



# Alternative ESP Deployment Selection

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# Agenda

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- Introduction
- Alternative Deployment methods available and specific challenges for each method
- A tailored approach to ESP deployment selection.
- Example deployment selection
- Further Evaluation of Facilities – Rig Up Height
- Key Points in Deployment Selection
- Summary

# Introduction

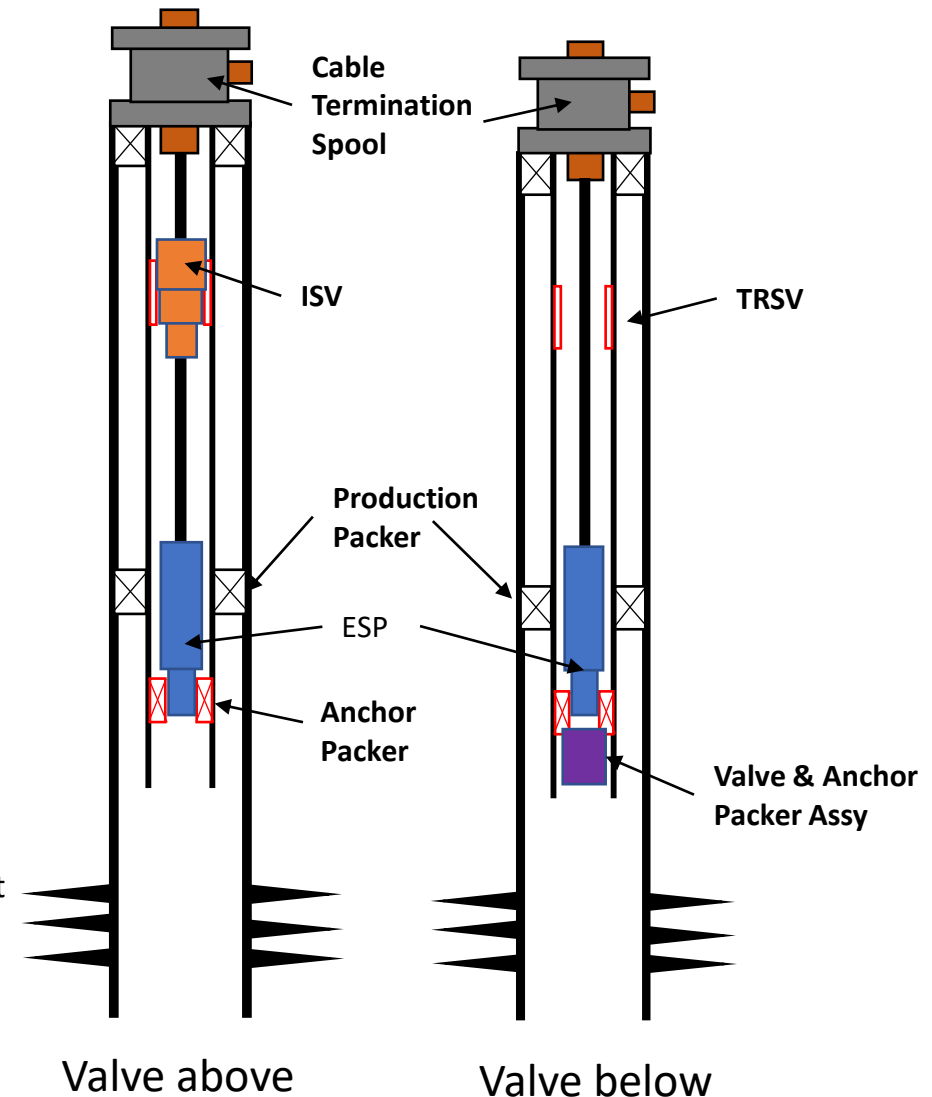
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- Why are operators keen on the idea of Alternative Deployment?
  - Simpler platform designs for new ESP projects.
  - Reduced cost in ESP replacement.
  - Less waiting time for rig or crew i.e. less deferment or loss of product.
  - No need for a rig at all for certain deployments (live well cable deployment).
  - Inexpensive and flexible alternative to CT nitrogen unloading.
  - Temporary installation over failed ESP or gas lift well with integrity issues.
- What are the challenges thrown up?
  - Technology readiness; perceived reliability issues with limited operational data.
  - Installation “do-ability” – working over a live well with long ESP strings.
  - Platform design: installation, handling, power, controls, etc.
  - Cost vs. conventional for equipment.

# Alternative Deployment Methods – Power Cable Deployed

## Key Features

- Generally, comes as an inverted ESP design (pump at bottom, motor at top).
- Most options utilize PMM to keep system length and OD to a minimum.
- Deployable on modified or standard wireline winch.
- Capable of live well deployment
- Utilises anchor packer technology for setting pump and spacing out cable.
  - Variations available
  - ISO 14310 packings
- Uses an insert safety valve:
  - Discharge pressure activated valve below ESP.
  - Cable through valve above utilizing existing valve hydraulics.
  - API 14A qualified valve
  - ISO14310 qualified packings
- Uses a wellhead termination spool as a cable exit with cable hanger:
  - Electrical connector/hanger alignment within riser above tree and alignment within spool.
  - Qualified to API 6A.



# Alternative Deployment Methods – Power Cable Deployed

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## Advantages

- Lightweight deployment with slickline and wireline equipment
- Easy interventions once comfortable with deployment technique
- Can be installed without killing the well – live well deployment
- Can be retrofitted in existing wells with minor modifications and minor facilities modifications.
- Can be installed quickly (with good planning and preparation installation should be very quick).

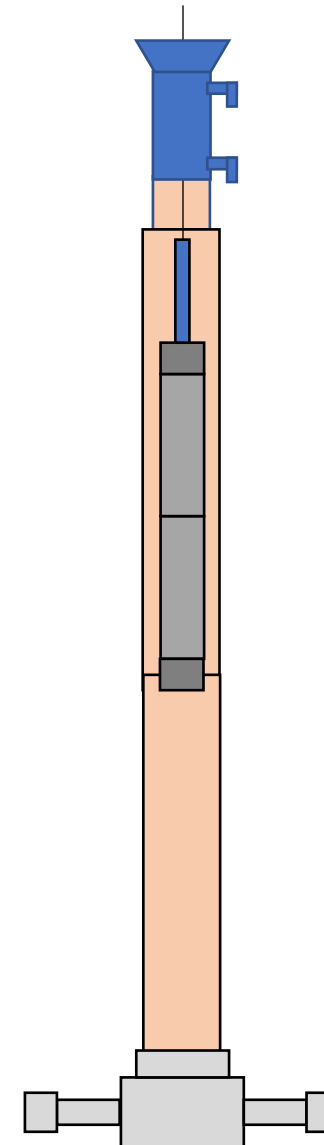
## Disadvantages

- Very few installations globally
- Limited flow range available (despite high-speed operation pump OD is limited to keep weight and length down).
- Limited horsepower (length becomes an issue with multiple motors).
- Careful well selection criteria required (susceptible to gas interference and possibly solids fallback).
- Requires careful space out of cable.
- Equipment in some cases may still be under development
- Requires meticulous planning with a slightly different approach on almost every asset.
- Difficult/limited setting in highly deviated tubing

# Alternative Deployment Methods – Wireline Deployed

## Key Features

- Systems available with PMM and Induction type motors.
  - AccessESP: PMM
  - SLB: Induction
- Deployable on standard wireline winch.
- Capable of live well deployment using lubricator and PCE.
- Utilises wet mate connector for downhole connection. Two types available.
- Access below ESP available from one supplier
- The cable becomes part of the “permanent” completion and the ESP motor, seals/protectors and pumps become retrievable.
- Long life cable available from one manufacturer.
- Deployment varies by manufacturer:
  - SLB full system in one run
  - AccessESP 4 runs.



AccessESP: Male wet mate connector



SLB Zietecs: wet mate connector

# Alternative Deployment Methods – Wireline Deployed

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## Advantages

- Lightweight deployment with slickline and wireline equipment
- Easy interventions once comfortable with deployment technique
- Can be installed without killing the well – live well deployment
- Many case histories globally from major suppliers/operators
- May be able to use pumps and seals from a preferred vendor
- Purpose designed cable systems for long life available.
- Could be used for a combination ESP unloading/Natural Flow/Late Life

## Disadvantages

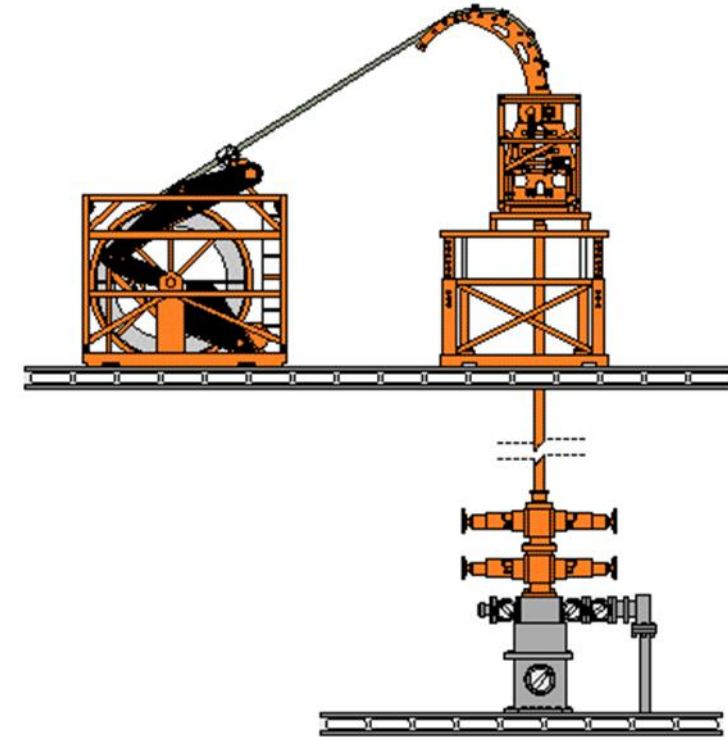
- Initial cost are likely to be expensive compared to other rigless options
- The first installation requires a rig to prepare the completion. Cable is permanent.
- Larger companies focused more on conventional deployment and have wireline as a product line.
- Small WR-ESP companies may have tight manufacturing schedules.
- Length of systems for live well deployment can present a challenge for rig up height.
- ESP companies may not be so competent with rigless deployment particularly since every asset is different.
- Difficult/limited setting in highly deviated tubing

# Alternative Deployment Methods – CT Deployed (cable outside)

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## Key Features

- Deployable on 2-3/8" and 2-7/8" CT
- More like a standard conventional ESP deployment
- Can use a conventional production packer
- Could use a conventional tubing retrievable safety valve
- Uses a conventional tubing hanger.
- Not for live well deployment





# Alternative Deployment Methods – CT Deployed (cable outside)

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## Advantages

- Uses mostly standard ESP components
- Low cost option
- Some good but limited case histories globally
- Requires no special well preparation
- No limitation on ESP provider – available from all as a standard ESP system.

## Disadvantages

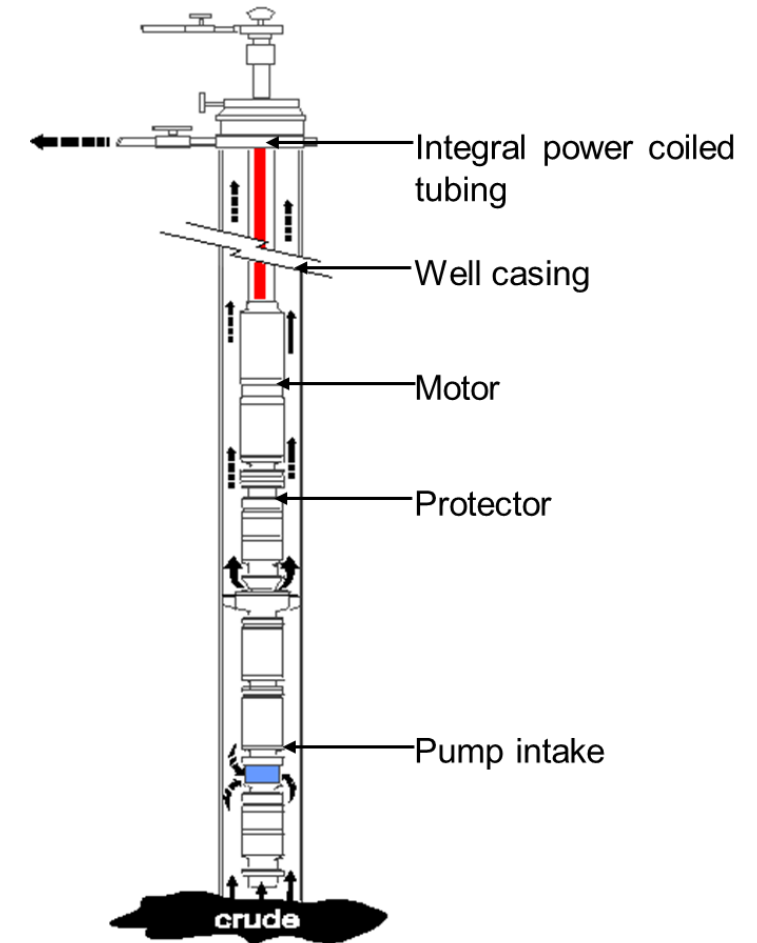
- Limited to 2-7/8" coil tubing as max size
- Difficult to find API 5CT coiled tubing connectors, makes installing packers and safety valves tricky.
- Setting packer (if needed) may require standing valve.
- Large footprint and heavy installation equipment
- Requires in house completion expertise

# Alternative Deployment Methods – CT Deployed (cable inside)

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## Key Features

- Cable inside coiled tubing - no clamps required
- Inverted ESP design (pump at bottom, motor at top).
- Uses stinger or discharge pack-off to prevent recirculation.
- Since cable comes out via top of tubing a horizontal tree is used.
- Traditionally the most common alternative deployment method.
- Most designs are not for live well deployment.



# Alternative Deployment Methods – CT Deployed (cable inside)

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## Advantages

- Uses a lot of conventional components.
- Historically the most commonly used form of alternative deployment.
- Available from big name ESP providers.
- Good case histories globally.

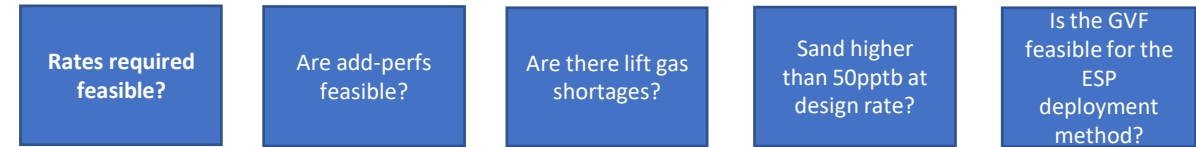
## Disadvantages

- Long lead times.
- Requires careful space out of completion.
- Requires knowledgeable personnel for deployment.
- Large footprint and heavy installation equipment.
- Cost of some options may be off putting.

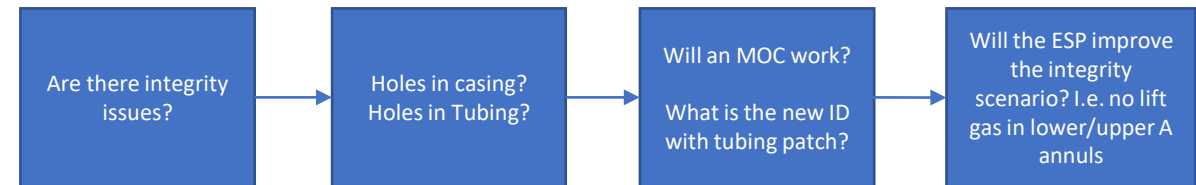
# A Tailored Approach to Deployment Method Selection

- Evaluate the field and wells to understand what deployment methods will work. For example:
  - Does field have a sanding problem?
  - Do wells have excessive free gas?
  - Do wells have integrity issues?
  - What are the rates expected from the wells?
  - What are the well barrier regulations?
- Conduct an economic study and understand what makes sense financially:
  - Is it a new field where wells will be drilled and completed with a rig?
  - Is it a mature asset where bringing a rig in would severely erode the economic viability?
  - What other intervention work might need done i.e. add-perf, integrity work?
  - What other equipment/facilities might be needed to make alternative deployment doable?

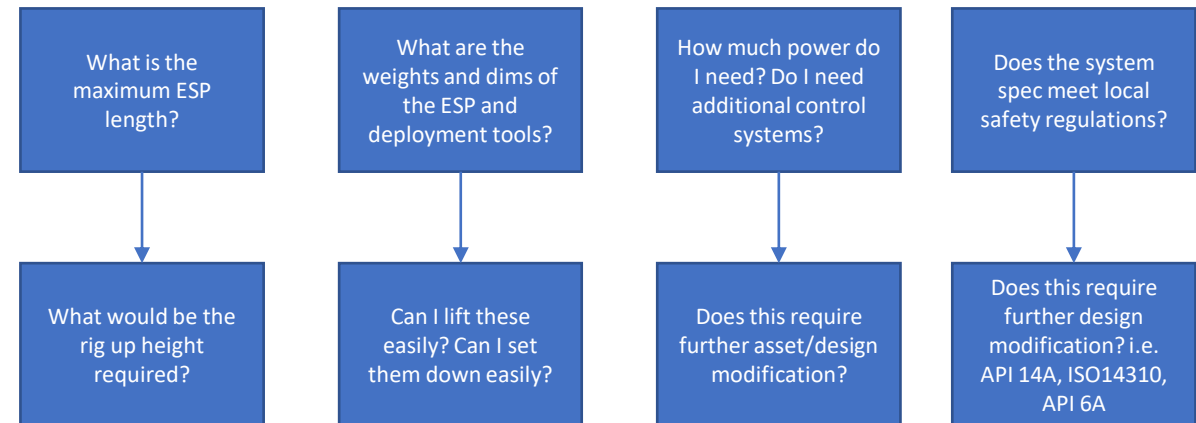
## Basic technical



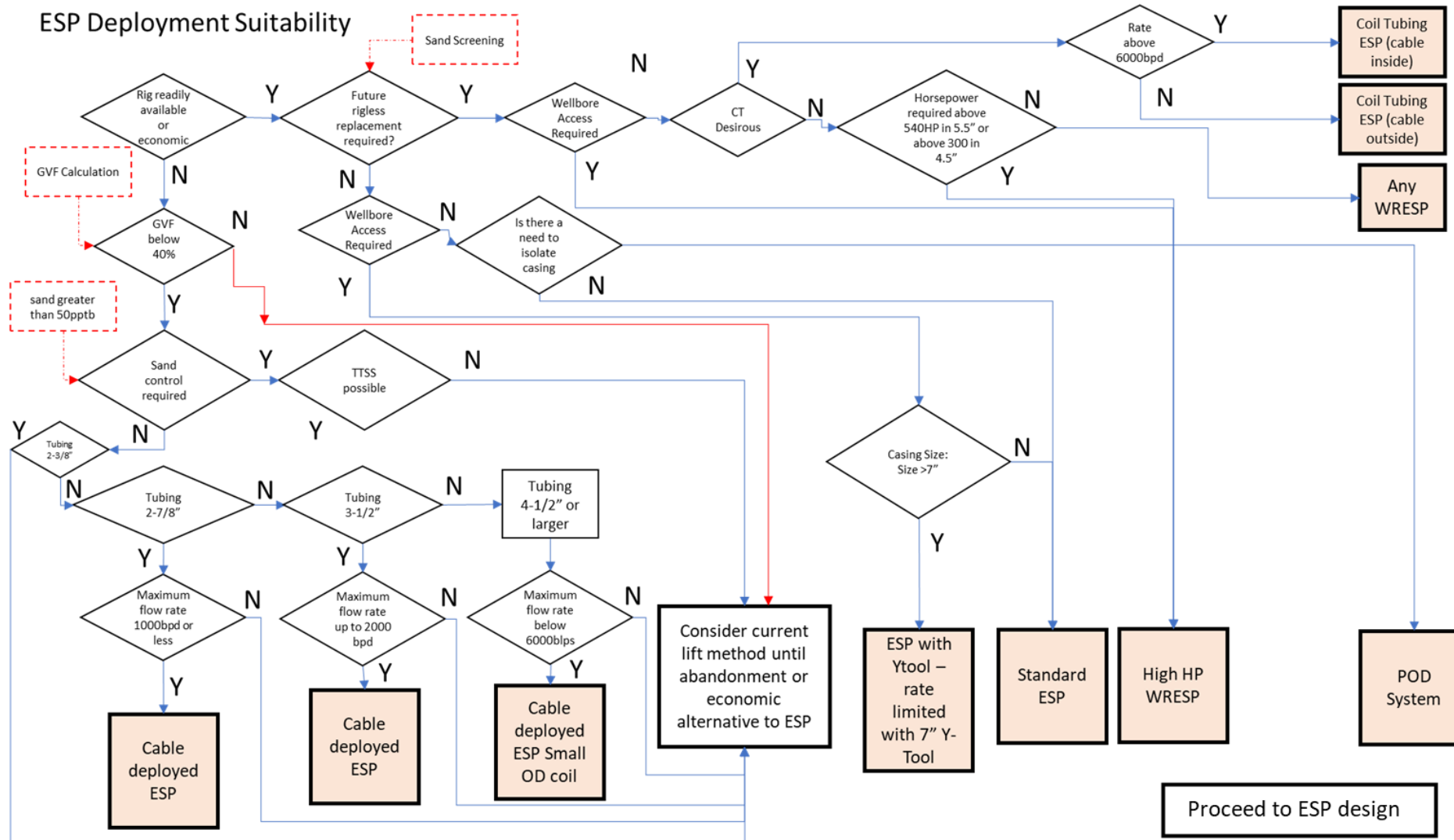
## Basic integrity



## Basic logistical & regulatory



# A Tailored Approach to Deployment Method Selection



**Note: gas handling and sand should be assessed case by case.**

# A Tailored Approach to Deployment Method Selection

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Using the previous workflow here are some examples of deployments selected based on requirements or limitations:

## High HP WRESP Selected:

- a. GVF not considered but within bounds of ESP handling capability.
- b. Alternative deployment preferred
- c. Rig available for first installation and economic
- d. 5-1/2" tubing
- e. Sand screening favorable
- f. CT not desired
- g. Horsepower above 540HP

## Cable Deployed ESP Selected:

- a. No rig available
- b. No sand control required or already installed
- c. GVF below 40%
- d. Tubing 2-7/8"
- e. Maximum desired rate less than 2000bpd

## Cable Deployed ESP Selected:

- a. No rig available
- b. No sand control required or already installed
- c. GVF below 40%
- d. Tubing 4-1/2"
- e. Maximum desired rate less than 6000bpd

Next steps would include full ESP design as well as facilities and utilities evaluation including site visits if possible.

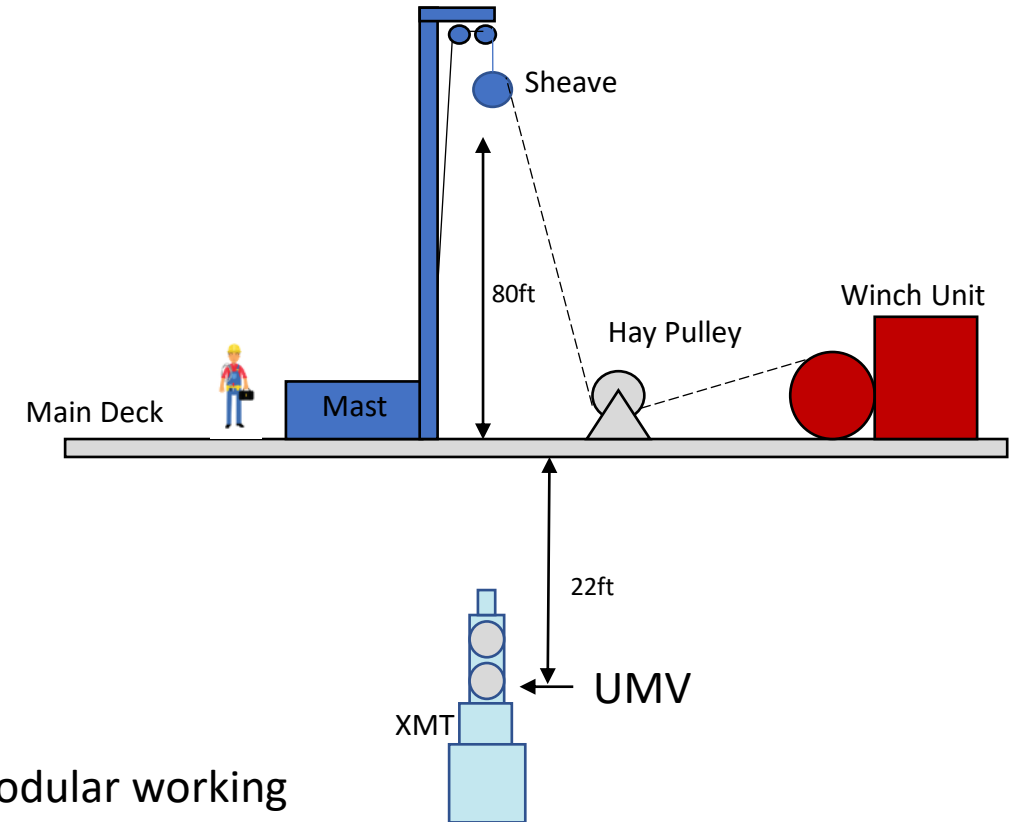
# Further Evaluation of Facilities – Rig Up Height

There are many scenarios an operator may find themselves having to evaluate technically but one of the key challenges with alternative deployment is rig up height for live well deployment:

Example (live well deployment):

- Maximum mast height = 90ft (usable height ~80ft)
- Tree cap below working deck = 20ft
- Distance to Upper Master Valve (UMV) = 2ft
- Total working height for live well ops = 102ft
- Must leave room for lifting lubricators and slickline tools

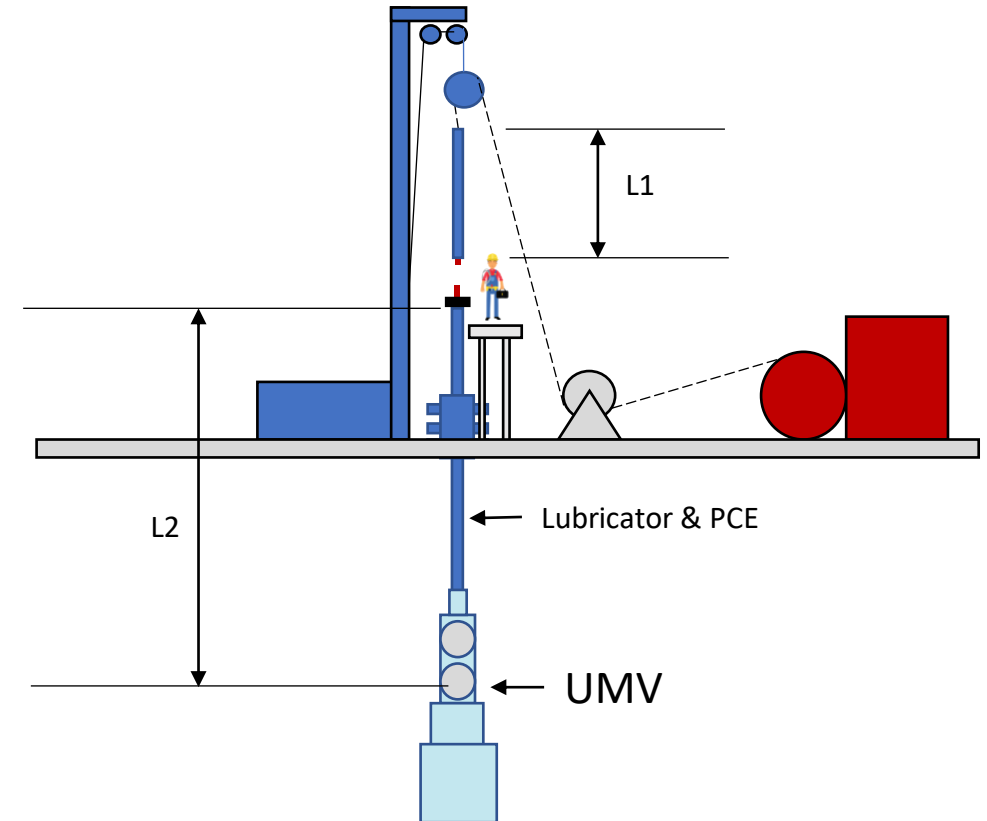
Towers are now available that can replace the mast and offer modular working height arrangements



# Further Evaluation of Facilities – Rig Up Height

Rig-up height is only one part of the puzzle for live well deployment:

- The length of each section to be built must be considered so that working height can be established and lubricator lengths selected.
  - Dimensions L1 & L2 are critical.
- How to handle the next piece of the string.
- Type of alternative deployment used i.e. wireline or cable deployed.
- Manufacturer specific challenges
- Weight on Mast crown and auxiliary winches.
- Crane availability and working area footprint.



Note: towers are now available that can replace the mast and offer modular working height arrangements



# Revision

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Review the plan, make sure you have all you need:

If you have added significant items to accommodate the deployment methodology, revise the project schedule and economics if required.

# Key Points in Deployment Selection

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- Fully understand the alternative deployment methods and their distinct advantages and disadvantages.
- Make sure that alternative ESP deployment is the way to go for the target asset and commit to it.
  - Ensure the deployment strategy matches the well conditions – flowrate, sand production, gas, completion size constraints, etc.
  - Ensure all requirements to make the methodology succeed are considered in the economics
- Fully understand the practicality of the installation from a lifting and handling perspective – ease of intervention is a major benefit and should be leveraged.
  - Write the installation procedure early.
- Review the plan!

# Summary

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- Alternative ESP deployment has been around for decades but does not have the same volume of case histories as conventional tubing deployed ESPs.
- Alternative ESP deployment can offer major advantages over conventional and cost savings if planned properly.
- Alternative ESP deployment is more complex than conventional deployment techniques.
  - Each deployment type requires special attention
  - Even changing asset may require a change in strategy

# Close

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Thank you!