# All Electric System as a Key Enabler for Long Distance Tie-backs

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DEEPWATER DEVELOPMENT

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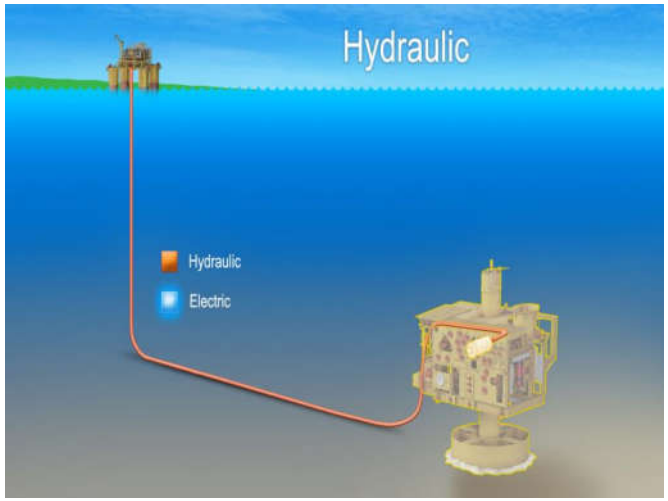
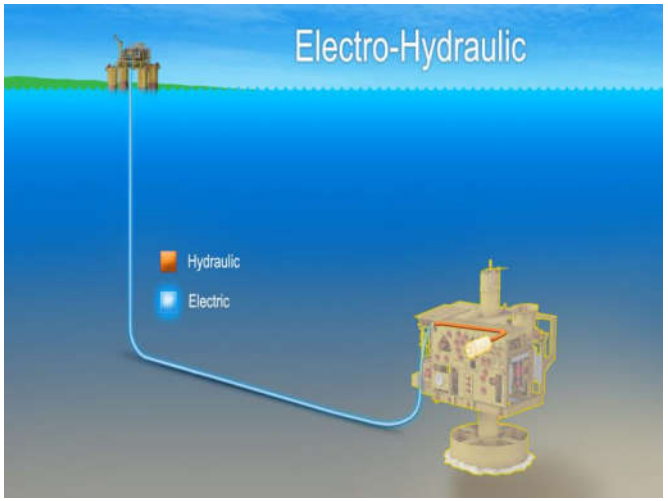
# Agenda

- Subsea Technology Evolution
- Ultra-Deep Water and Long Tie-backs Challenges
- All Electric Technology Drivers
- Subsea Power Distribution Efficiency
- Subsea DC All Electric Milestones
- Subsea All Electric Technology Today
- All Electric Technology Future
- AES vs E+H Cost Analysis
- Closing Statements

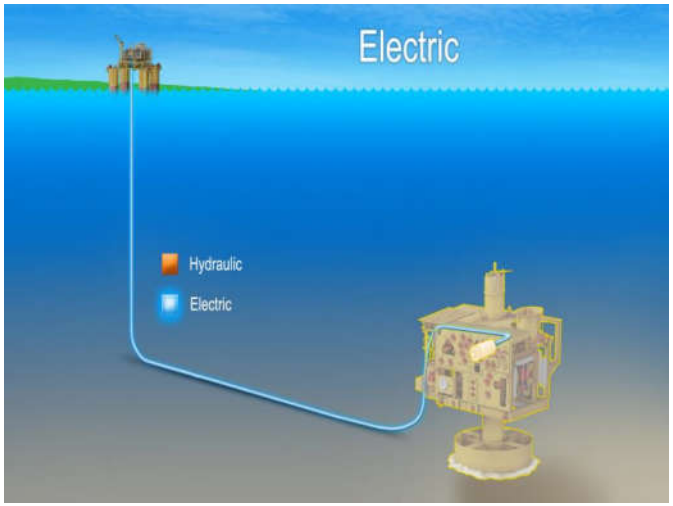
# Subsea Technology Evolution




**Hydraulic System:**
Cheap and low tech solution.




**Electro-Hydraulic System:**
More efficient approach since the 80's.




**Electric System:**
Eliminates the need of hydraulic power, enabling ultra-deep water and long step out development.

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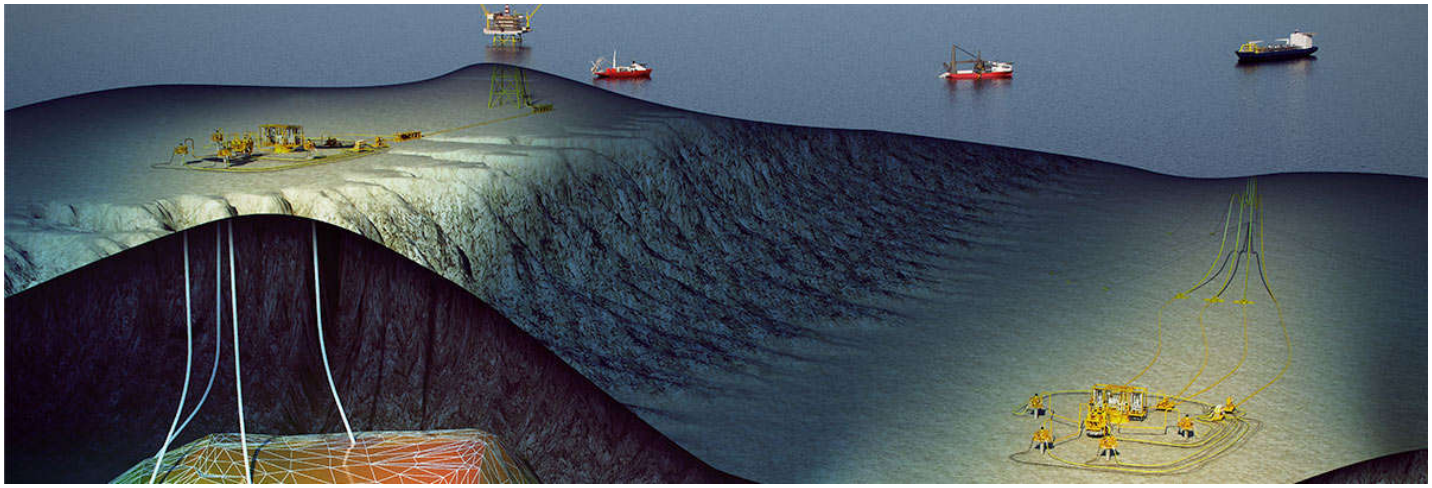
# Ultra-Deep Water and Long Tie-backs Challenges



- Distance from existing installation
- Water depth
- Recoverable volumes, reservoir size and complexity
- Tariffs for processing the produced fluids on an existing installation
- The potentially higher recovery rates from platform wells, due to easier access to well intervention and workovers…

CAPEX/OPEX

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# All Electric Technology Drivers

## Reliability

- Fewer parts, more standardized modules
- More reliable overall system

## Operability

- Increased System Capabilities
- Enhanced diagnostic features
- Surveillance and health assessment

## Maintainability

- Preventive Maintenance
- Reduced system downtime
- Pro-active intervention planning


## CAPEX/OPEX

- Reduced umbilical diameter
- No hydraulic fluid consumption
- Reduced intervention time
- Simplified equipment


## Game-Changing

- Better response time and rapid control
- Elimination of Deep Water/Long Step out limitations
- Environment-friendly

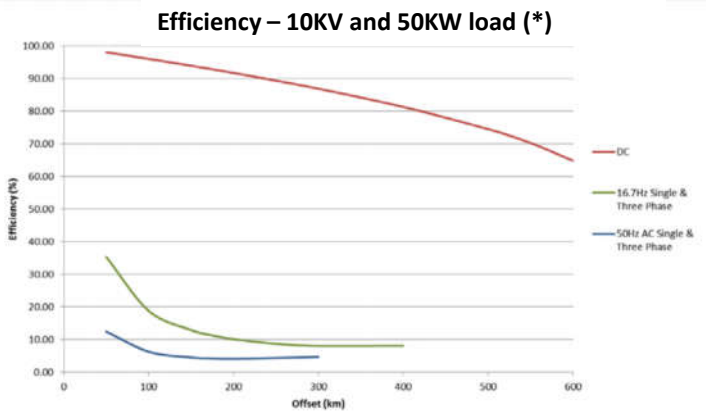
# Power Distribution Efficiency – Where it all started

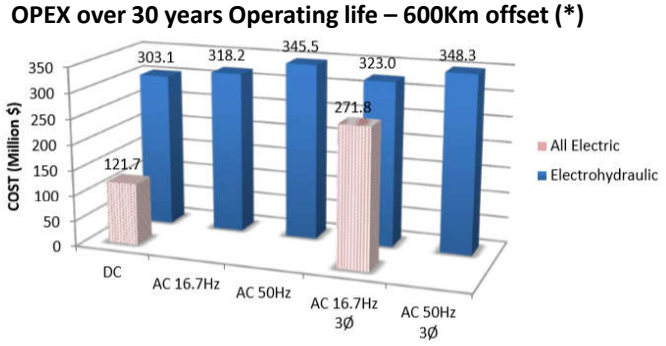
# Subsea Power Distribution Efficiency

- All Electric offers a clear advantage over Electrohydraulic systems.
- DC delivers largest coverage of power vs offset compared to AC.
- CAPEX and OPEX savings when comparing All Electric vs Electrohydraulic systems.

*"The results of the electrical analysis and economic evaluation indicate that the **all electric solution could provide not only the most technically proficient solution but also the most cost effective in satisfying the requirement for longer tie-backs and higher power demands**... In all cases, the total costs associated with an all-electric system operating over a 175km tie-back are lower than the traditional electrohydraulic equivalent. The same is true in the case of a 600km offset cluster, however at this tie-back distance further benefit can be achieved by the selection of DC over AC."(*)*

**** Source: Viper Subsea, Power Delivery and Umbilical Cable Optimization for Long Offset Tiebacks***

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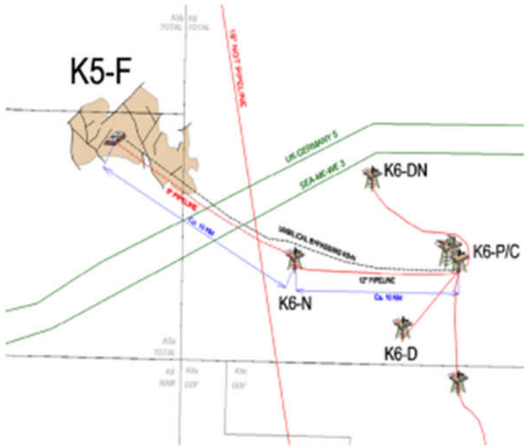
# Subsea DC All Electric Milestones

- Customer Name: Total
- Project Name: K5F
- 3 off Mudline style Xmas Trees
- Water Depth: 44 m
- Step out 18 km
- Actuator reliability – 100% to date




**1999**

**2004**

Successful Pilot Trial BP Magnus

**2008**

Successful Start – World's first All Electric Production System (Total K5F)


**2012**

Second Generation DC All Electric System

**2014**

Rotary Valve Actuator Qualification (1MM Movements)

**2016**

Installation of ESCSSV in K5F3 project

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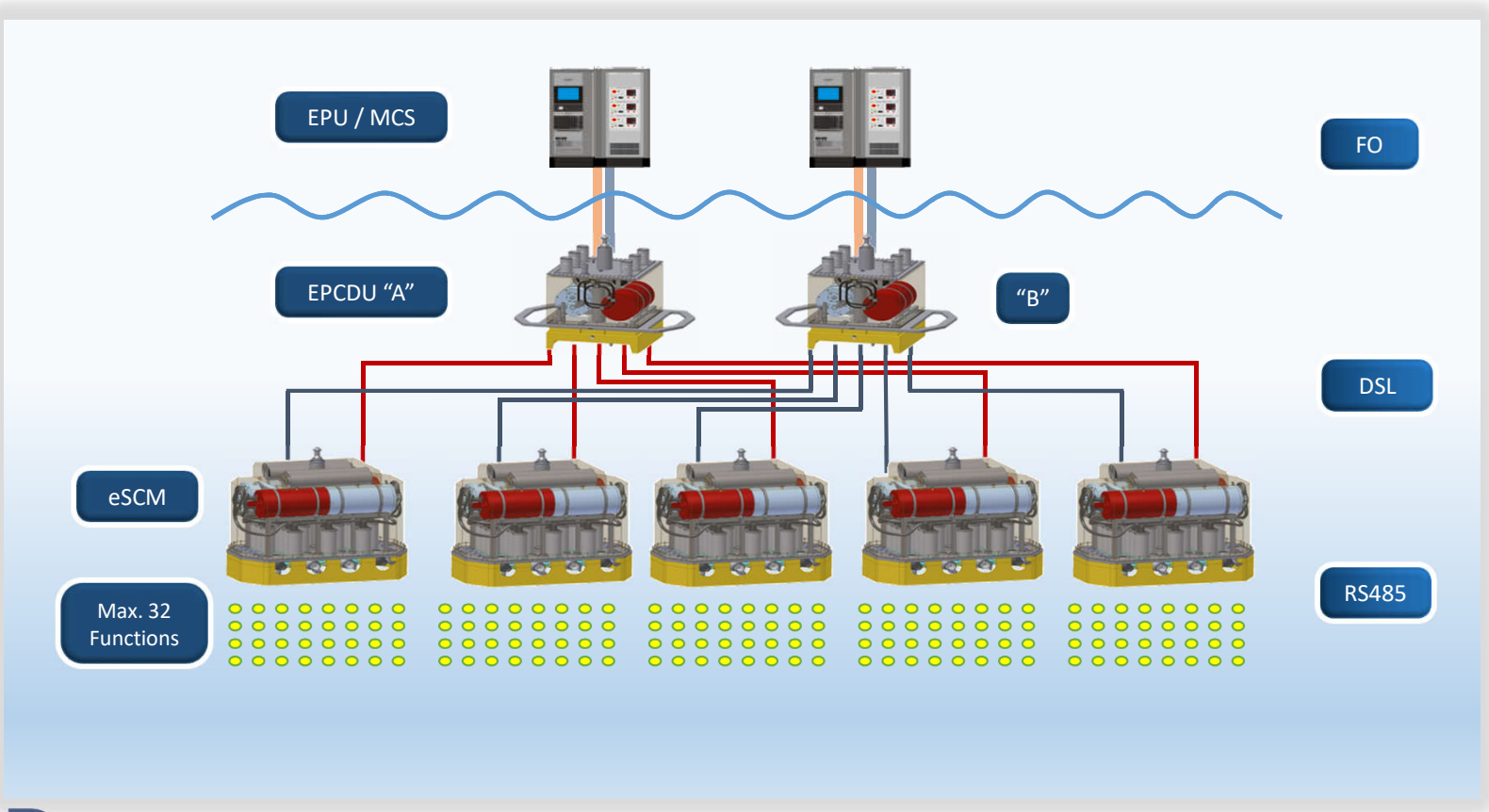
# Subsea All Electric Technology Today



# Subsea All Electric Technology Today

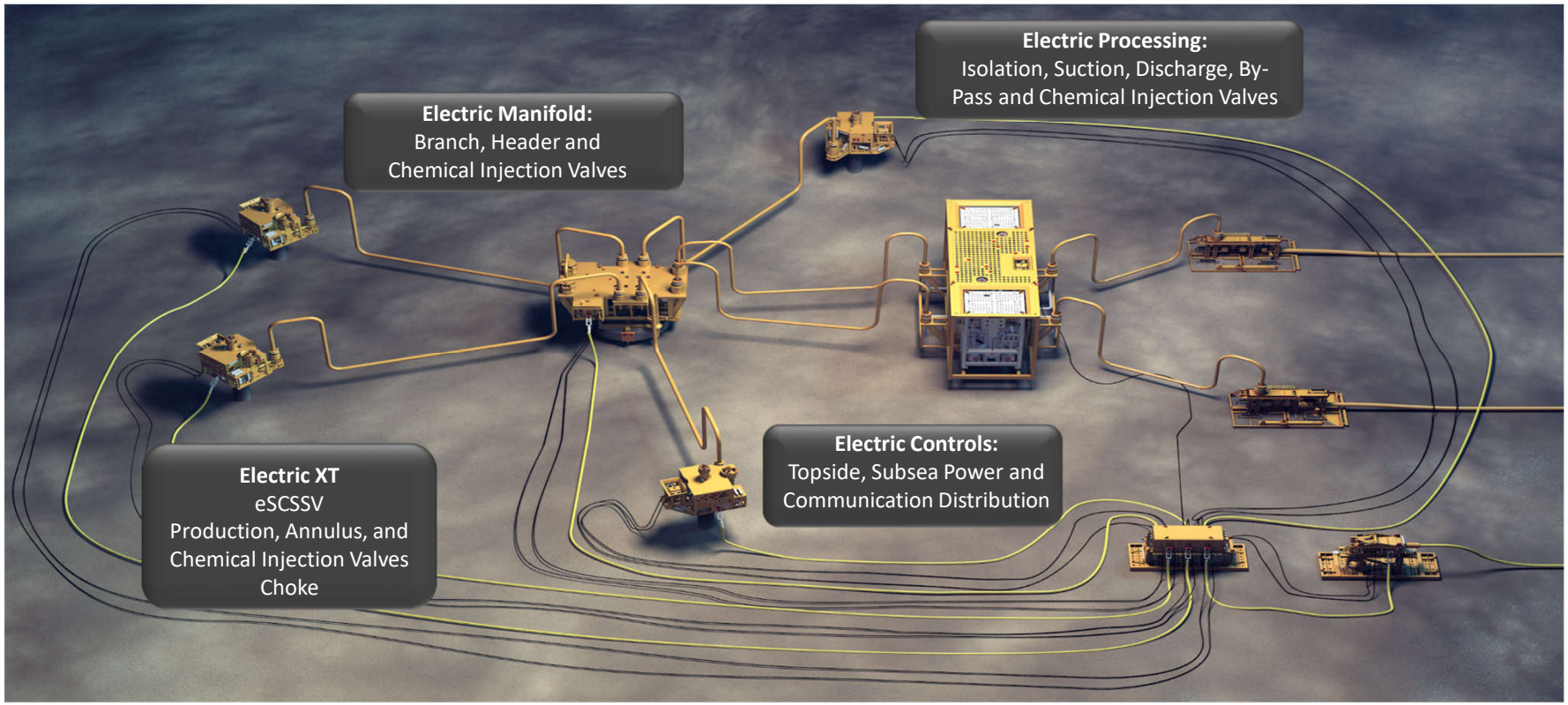
**eSCSSV**
Electrical downhole safety valve.

**Linear**
Spring Return, Fail-safe electric actuators.

**Choke**
Absolute position indication and no-stepping

**Rotary**
Drop-in-Place Fails as is electric actuators

# Subsea All Electric Technology Today

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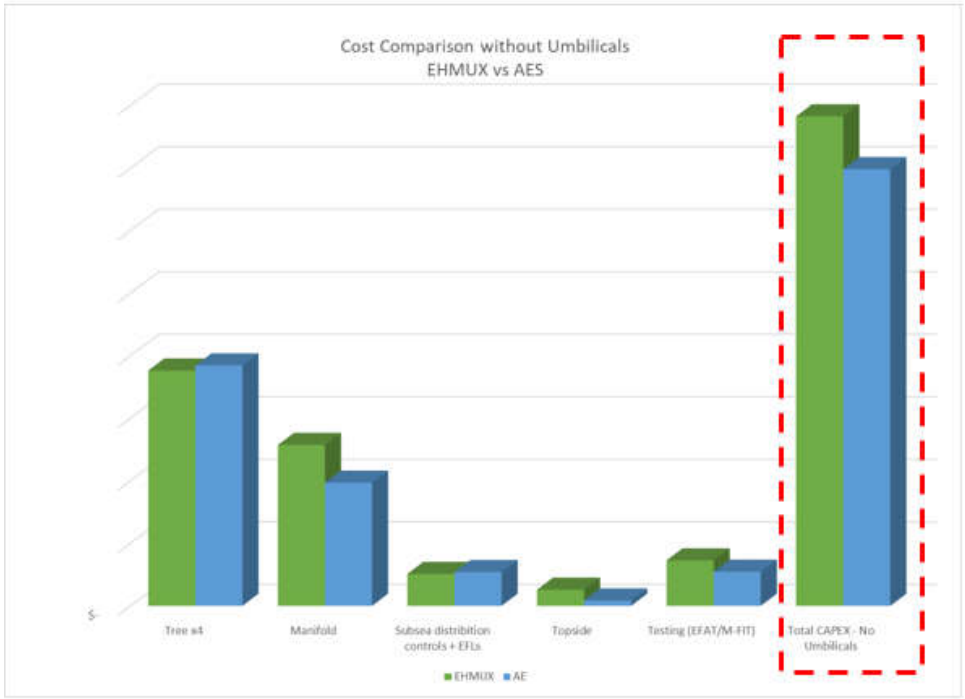
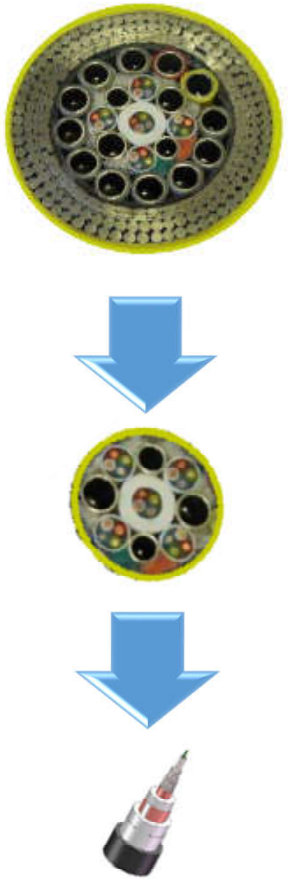
# AES vs E+H Cost Analysis

| Scope of Supply Cost Comparison | Savings |
|---|---|
| AES Savings vs. Electro-hydraulic (not including umbilical) | 11% |



Cost Savings: 30%

Cost Savings: 70%

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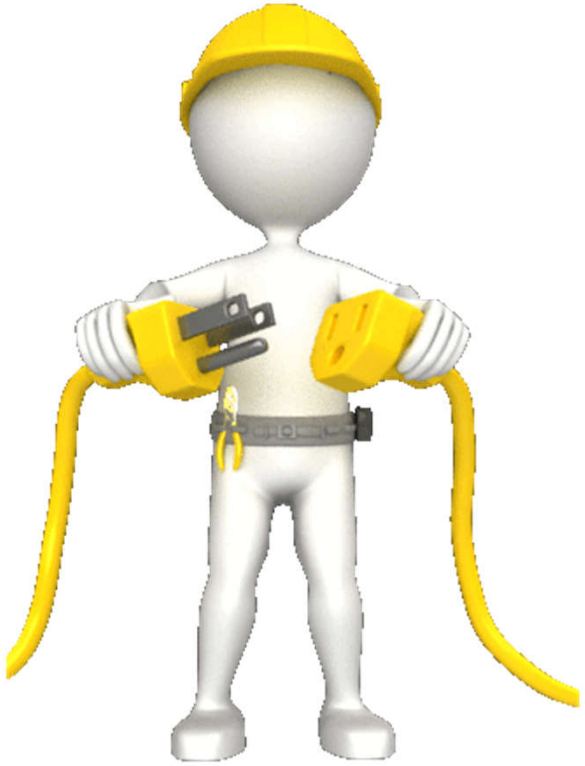
# All Electric Technology Future

- Closing technology gaps:
  - Valve sizes
  - Subsea Chemical Injection
  - Battery management systems
  - Integration to existing Electro-Hydraulic Systems.
- Cost Reductions

# Closing Statements

- For Ultra Deepwater and long tie-backs, All Electric Systems offer a more economical solutions than Electro-Hydraulic Systems.
- DC Power distribution has proved to be more efficient than AC power distribution.
- Subsea All Electric Technology is available today.
- Subsea All Electric technology can reach far longer distances than ever considered with Electro-Hydraulic Systems.

<u>AE is the key enabler for long distance tie-backs!</u>



# Questions?

Contact Information for additional questions:
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