Subsea Innovation : a key for cost reduction ?

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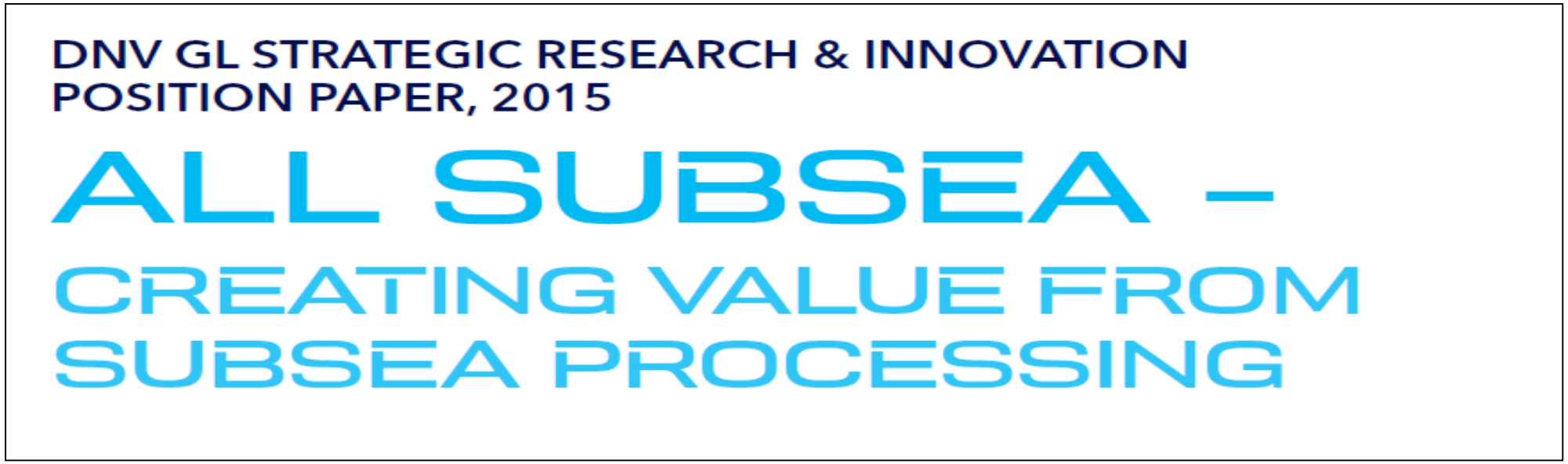
INTRODUCTION



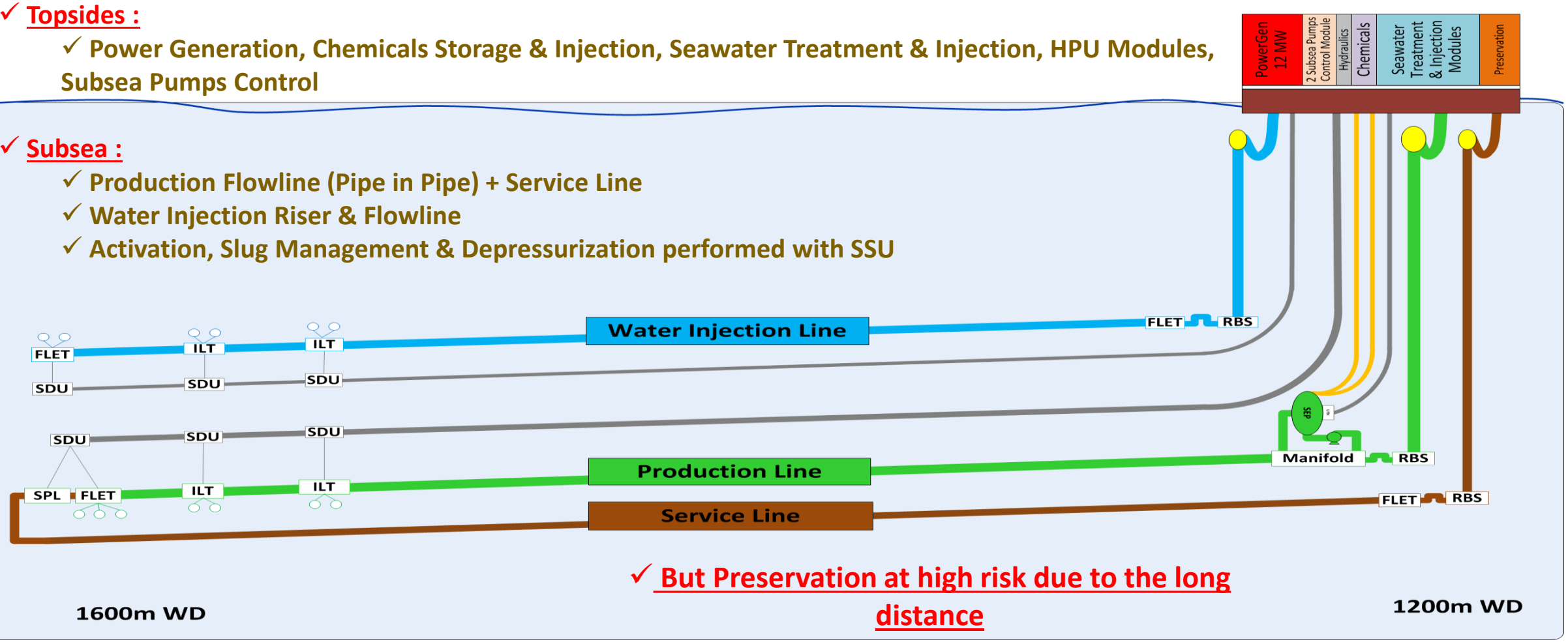
Deep Offshore Field – 60 kbopd
Base Case = Conventionnal

Facilities CAPEX = 100%

20 km | 60 km

✓ **Topsides :**
- ✓ Power Generation, Chemicals Storage & Injection, Seawater Treatment & Injection, HPU Modules, Subsea Pumps Control

✓ **Subsea :**
- ✓ Production Flowline (Pipe in Pipe) + Service Line
- ✓ Water Injection Riser & Flowline
- ✓ Activation, Slug Management & Depressurization performed with SSU



✓ **But Preservation at high risk due to the long distance**

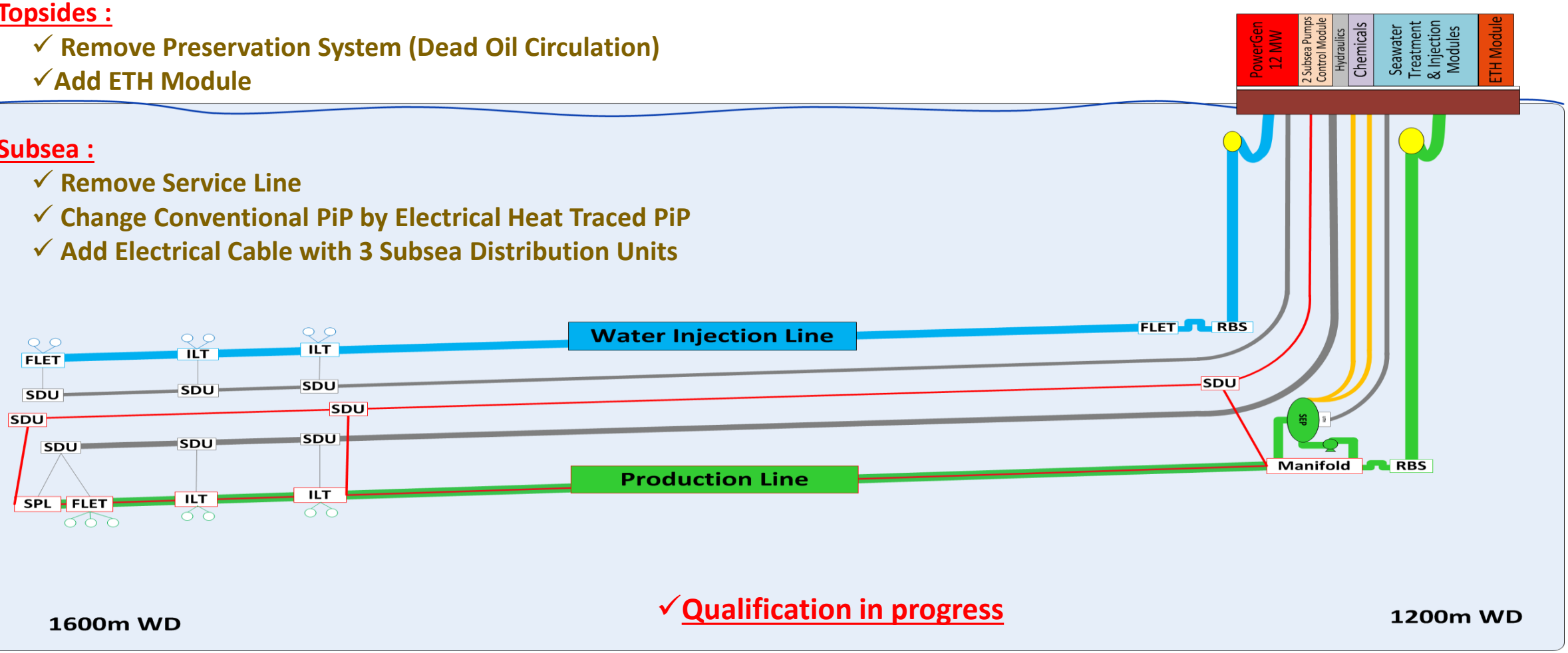
Deep Offshore Field – 60 kbopd
Case 1 = Electrical Trace Heated PiP

Facilities CAPEX = 97%

20 km | 60 km

✓ **Topsides :**
- ✓ Remove Preservation System (Dead Oil Circulation)
- ✓ Add ETH Module

✓ **Subsea :**
- ✓ Remove Service Line
- ✓ Change Conventional PiP by Electrical Heat Traced PiP
- ✓ Add Electrical Cable with 3 Subsea Distribution Units



✓ **Qualification in progress**

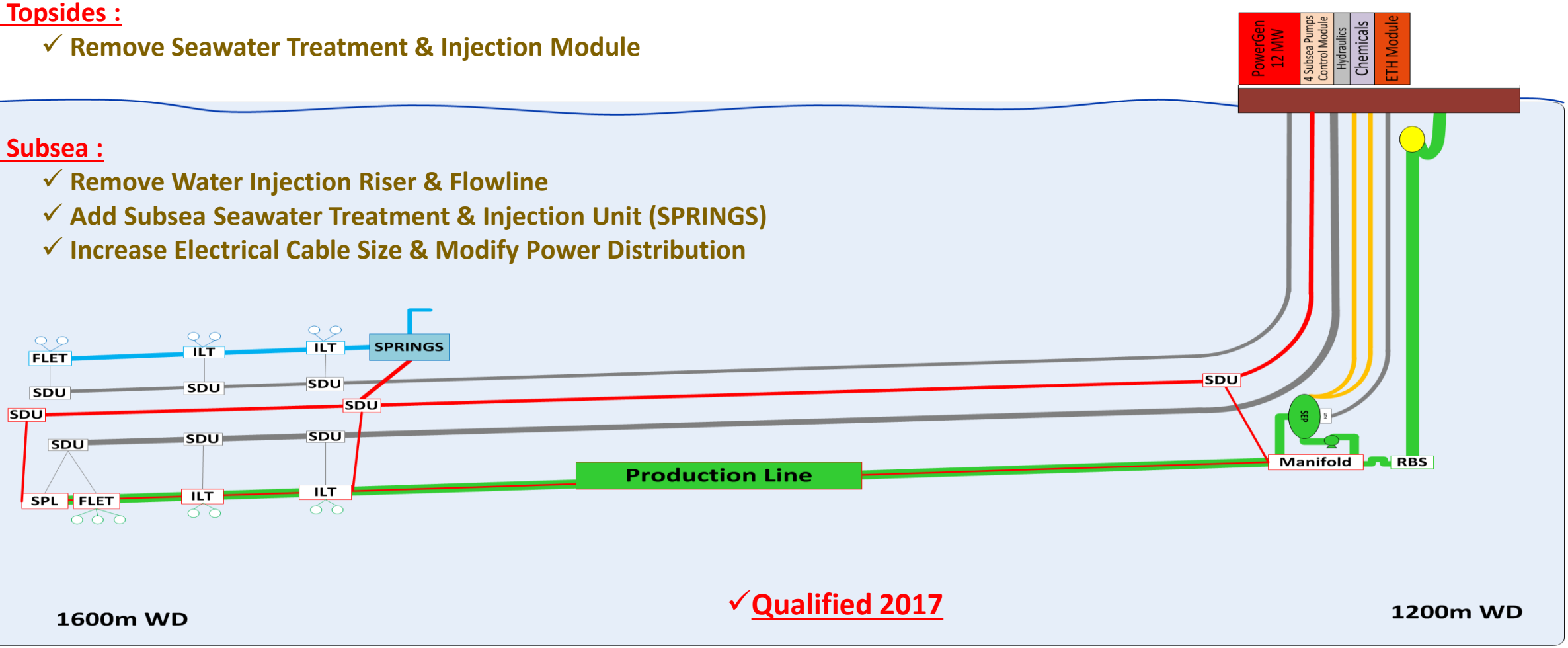
Deep Offshore Field – 60 kbopd
Case 2 = ETH PiP + SPRINGS

Facilities CAPEX = 92%

20 km | 60 km

✓ **Topsides :**
- ✓ Remove Seawater Treatment & Injection Module

✓ **Subsea :**
- ✓ Remove Water Injection Riser & Flowline
- ✓ Add Subsea Seawater Treatment & Injection Unit (SPRINGS)
- ✓ Increase Electrical Cable Size & Modify Power Distribution



✓ **Qualified 2017**

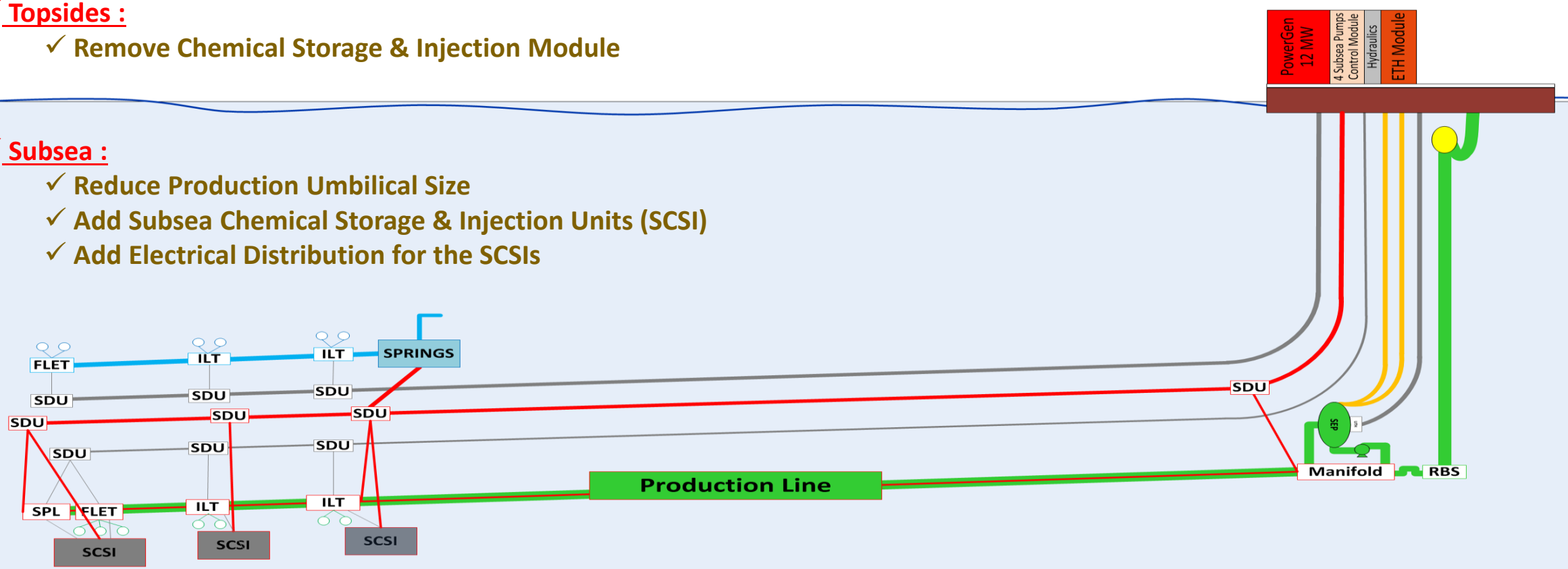
Deep Offshore Field – 60 kbopd
Case 3 = ETH PiP + SPRINGS + SCSI

Facilities CAPEX = 84%

20 km | 60 km

✓ **Topsides :**
- ✓ Remove Chemical Storage & Injection Module

✓ **Subsea :**
- ✓ Reduce Production Umbilical Size
- ✓ Add Subsea Chemical Storage & Injection Units (SCSI)
- ✓ Add Electrical Distribution for the SCSIs



✓ **Qualified 2019**

Deep Offshore Field – 60 kbopd
Case 4 = ETH-PiP + SPRINGS + SCSI + AES

Facilities CAPEX = 80%

20 km

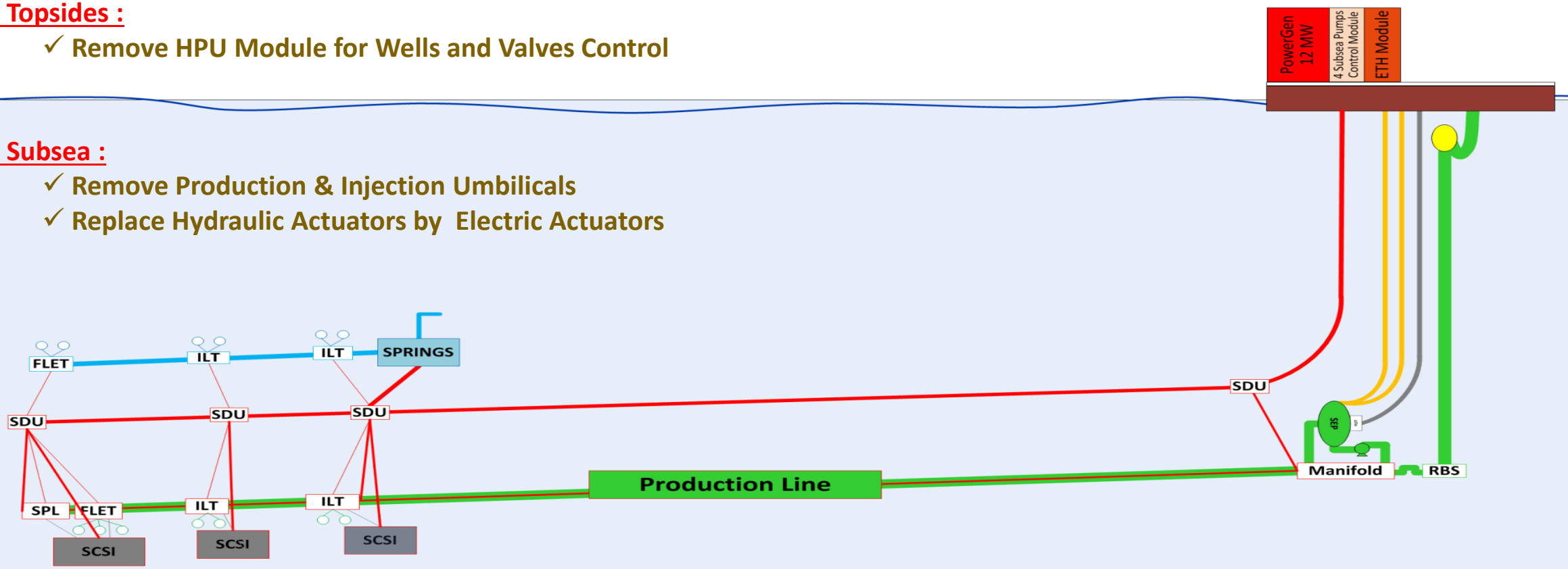
60 km

✓ **Topsides :**

- ✓ Remove HPU Module for Wells and Valves Control

✓ **Subsea :**

- ✓ Remove Production & Injection Umbilicals
- ✓ Replace Hydraulic Actuators by Electric Actuators



✓ **Qualified 2019**

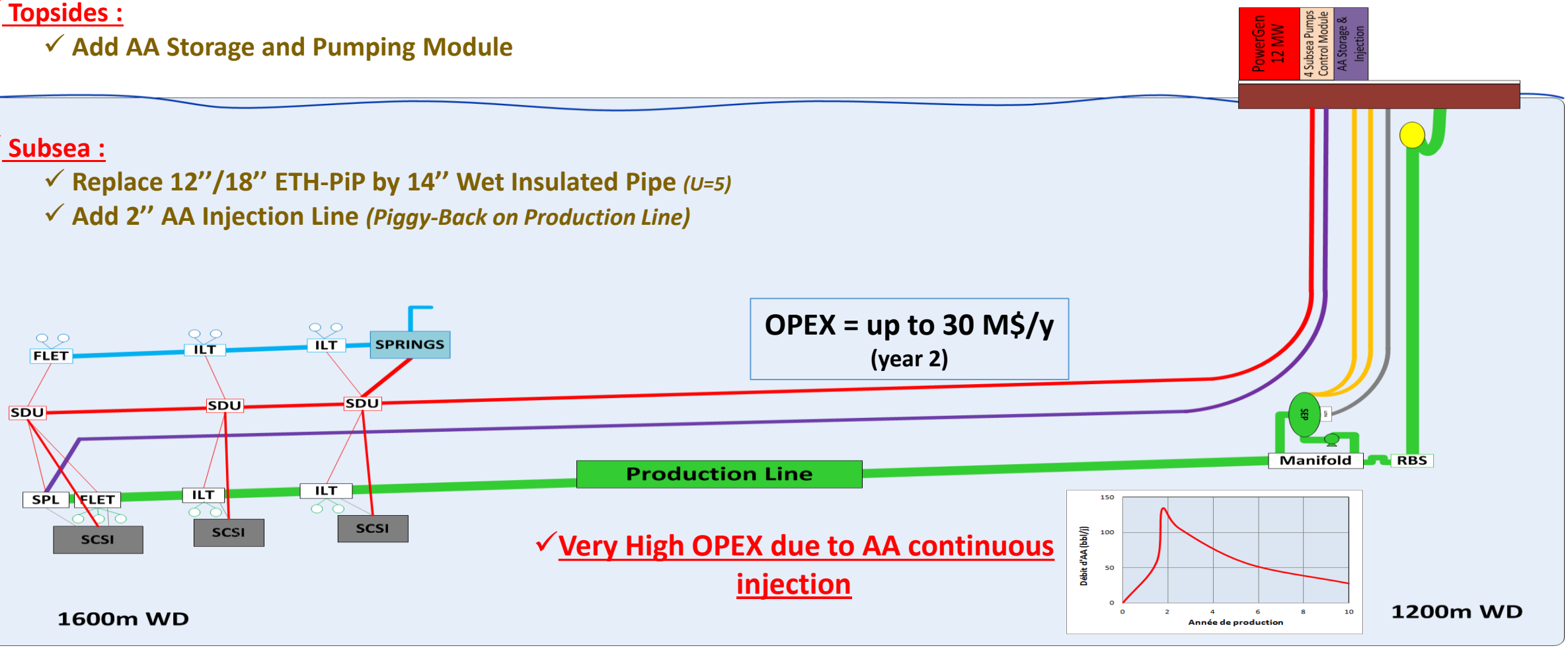
Deep Offshore Field – 60 kbopd
Case 5 = ETH-PiP + SPRINGS + SCSI + AES + AA

Facilities CAPEX = 69%

20 km | 60 km

✓ **Topsides :**
- ✓ Add AA Storage and Pumping Module

✓ **Subsea :**
- ✓ Replace 12''/18'' ETH-PiP by 14'' Wet Insulated Pipe *(U=5)*
- ✓ Add 2'' AA Injection Line *(Piggy-Back on Production Line)*

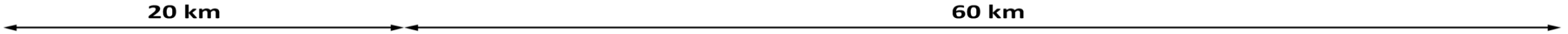


OPEX = up to 30 M$/y
(year 2)

✓ **Very High OPEX due to AA continuous injection**

Deep Offshore Field – 60 kbopd
Case 6 = ETH-PiP + SPRINGS + SCSI + AES + no continuous AA

Facilities CAPEX = 62%

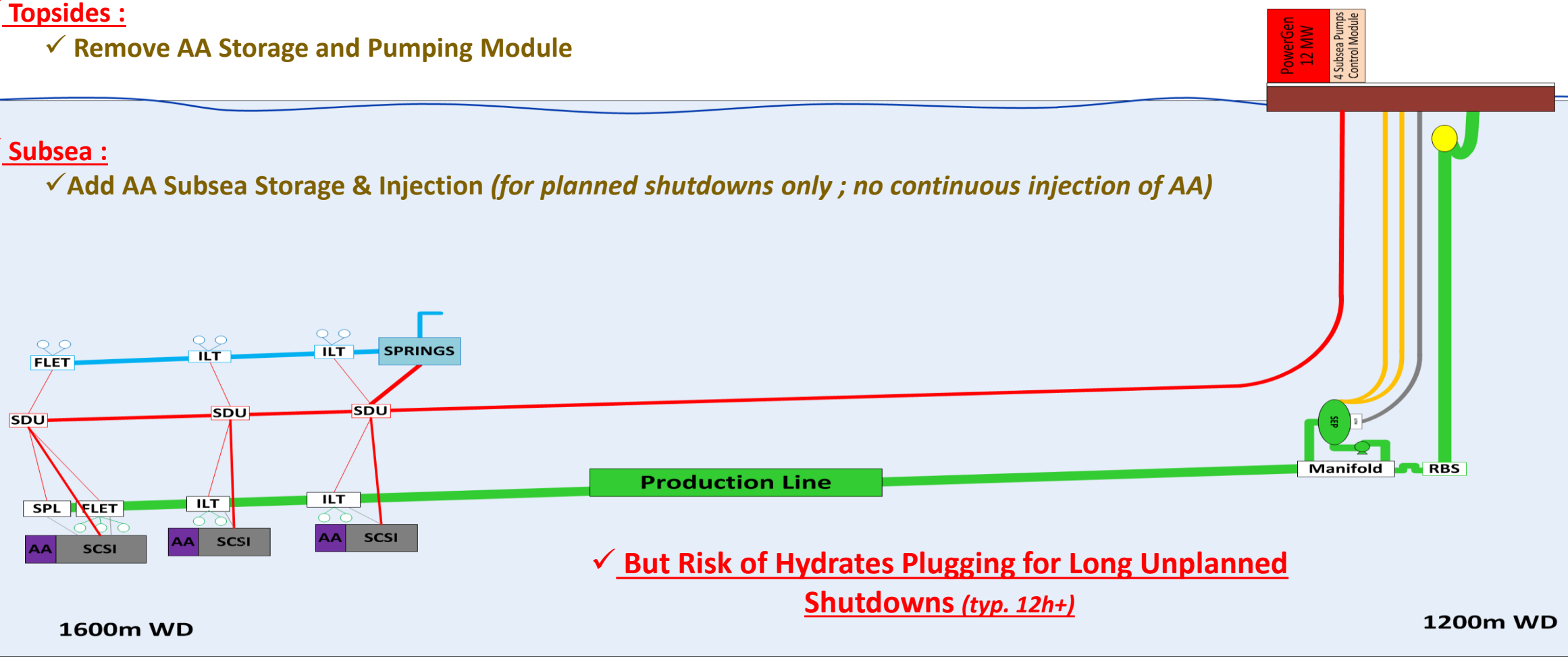


✓ **Topsides :**

✓ Remove AA Storage and Pumping Module

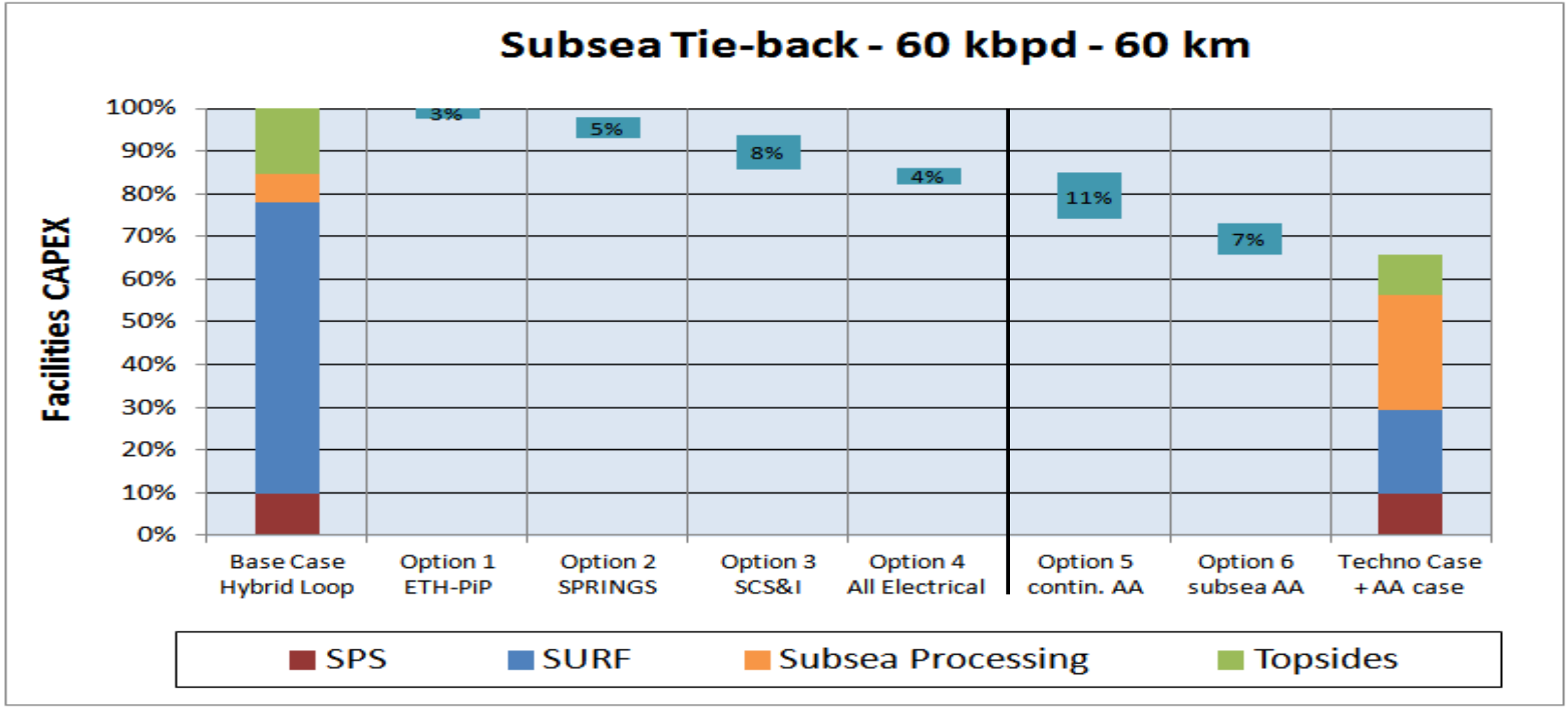
✓ **Subsea :**

✓Add AA Subsea Storage & Injection *(for planned shutdowns only ; no continuous injection of AA)*



✓ **But Risk of Hydrates Plugging for Long Unplanned Shutdowns *(typ. 12h+)***

SUMMARY


Subsea Tie-back - 60 kbpd - 60 km
Facilities CAPEX
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
3%
5%
8%
4%
11%
7%
Base Case Hybrid Loop
Option 1 ETH-PiP
Option 2 SPRINGS
Option 3 SCS&I
Option 4 All Electrical
Option 5 contin. AA
Option 6 subsea AA
Techno Case + AA case
SPS
SURF
Subsea Processing
Topsides

CONCLUSION

- **Technology**
  - Each Subsea Technology improves slightly the economics
  - All Subsea Technologies have to be combined to obtain maximum benefit

    20% CAPEX cost reduction on this case due to subsea processing

- **Operating Philosophy**
  - Use of AA is the next game changer for Deep Water, but it implies a drastic change in Operating Philosophy
  - Extra 20% cost reduction by using AA but higher risk of hydrates plugging

YES, we think Subsea Processing has a large potential for cost reduction in Deep Offshore

THANK YOU FOR LISTENING

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