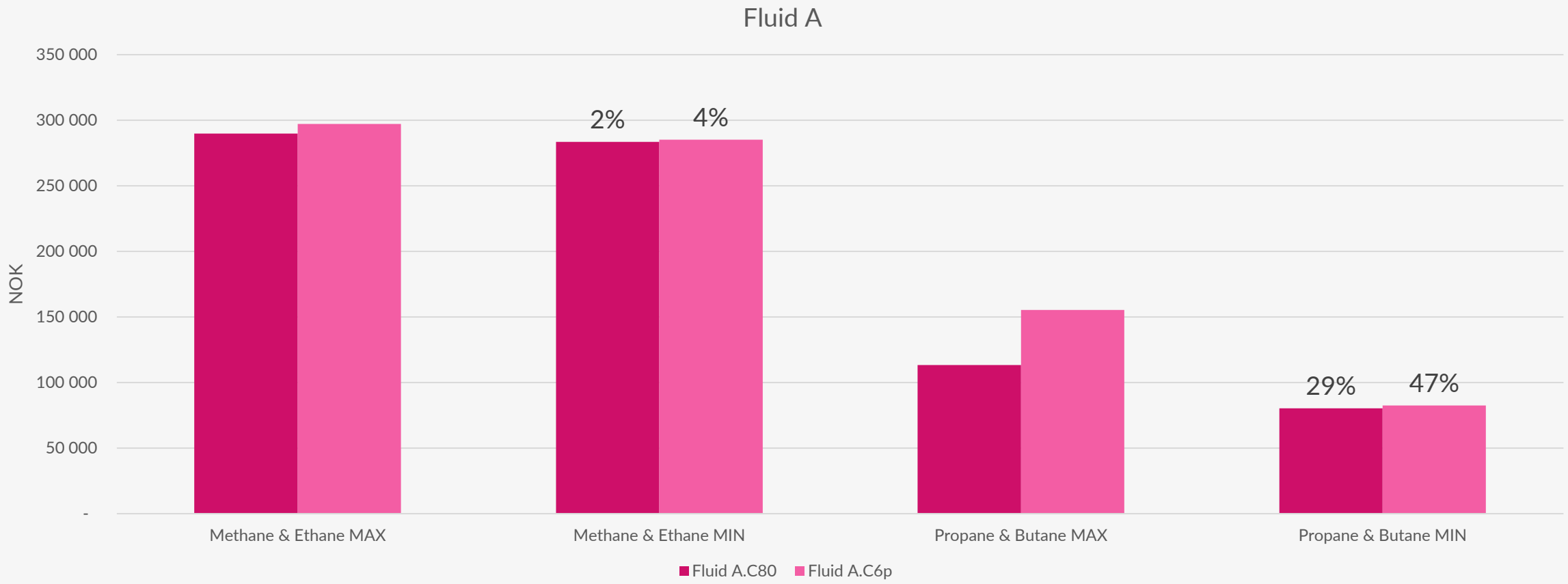
- Both fluids:
  - Temperature-dependant

- Fluid A (oil-dominant):
  - Most sensitive to 1st separator temperature for both C80 and C6p, slightly amplified dependency with C6p
    - Iso-butane becomes minorly dependant on 2nd sep. pressure
  - Increase in sensitivity to 1st separator temperature
    - Pentane: twofold

- Fluid B (gas-dominant):
  - Most sensitive to 2nd separator temperature for C80
  - Most sensitive to 1st separator temperature for C6p
  - Increase in sensitivity to 1st separator temperature
    - Butane: fourfold
    - Pentane: fivefold

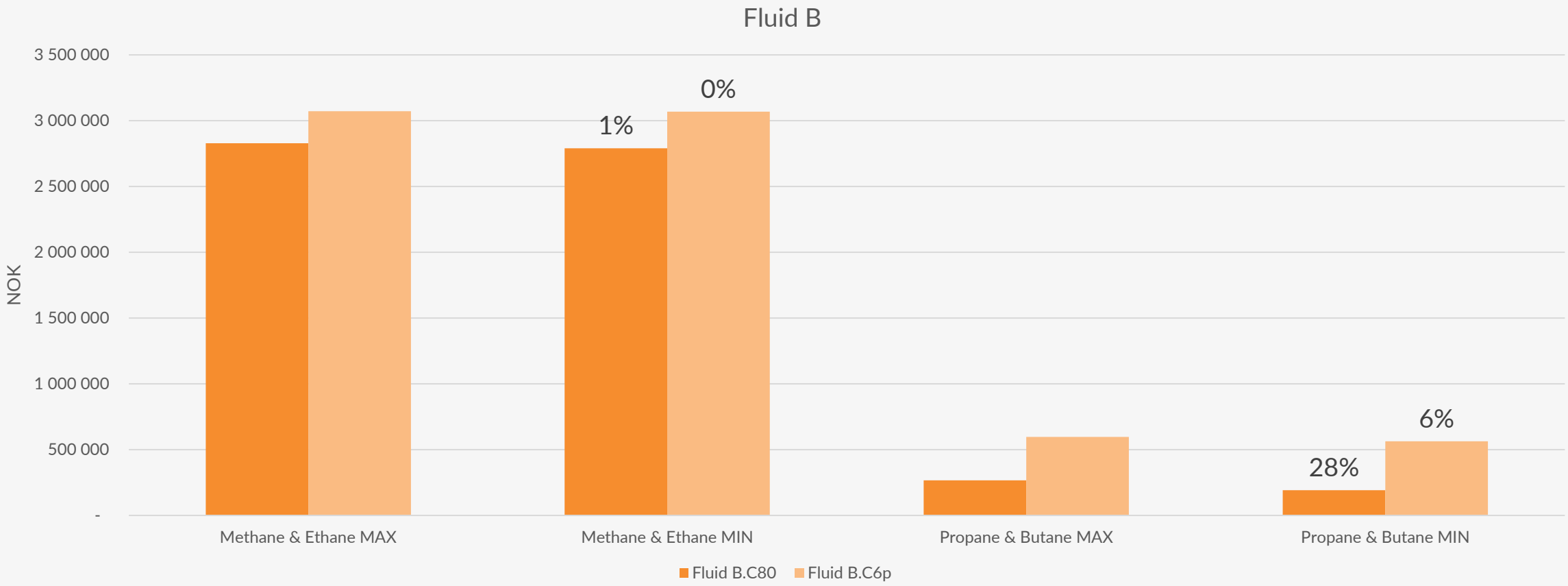
Daily gas values due to CORF

Fluid A (oil-dominant)



Daily gas values due to CORF

Fluid B (gas-dominant)



Conclusions and last thoughts

- Nomenclature and precise formulation in commercial agreements is key
  - allocation procedure, deferral, tariff, OPEX, …
- CORF: proper input and QC of simulation results extremely important
  - Be aware of differences in gas- and oil-dominant streams dependencies to process conditions when considering allocation systems based on simulations
- Allocation professionals: the devil is not in all of the details, so think cost/benefit!
- Commercial professionals: involve allocation experts to solve that Rubik's cube as early as possible!

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