

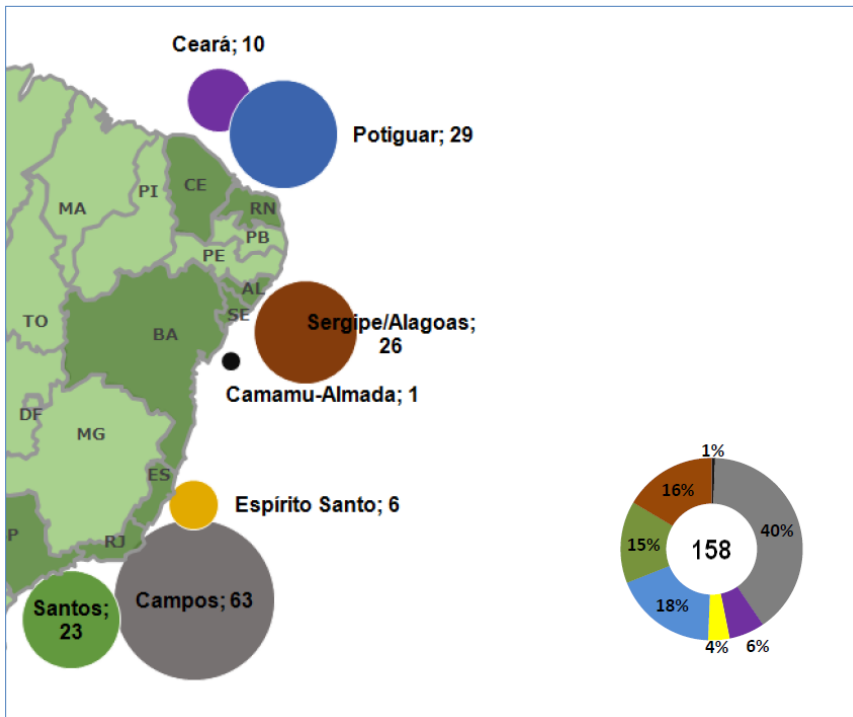
October 10, 2018

ANP – VI SOMA

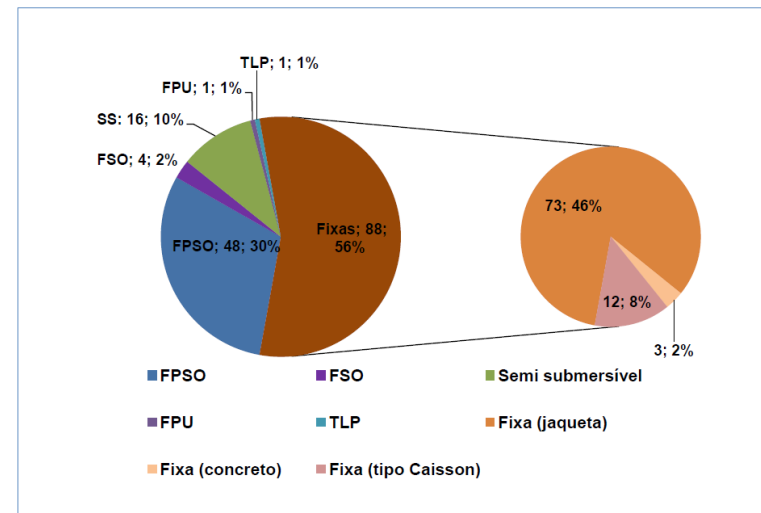
Industry vision regarding Decommissioning

# Brazil Offshore Perspective

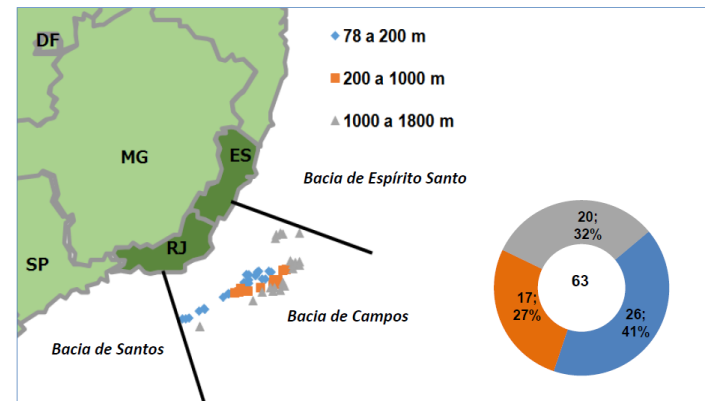
## Platforms per Basin



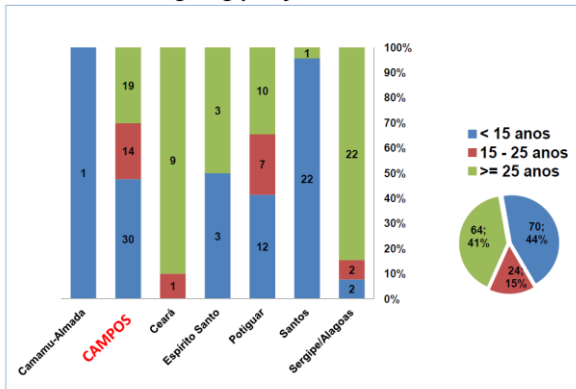
## Platforms per Type



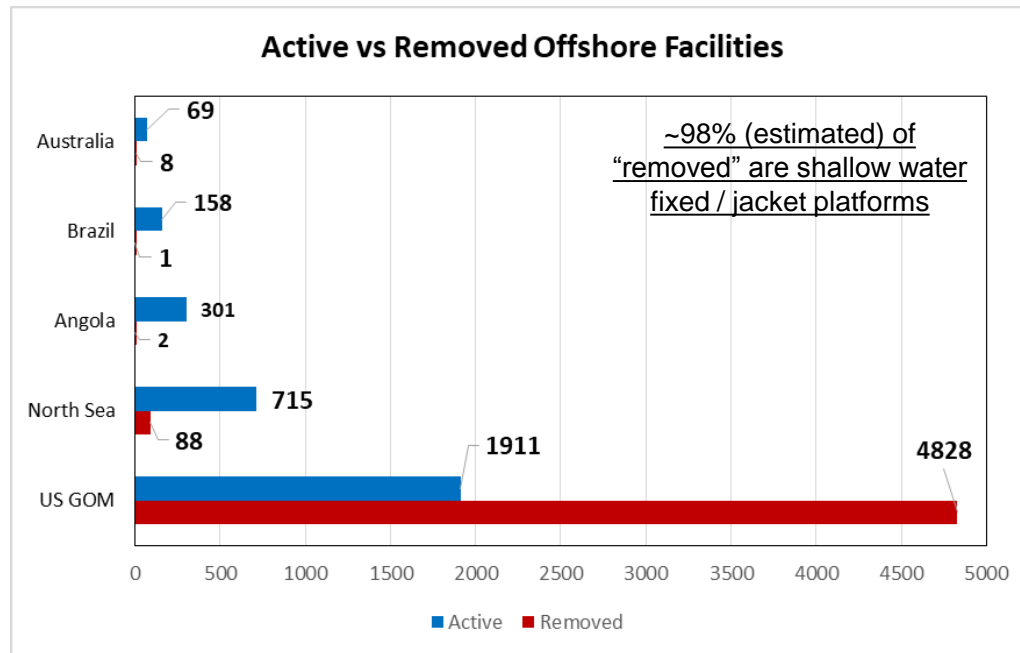
## Platforms per depth in Campos Basin



## Ageing platforms in Brazil



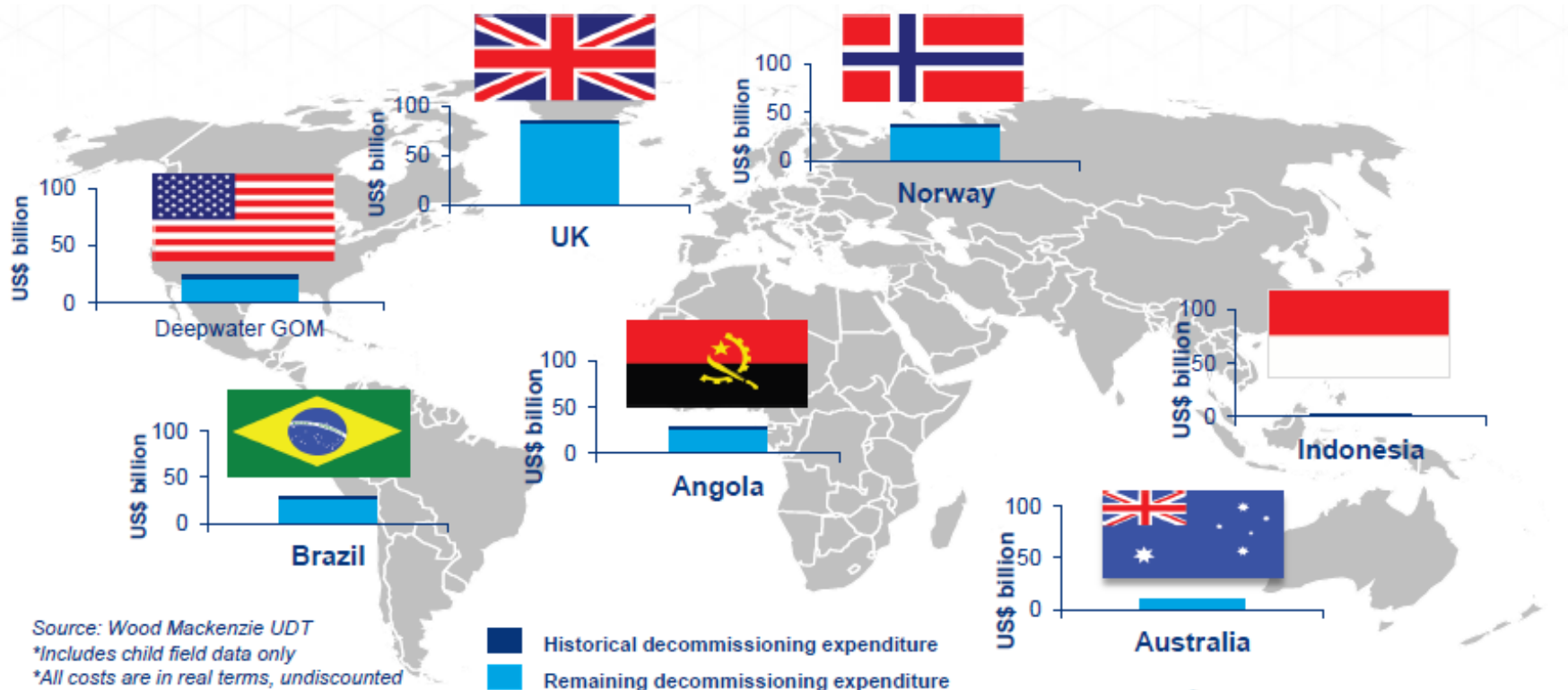
# Industry Perspective



## Publically available data

- Brazil – 158 facilities ~ 50% “deepwater”
- Angola - ~10% > 400m water depth, ~90% < 100m
- Australia ( Bass Strait & Western Australia) – ~48 SPJ, 3 GBS, ~14 FPSO/FLNG (max water depth ~ 130m);
- North Sea – average water depth 95m, max depth 700m (offshore Norway)
- US Gulf of Mexico – removal activities is circa 1947 (year) to present; **only 53 active facilities > 400m & only 1 removed >800m (Anadarko Red Hawk Spar....Spar was reefed)**

# Early Days in Global Deepwater Abandonment



13 Trusted commercial intelligence  
www.woodmac.com

 **Wood Mackenzie**  
A Verisk Analytics Business

Brazil estimated to be ~\$30G  
Annual decommissioning spend estimated to reach ~\$500M/yr in ~10 yrs (IHS)

# Vision

## **Achieving the right “balance” & scope of work**

- Clarity on scope of work leads to higher predictability of execution outcome – scope >100m depth
- Recognized decision making process where options are available...multi-criteria decision analysis...best option based on evaluation of 5 criteria (per UNCLOS/IMO)....safety, environmental, technical, other users of the sea/societal, economic
- Industry has demonstrated that complete removal is not always the best option (habitat retention)

## **Utilize Industry experience / learnings to accelerate the learning curve....no need to “reinvent the wheel”.... existing Industry processes have run time**

- Comparative Assessment – Oil & Gas UK
- Well Decommissioning Guidelines – Oil & Gas UK, June, 2018
- Flexible complexity of processes (i.e. qualitative vs semi-quantitative) – don’t require a more complex process if it does not provide value / improve the answer – CA is based on best available science & expert input

## **Operators need execution flexibility to optimize decommissioning / abandonment cost**

- Technology, contracting, & schedule

## **Recognition of repeatability / scalability with respect to regulations...differences in “deepwater”**

- Regional or “blanket” / water depth driven standards may be appropriate i.e. assessments of similar facilities / structures, similar environments, similar water depths, etc. should result in the same answer

# Objectives— Achieving the Right Balance

## Execution

Clarity of decommissioning scope of work leads to more predictable investment costs

Simple process for “remove / remain” decisions

Non prescriptive execution methods (“how”) & schedule allows flexibility to contract for optimum costs/ market conditions

Execution

Operational Safety

Technical Feasibility

Risk / Comparative Assessments

Protection

Environmental Protection

3<sup>rd</sup> Party Rights

Navigation Safety

## Protection

Environmental protection; other users of the sea

Navigation safety

Minimize long term impact, leaking wells, etc.

***Good balance = win / win for all stakeholders***





# Options / experience for underwater steel structures

Topsides – always removed



## Structure / Jacket Options

- Full removal
- Partial removal
- Reefing (in-place or remote)

+44m  
above  
seabed /  
122m  
clearance



## Jackets

- US Gulf of Mexico allows reefing (min clearance = 85' (26m))
- IMO A672 – minimum clearance of 55 m for any structure left in place
- OSPAR / North Sea regulations allows derogation case if SPJ weight > 10k mt



Offshore Magazine

Comparative assessment helps determine decommissioning options (June, 2013)

CNRI Murchison Platform – North Sea (installed 1979; topsides 24.5k mt, jacket ~27k mt)

<https://www.offshore-mag.com/articles/print/volume-77/issue-6/engineering-construction-installation/comparative-assessment-helps-determine-decommissioning-options.html>

# Options / experience for underwater concrete structures



Frigg GBS North Sea  
“Legs Up” (2005-2008 program)



Brent Delta  
“Legs Up” (2017 removal)

North Sea: All GBS left in place to date



# Brazil – large underwater steel jacket structures

MEXILHAO PMXL-1 PLATFORM

Fig. 1



Source: Petrobras

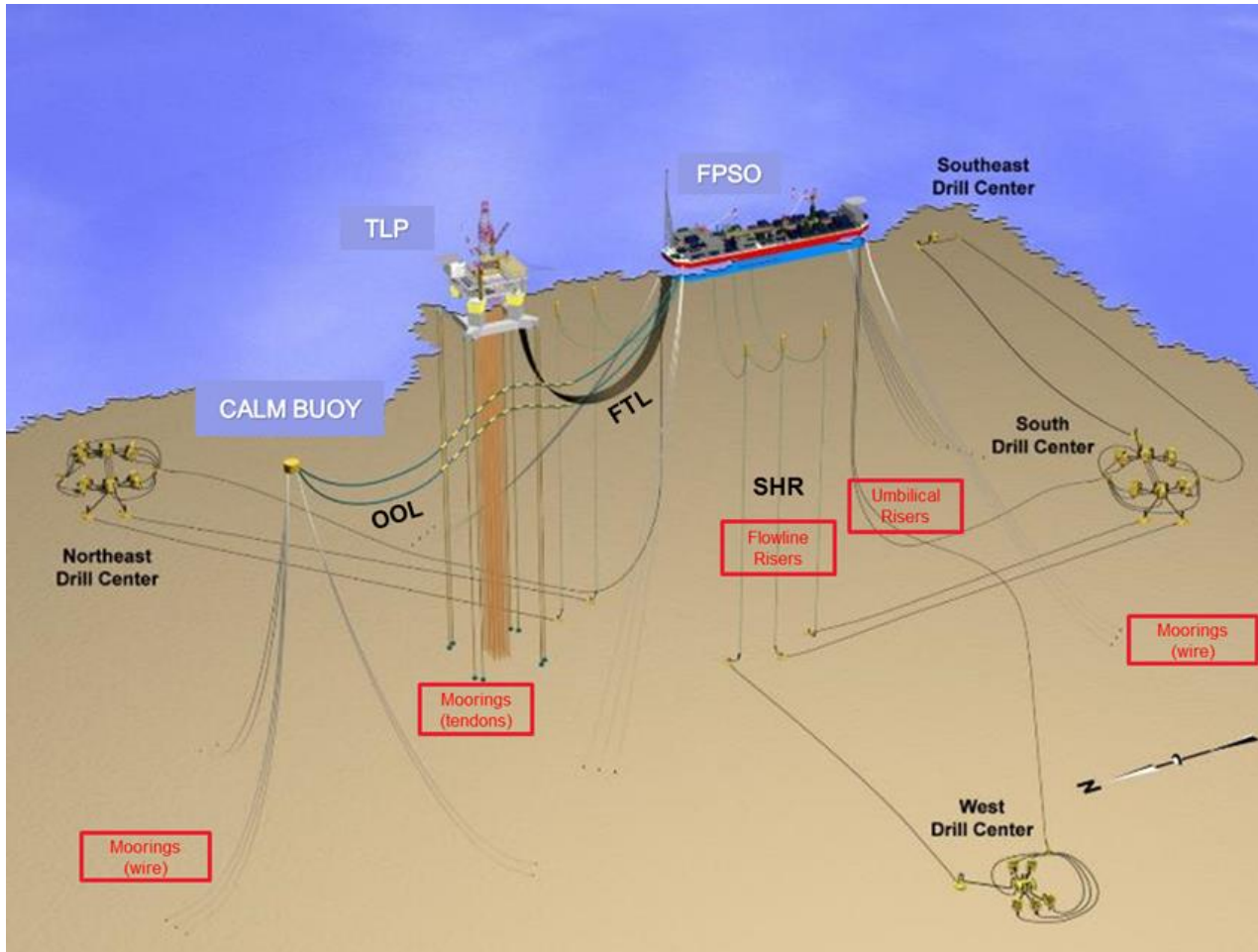
## Steel Piled Jacket

- 172 m (~560') water depth
- 11,300mt
- Skirt piles (removal to (-) 3m technologically challenging)

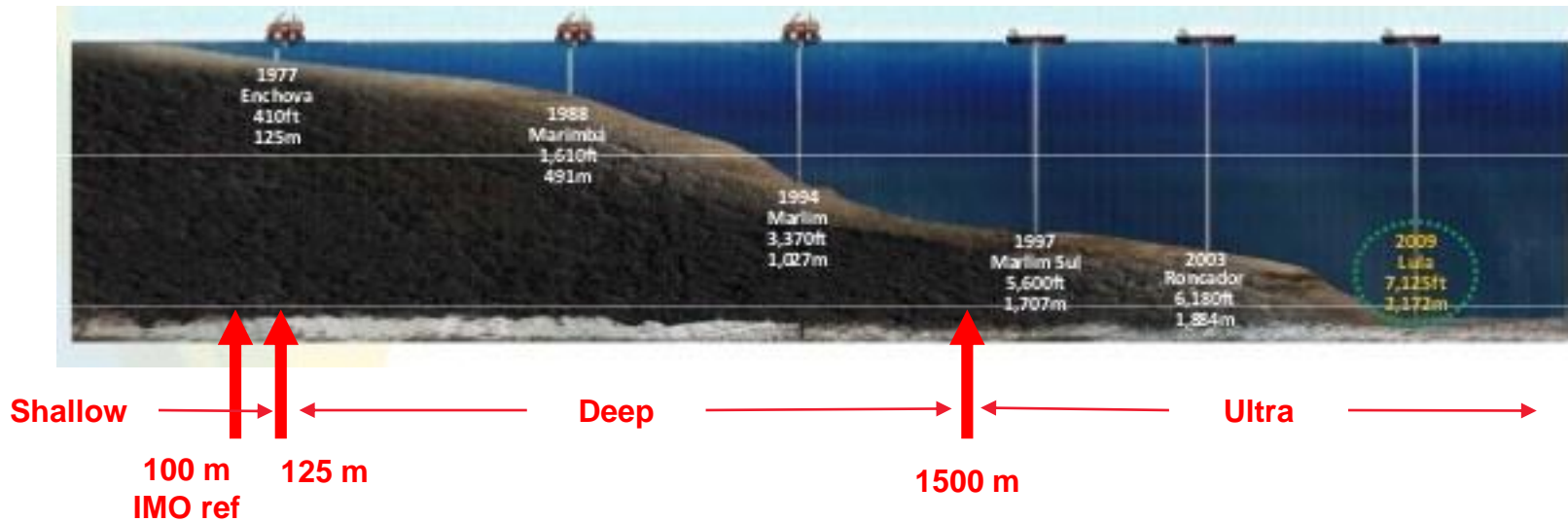
## Topsides

- 12,000 mt total weight

# Deepwater Facilities Decisions



# Water Depth Considerations



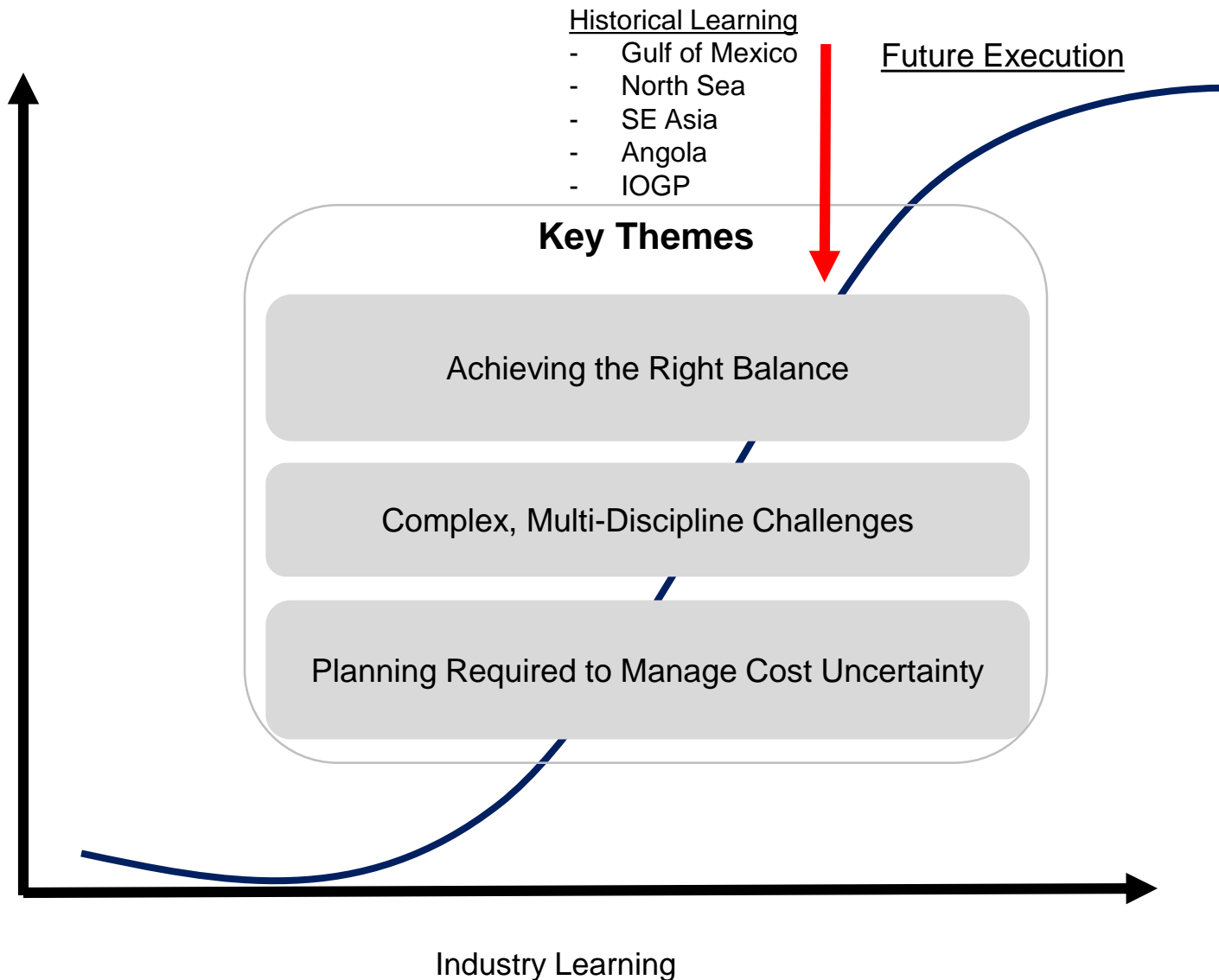
## Key Points

- International regulations & industry decommissioning experience lags deepwater development experience, UNCLOS / IMO current reference is 100m
- Scope of work is dependent on types of facilities & water depth
- Impact to other users of the sea diminishes and possibly no impact as water depth increases – consider “blanket” comparative assessment

# Angola Presidential Decree 91/18 (10 April 2018)

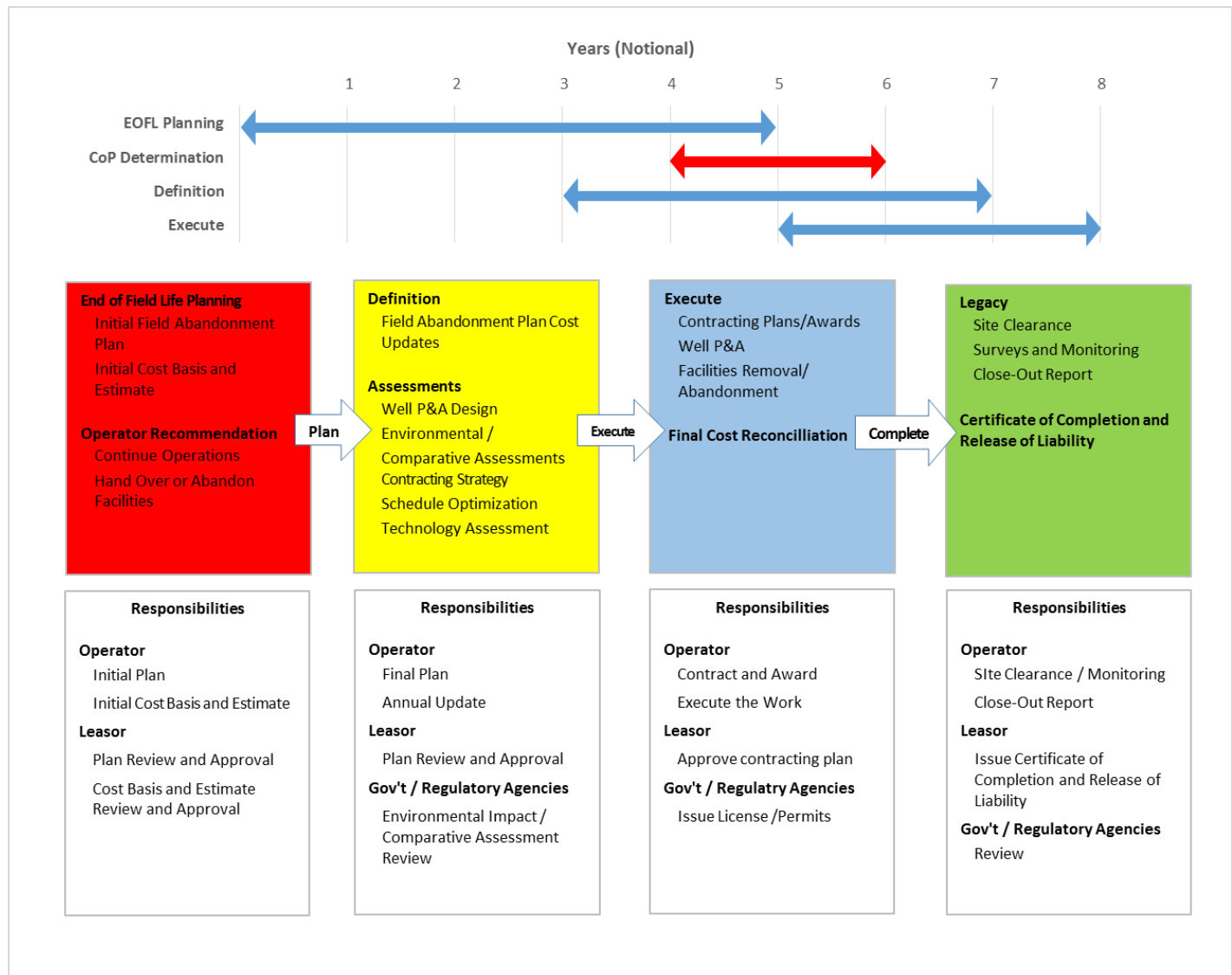
Facility Component	Water Depth	
	< 400 m	> 400m
Topsides	Remove	Remove
Floating Units (FPSO, TLP, FSO, FPU, CALM, etc.)	Remove	Remove
Oil Offloading Lines (OOLs), fluid transfer lines (FTLs), other jumpers between Floating Units	Remove	Remove
Substructures(SPJ, CPT, all others fixed to seabed)	Complete or Partial Removal <sup>(1,2,4)</sup>	Complete or Partial Removal <sup>(1,2)</sup>
Subsea wellhead & production equipment	Best Option <sup>(2)</sup>	Best Option <sup>(2,6)</sup>
Umbilicals including associated risers & structures such as SCM, SDU, UTA, etc.	Best Option <sup>(2)</sup>	Best Option <sup>(2,6)</sup>
Mooring systems for floating facilities (wire & chain, tendons, suction piles, etc.)	Best Option <sup>(3)</sup>	Remain
Export pipelines, infield flowlines	Best Option <sup>(3,5,8)</sup>	Remain
Risers / riser components, & structures associated with pipelines / flowlines such as F/PLET, F/PLEM, valve manifolds, etc.	Best Option <sup>(7)</sup>	Remain

# Decommissioning Journey





# Planning Cycle



- *Process mapped from beginning to end*
- *“Trigger” for initial plan typically linked to remaining reserves & size of field (e.g. 25-40% RUR but not less than 5 yrs)*

Thank You  
Obrigado