TRIDIUM

25 Years

NS2024

POWER OF PARTNERSHIP

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Niagara Beyond Buildings

From the Well Head to the Charger

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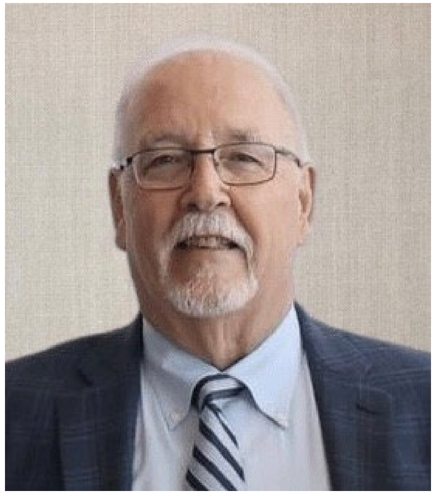
Panel



Ed Merwin
Tridium

Jagdish Naik
TAS

Andy Abrams
EVauto

TOTAL AUTOMATION SOLUTIONS

JAGDISH NAIK

- Established 2004
- Houston, Oman, Pune
- Tridium Development Partner
- Strong Product /Embedded Systems development / Cloud infrastructure Experience
- 100+ Engineers, 20+ Developers

- Offering Leader for TAS
- Formerly 32 Years with Honeywell International.(Industrial and Buildings Controls)
  - Global Roles in Technology/Engineering /NPI and Product management, new Growth initiatives, and P&L management.
- Founded Global Engineering Centres for Honeywell (Direct Business and Channel partner businesses including Tridium partners)
- PAC leader and Product Leader for the development and deployment of enterprise-scaled open-source platform in Honeywell's High-growth regions.
- Lived in the US, UK, JAPAN, South Korea, and India.

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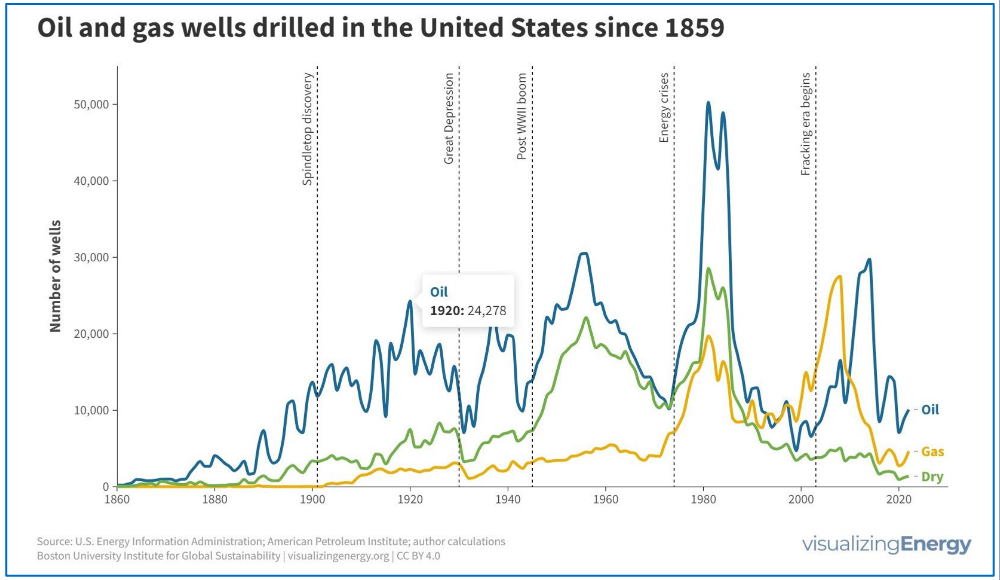
ROD PUMP CONTROLLERS- OIL AND GAS – THE CONTEXT

What is this project About?

Historical Data- The U.S



- TX 43%,
- ND 12 %,
- NM 10 %
- OK 4 %
- CO 4 %
- Rest Of USA 27 %

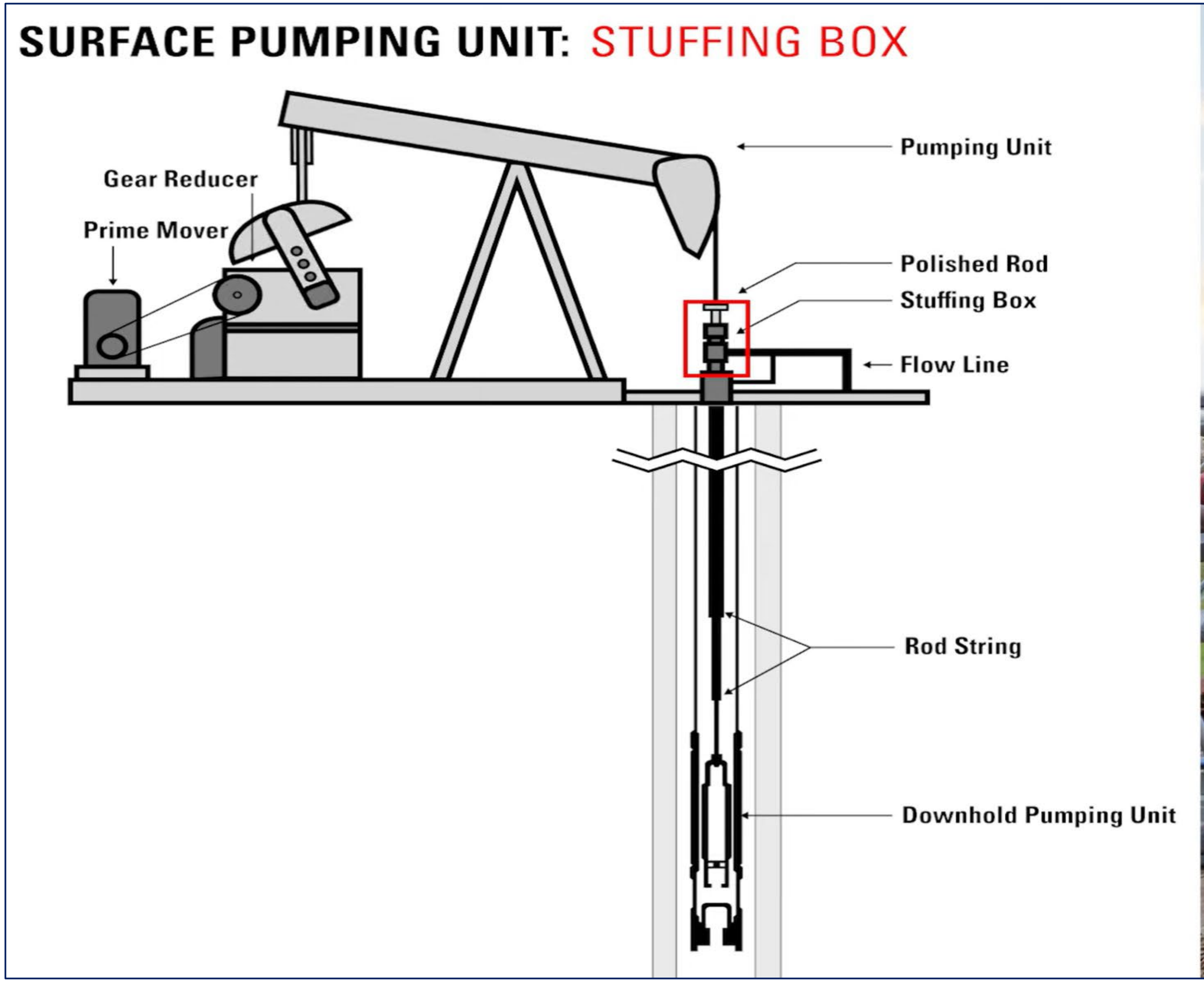
Opportunity Data

- ~ 1 Million active Oil wells in the US
- Approximately 75% of all US oil wells i.e. 750,000 wells are stripper wells (~ < 15 BPD lift)
- Per Well Revenue by operator ~ $220K to $300K
- RPC investments ~ $6K to $7K/Well +Subscription to Analytics

The Problem we are solving ..

- Minimize /Eliminate rod and Tubing failures
- Lower Downtime and Improve Production levels
- Minimize Operation cost (Labor/Power/Maintenance improvements)

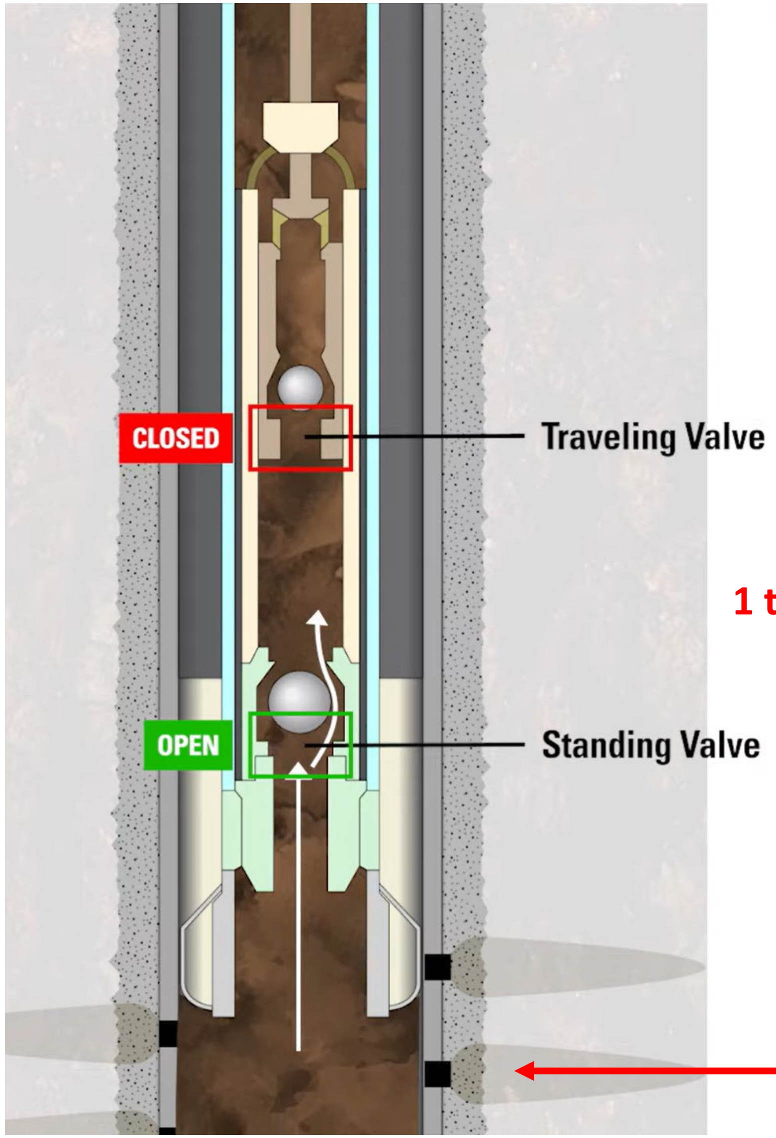
PUMP JACK- BEAM PUMP- THE BASICS



ROD PUMP OPERATION

UPSTROKE

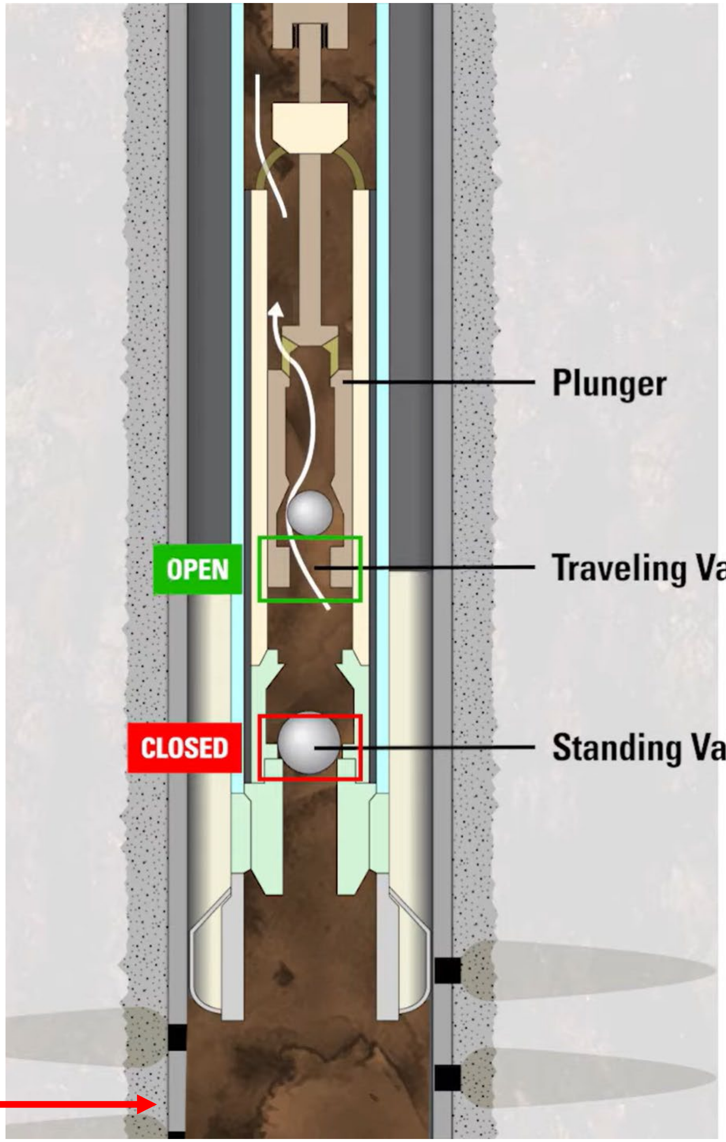
Oil moves up from the Reservoir to the Pump Chamber



1 to 6 Kms Depth

DOWNSTROKE

Oil moves up from the Pump Chamber to the upper/ground level

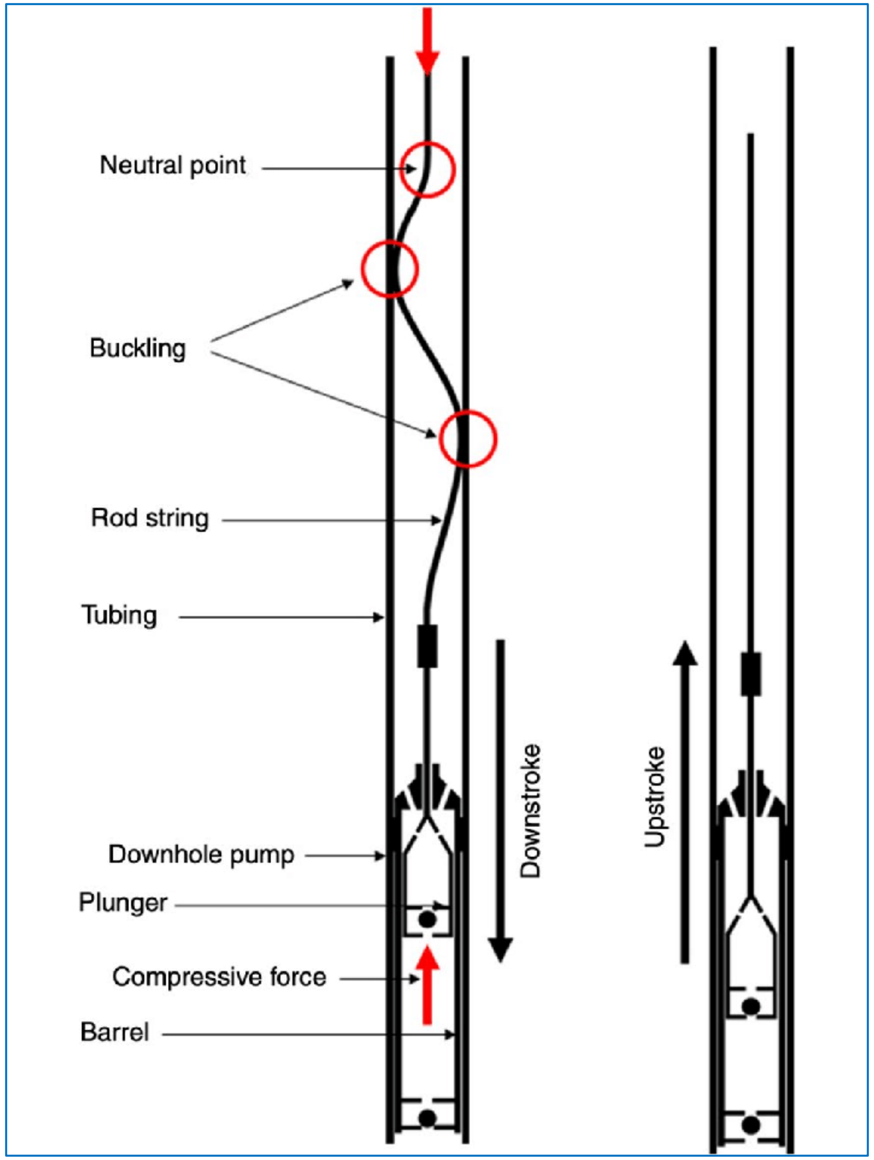


Oil Reservoir

MAJOR ROD PUMP FAILURES

Major Failures :

- **Subsurface pump**
- **Sucker rod string or**
- **Tubing string**



ROD PUMP - WHY AUTOMATE ?

Customer Needs

- Improve Asset Life /Reduce equipment wear
- Reduce Maintenance (VERY expensive)
- Reduced downtime/ Increased production
- Reduced power consumption
- Reduced Labor

Offering / Solution

- Rod Pump Controller Automation. N4 Modules at Well level.
- Analytics ON Pump fillage, Valve conditions , Pump displacements, Gearbox Net Torque estimations in the cloud
- Native APP availability.

Features

- Predictive Algorithms creating Downhole card from RPC Surface Card.
- Geo Map based Remote Monitoring and control of Oil & Gas Assets like RPC
- Well Test Manager /Scheduler
- Production and Downtime Analytics

Outcomes

- Controllers reduce rod and tubing failures by ~20 to 30 % and electric costs by 20 to 40%, equating to about $50K savings
- Reduced Downtime improves Production by 15 %
- Reduced Operation costs

i.e. (Labor/Power/Maintenance improvements)

WHAT IS INVOLVED ? –SENSING AND CONTROL

Inputs/Outputs

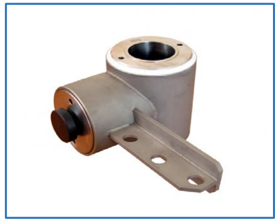
- Five Analog inputs
  - Casing, Tubing Pressures, Flow Line Pressure, Load and Position
- Eight digital inputs

- Pump Run status, Push buttons etc

- Four digital outputs to the Electrical Panel

Sensors

•Wireless Load Cell & Position Data
•Polished rod load cell (Wired Option)
•Tubing pressure sensor (optional)
•Casing pressure sensor (optional)



Control

•Downhole based Pump control
•Timer based control
•Automatic restart after power Failures
•Oil/belt/gearbox service reminders
•IEC 61131 programmable logic

Hardware

- 115/230 V AC supply input
- Weatherproof design
- **Rugged** NEMA 4R polycarbonate enclosure

Communication

- Wired local/remote serial ports
- Modbus RTU, TCP protocols
- OPC-UA Protocol
- MQTT Protocol

Road Map

- Bluetooth interface (optional)
- Wireless radio (optional
- Cellular modem (optional)

Data Flow

RPC Panel → RPC | MODEM | DNP3 / MQTT → Customer SCADA / ADVAIT (TAS's own Platform)- On Prem +Public Cloud Deployment

HOW ROD PUMP CONTROL WORKS ?

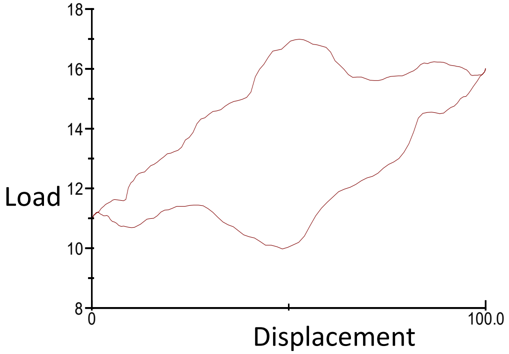
Pump / Well Head Information

Field Sensor data

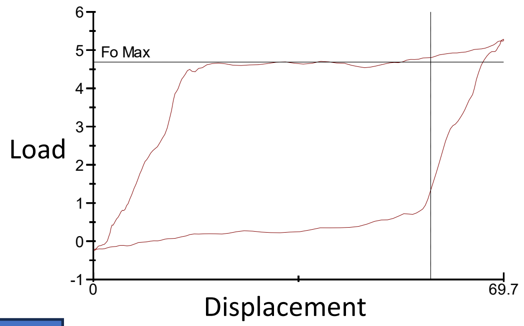
Operation Commands Start / Stop / Interlocks

- Viscosity of Oil
- Rod string Data
- Well Depth

Surface Card Generation



Apply Wave Equation Processing & Other Analysis



Downhole Card Generation

- Calculated Pump Fillage
- Determine Pump /Valve Condition
- Calculated Pump Displacement
- Gearbox Net Torque Estimated
- Production Results

Alarm Processing / Actions

Resulted Actions

Logging Data Historical / Reporting

Pump Starts/ restarts on Timer or Downhole Pressure gauge

- Protective Action to be taken up (if any)
- Request for Change in Speed of the pump (If VFD)
- Start / Stop Actions based on Fillage

Data Collection

Analysis and Data Processing through Equations

Results of Downhole and Pump Status Information

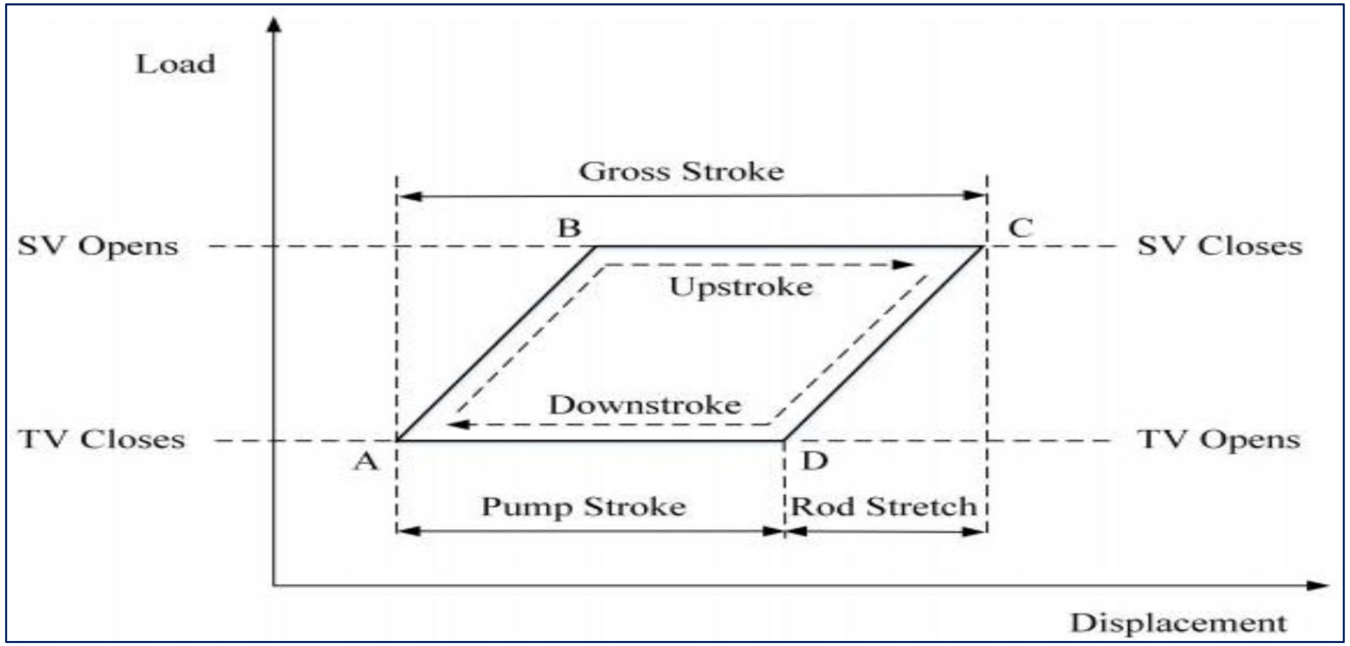
Actions on Pump

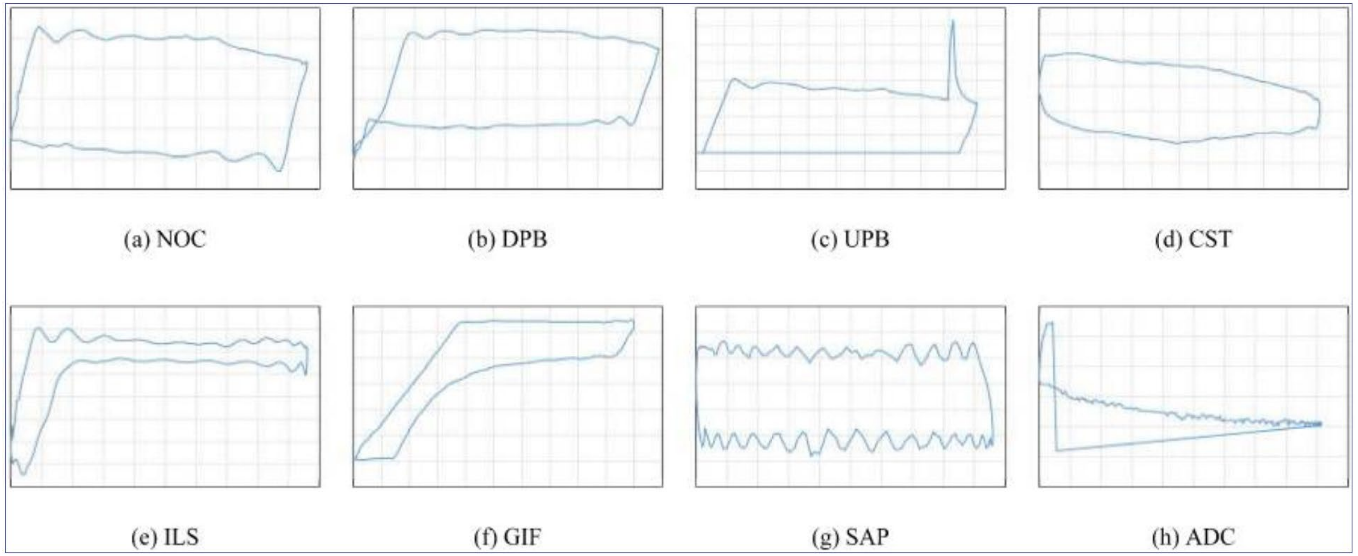
WHAT IT MEANS ?

Typical working conditions of the sucker-rod pumping system, where the horizontal axis denotes the **displacement**, and the vertical axis denotes the **Load**:

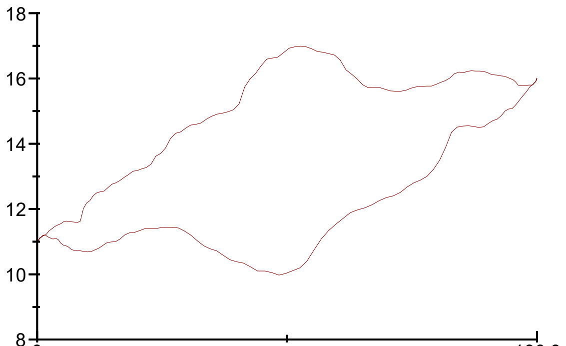
<u>Diagnosis:</u>

(a) Normal operation condition,
(b) Downstroke pump bumping,
(c) Upstroke pump bumping,
(d) Combination of leaking standing and traveling valves,
(e) Insufficient liquid supply,
(f) Gas interference,
(g) Sand production,
(h) Abnormal dynamometer card.

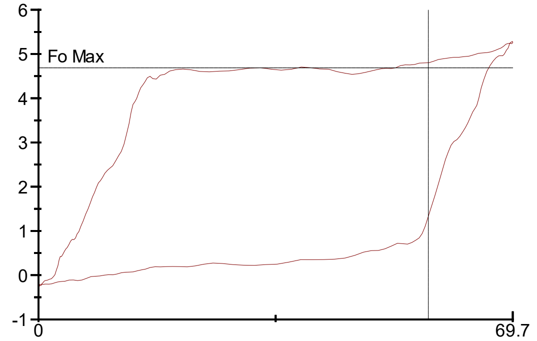




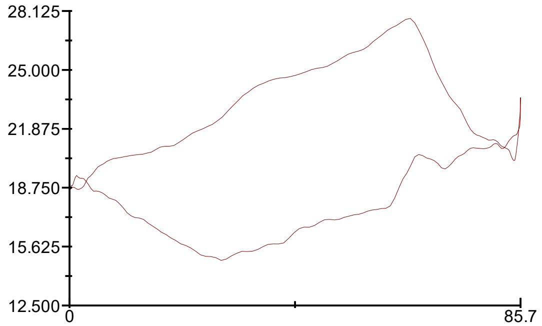
RPC OUTPUT DERIVATION FROM FIELD INPUTS



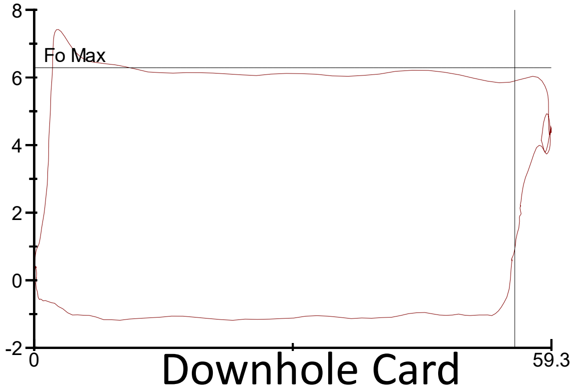
Surface Card



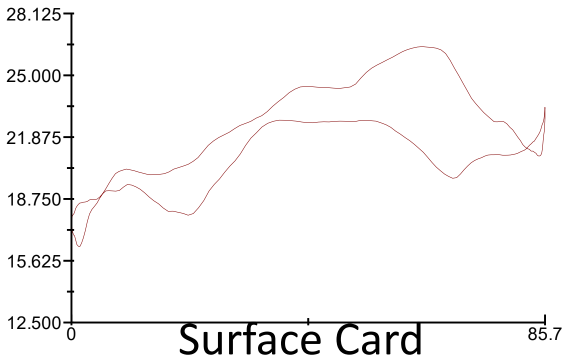
Downhole Card



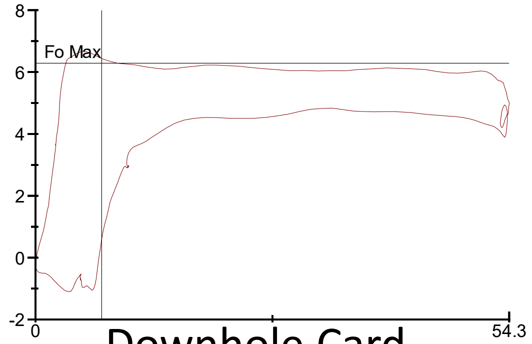
Surface Card



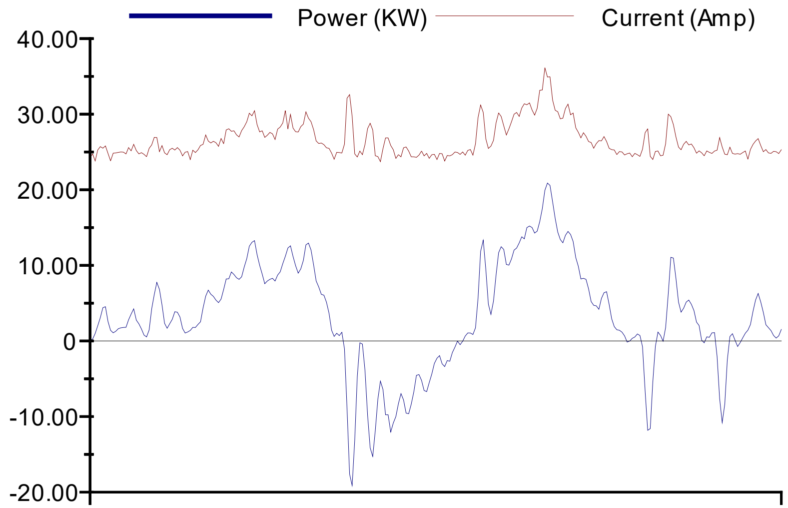
Downhole Card

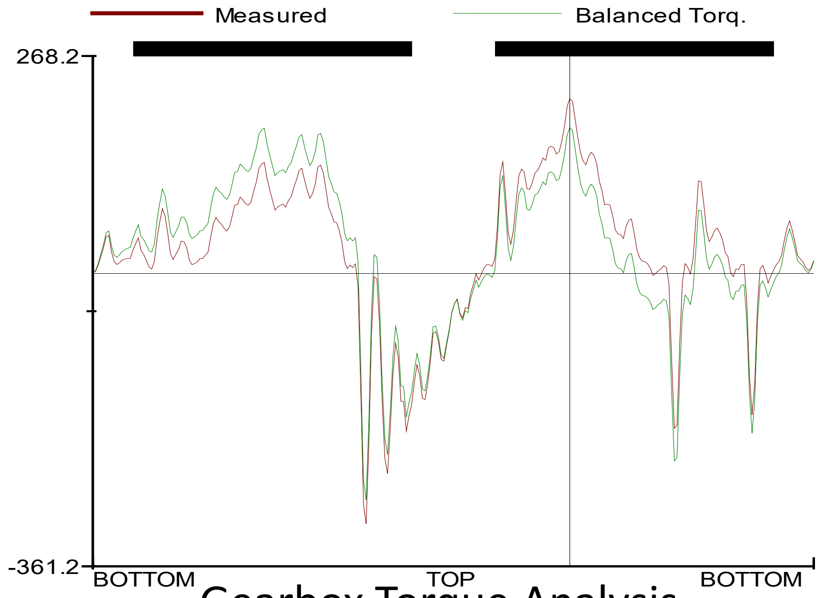


Surface Card



Downhole Card





Gearbox Torque Analysis

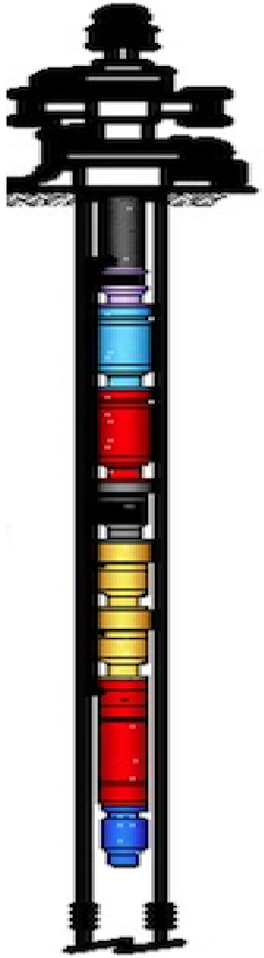
SYSTEM INTEGRATOR ACTIONS

Install RPC Module → Add Requisite I/O's → Connect-up I/O's (Load Cells etc) → Enter Well Head parameters → Connect-up with ADVAIT/ N4 Cloud → Run the operations

Supply & Install (Estimated Duration- 1 Day per Well Head)

- Supply of Wireless Loadcell and Position Sensor.
- Installation of Loadcell on the Rod Pump by Customer / Mechanical team.
- Installation of RPC Panel near the wellhead by SI's
- Casing and Tubing pressure sensors cabling from the wellhead to the RPC Control Panel by the SI's

ESP PUMP AUTOMATION



Features

ESP Read Parameters

- Motor Temperature
- Vibration
- Current and Voltage
- Intake Pressure /Discharge Pressure
- Flow Rate /Water Cut
- Gas-to-Oil Ratio (GOR)
- Frequency

ESP Write Parameters

- Pump Speed
- Start/Stop Commands
- Frequency Settings
- Torque Limits
- Protection Settings

Value

Adjusting write parameters allows for real-time optimization of the pump's performance to match the dynamic conditions of the well, such as changing fluid levels, varying gas-oil ratios, and fluctuating production requirements.

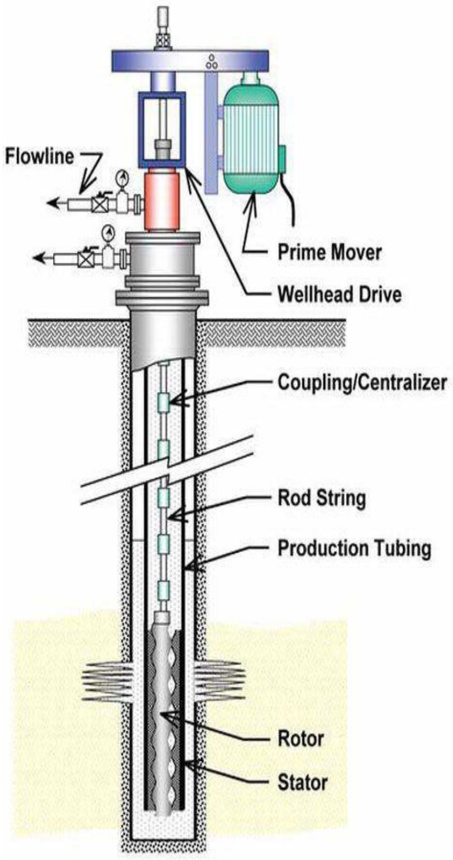
Our Experience

- 1000+ ESP's Connected through SCADA and Cloud Systems for Operational Monitoring Control
- Improve Productivity with Change Operations Planning.

Data Flow

ESP Panel → RTU → MODEM → DNP3 / MQTT → Customer SCADA / ADVAIT (TAS's own Platform)- On Prem +Public Cloud Deployment

PCP PUMP AUTOMATION



Features

PCP Pump- Read Parameters

- Motor Temperature
- Vibration
- Current and Voltage
- Intake Pressure /Discharge Pressure
- Flow Rate
- Torque /Rotor Speed
- Fluid Level

PCP Pump- Write Parameters

- Rotor Speed Adjustment
- Start/Stop Commands
- Torque Limits
- Protection Settings

Value

Adjusting write parameters allows for real-time optimization of the pump's performance to match the dynamic conditions of the well, such as changing fluid levels, varying gas-oil ratios, and fluctuating production requirements

Our Experience

- 300+ PCP's Connected through SCADA and Cloud Systems for Operational Monitoring Control
- Performance Reporting

Data Flow

PCP Panel → RTU → MODEM → DNP3 / MQTT → Customer SCADA / ADVAIT (TAS's own Platform)- On Prem +Public Cloud Deployment

BUSINESS OPPORTUNITY LANDSCAPE –RPC

Key Partners

Tridium Sales Team
Tridium Partners in the US/LATAM

Energy Consultant

Energy Services Partners such as
- Tally
- Flow Co ProLiftCo …

Key Activities

Launch RPC application (N4 Modules)

Port N4 to WP-500

UL Certifications for WP 500

Key Resources

Tridium Sales Leaders- Ed, Troy, Michael Youngs

Energy Services companies' collaborations in US

Consulting – Jesse /Daniel

Offering and Technology- Jagdish And Venkatesh

Value Drivers

✓ Controllers reduce rod and tubing failures by 31% and electric costs by 40%, equating to about $50,000 per year savings
✓ Increase Asset Availability with Immediate Actions
✓ Reduced Downtime and Increased Production by 15 % in some cases
✓ Reduce Operation cost (Labor/Power/Maintenance improvements

ESP Pump / PCP Pump :

Adjusting write parameters allows for real-time optimization of the pump's performance to match the dynamic conditions of the well, such as changing fluid levels, varying gas-oil ratios, and fluctuating production requirements.

Reference Customers

- Daleel
- ONGC
- CCED

Customer Decision Journey

- Energy Companies - Buy and Try RPC's
- Supply 10 Units FOC to Energy companies
- Timeline- Q4-2024 to Q2-2025

Customer Segments

Live Stripper Wells in US ~ 750000

Large Oil Operators with ownership of Oil Wells >400+ Wells

(Sensors+RPC+Analytics cloud subscription)- Simulation for Variation Dia/stroke/min

----

Oil Operators with ownership of Oil Wells >50 and < 200 Wells

----

Oil Operators with ownership of Oil Wells < ~50 Wells

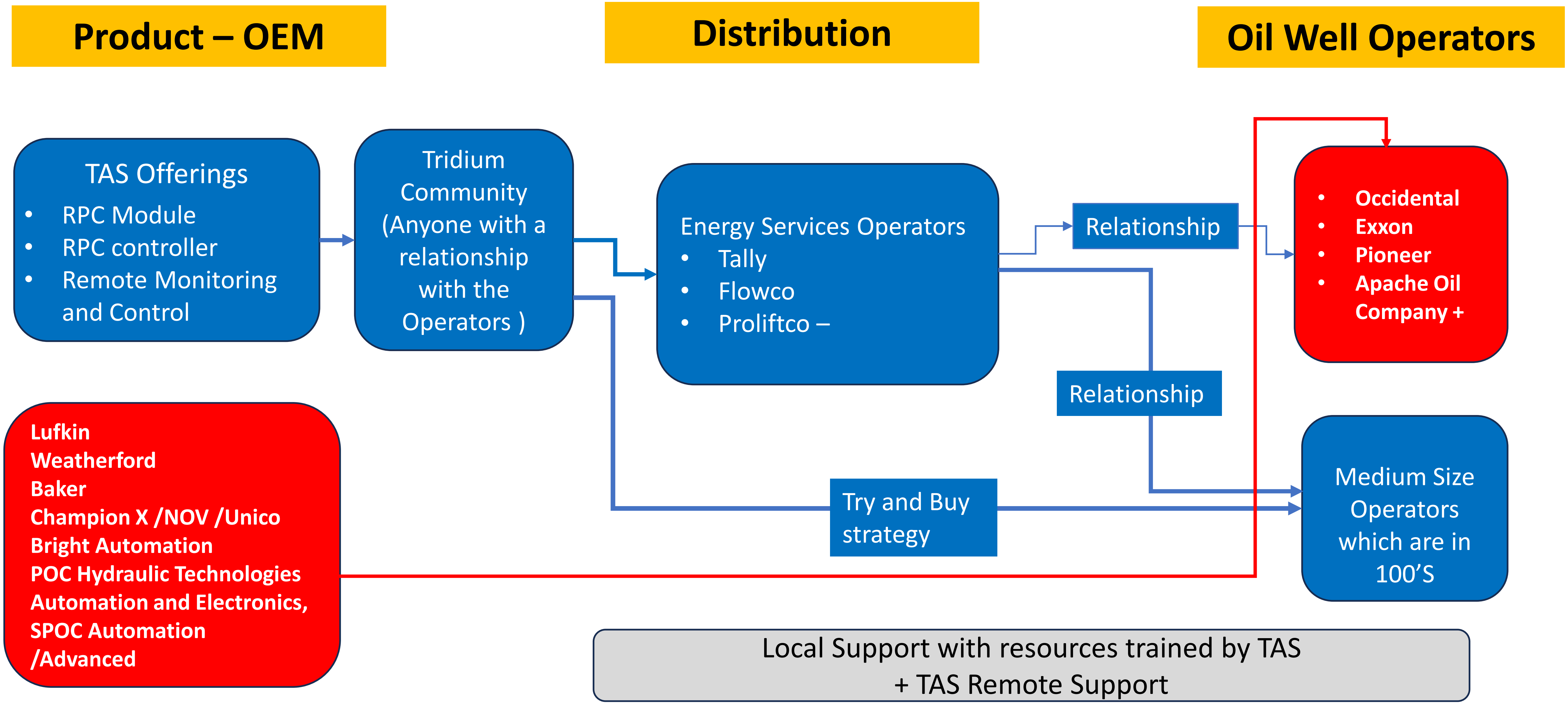
Cost Structure

RPC Module+ Sensors – TAS – Delivered to Energy companies
Support costs , Connectivity and Install –Energy Services companies

Revenue Streams

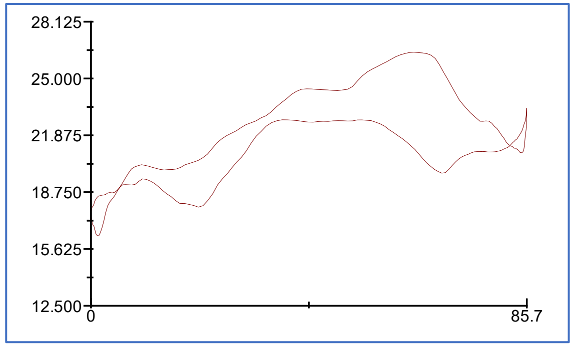
RPC - Sell, Install, Service and Remote Monitor
ESP and PCP –Remote Monitor

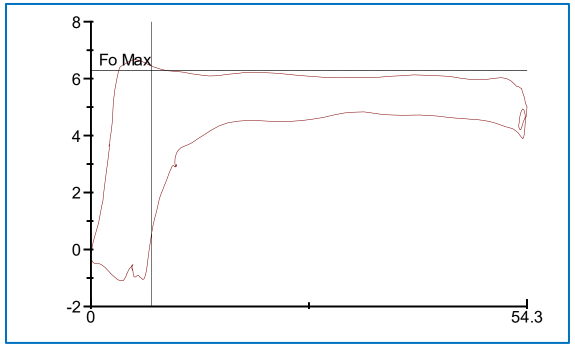
PATH TO MARKET - STRATEGY



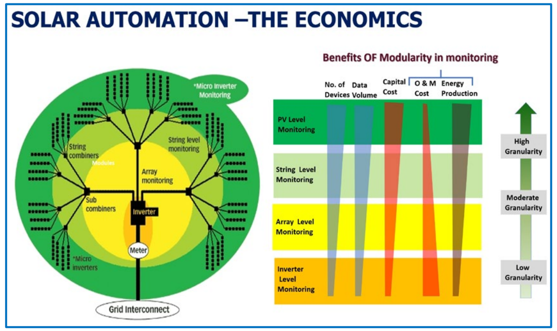
INDUSTRIAL NIAGARA - TAS N4 MODULE ROADMAP

Application	Module	Beta Test	RC
RPC Application	Niagara Modules for RPC and Associated UI	June 24	Aug 24
Manufacturing Applications	Niagara Module for Manufacturing (by Vertical) and Associated UI	June 24	Aug 24
Solar & Renewable	Niagara Module for Renewables and Associated UI	June 24	Aug 24





- On-time Delivery
- Production Schedule Attainment
- Cycle Time
- Throughput /Capacity
- Yield /Availability /OEE
- Performance Ratio



- Work Flow Scheduling
- Automatic Cleaning Schedules
- Support for Warranty Claims
- Energy Forecasts

QUESTIONS- ?

Jagdish.naik@tasind.com

EVauto®

fleet charging control system

EV Charging Control

powered by

niagara framework®

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EV Market - IMHO

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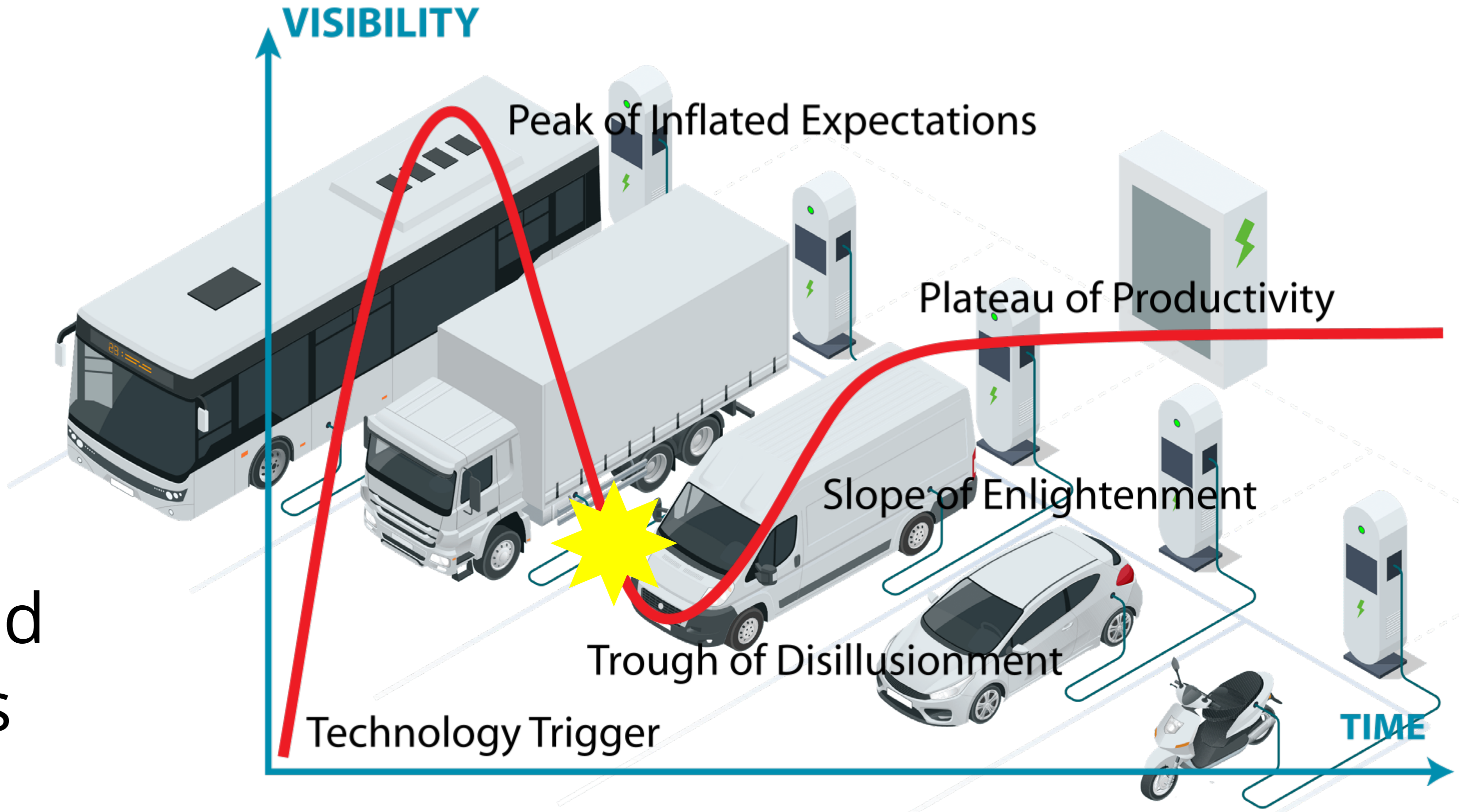
State of US EV Market

- Carrots and Sticks – Federal, State, Local
- Prices & Costs dropping
  - 30% less parts
  - 90% less moving parts
- Cars
  - Who, how and when
- Fleets
  - Commercial – Profits / Brand
  - Transit / School – Incentives



Utilities aren't keeping up

- Demand growing faster than forecast:
  - It's not just EVs
  - I.R.A. is driving manufacturing growth
  - AI, remote work, thermal electrification & shor
- Interconnection delays renewables
- NIMBY / NIMSP
- Waiting for theirs

CSMS / CMS Market

2024 is a year of change

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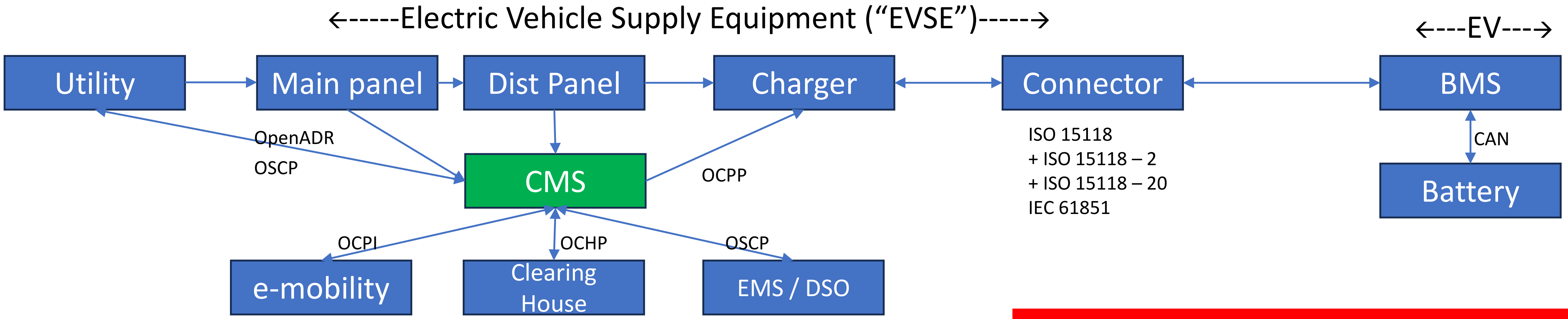
EV Charging Today

- Passenger Car Charging
  - 80% at home, mostly at night
  - Public chargers – the fastest is still too slow if it's working
    - Expensive or slow - Ads and signage
- CMS - Free, Monthly Subscription, Charge Network or *nothing*
  - EV and Charger OEM's offer for free to grow sales
- Private Depot Charging
  - Adapting car-focused tools / adding features
  - Public entities spend money
- Experienced fleets moving to the Edge

EV charging – a unique control environment

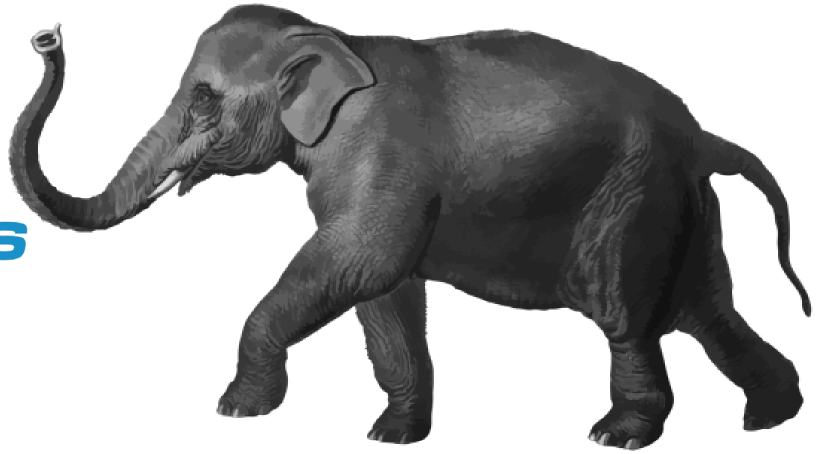
- **Tremendous amounts controllable of power**
- Multiple steps across different platforms / timing differences
- The controlled device leaves, and then the onboard meters disconnect.
- OCPP, ISO 15118 / 15118-20



- You can't charge EVs when they're gone
- You can't charge a full battery
- The BMS makes the final decision

OCPP is a protocol not a standard

- “Driver” between CMS / CSMS and charger
- Unique implementation for every different charger
- Developed in Europe & controlled by 5 private companies
- Use-case / requirements focused on public charging
  - Authentication (aka – clear credit cards)
  - JSON hosted by Charge Point / Socket initiated by Charge Point / Doesn’t support server polling
- Multiple versions 1.6 or 2.01 or 2.1?



Savings? Where?

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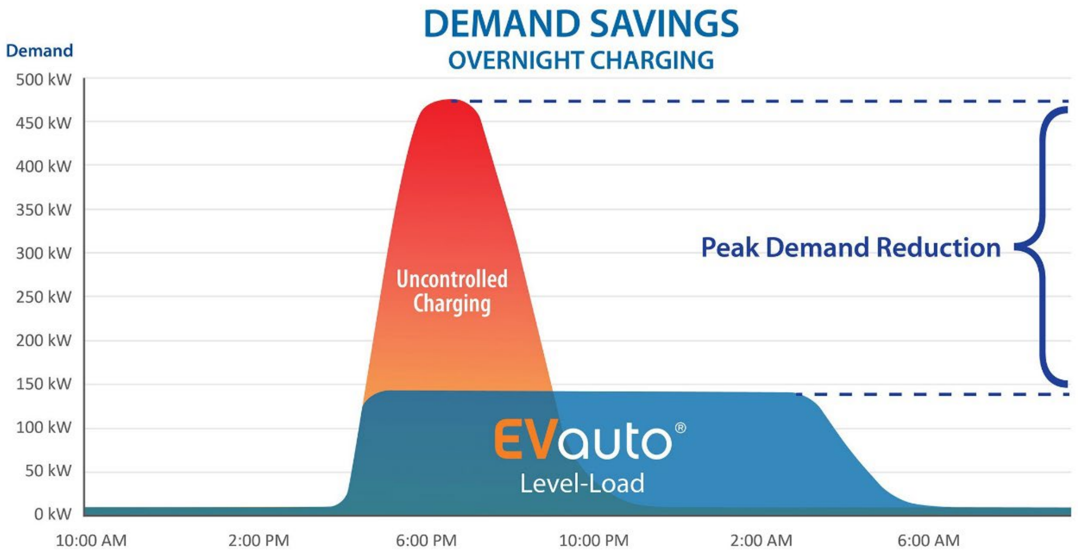
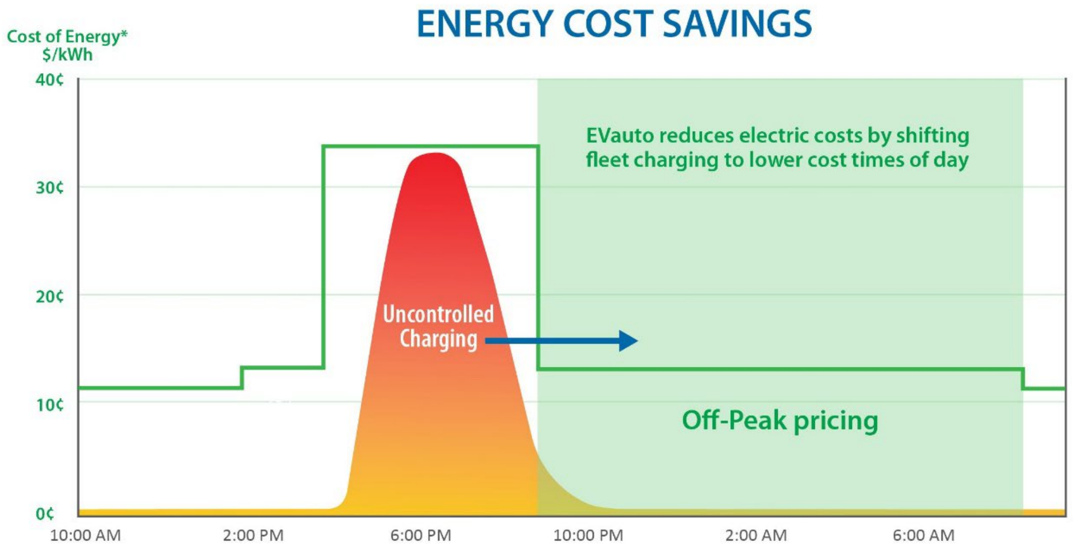
Electric Utility Savings





*Utility rates shown based on PGE BEV2 2021 rate schedule

THE IMPACT OF SMART CHARGING ON MONTHLY CHARGING COSTS

	Level 2 Charging			DC Fast Charging		
Chargers	Without EVauto	With EVauto	Monthly Savings	Without EVauto	With EVauto	Monthly Savings
10	$11,766	$8,186	30%	$17,061	$8,186	50%
25	$29,415	$20,466		$41,220	$20,196	

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A commercial office example - Demand

Pat from accounting goes to a late department lunch on the hottest day of the year. Pat's Leaf has amazing air conditioning which Pat turns on high to impress co-workers. Pat's not worried about the drive home as their office building provides free, low-power charging for employees. Even though it's a slow charge, Pat doesn't plan to leave until after 5 giving his vehicle 3 hours @ 7 kw ≈ 21 kWh which is more than enough to get home.

Here's the issue for the building operator on this sizzling hot day:

- Pat plugs in the snazzy EV at 2 pm to a L2, "slow" charger
- Starting a second chiller temporarily spikes demand peak at around 2:30 pm
- Which means that the 7 kW Pat's using helps to set the facility's annual peak demand
- If the facility is in Nebraska, the average demand charge is about $15 / kW ≈ **$100 per EV** / month

However, this charge can be eliminated by simply pausing charging until the peak passes. Just after the peak charging can continue without increasing peak demand charges.

Other savings

- **Demand Response**
  - EVs charging is the perfect controllable load
- **Improve charger reliability**
  - Onsite control avoids internet caused outages
  - Monitor depot power (OCPP won't w/o EVs)
- **Offset entire facility demand peaks**
  - Depot power can be quickly reduced to offset other facility demand spikes
  - Participate in Utility DR programs
- **Extend driving range**
  - Control charging to ensure battery preconditioning uses utility instead of battery power
- **Extend vehicle lifespan** – Battery management
  - Extend thermal conditioning
  - Limit maximum charging power level
- **Onsite renewable energy**
  - Integrate EV system with onsite green energy source to limit charging to available KW
- **Any OPEN Charger**

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OK, but can offering CMS make our firm money?

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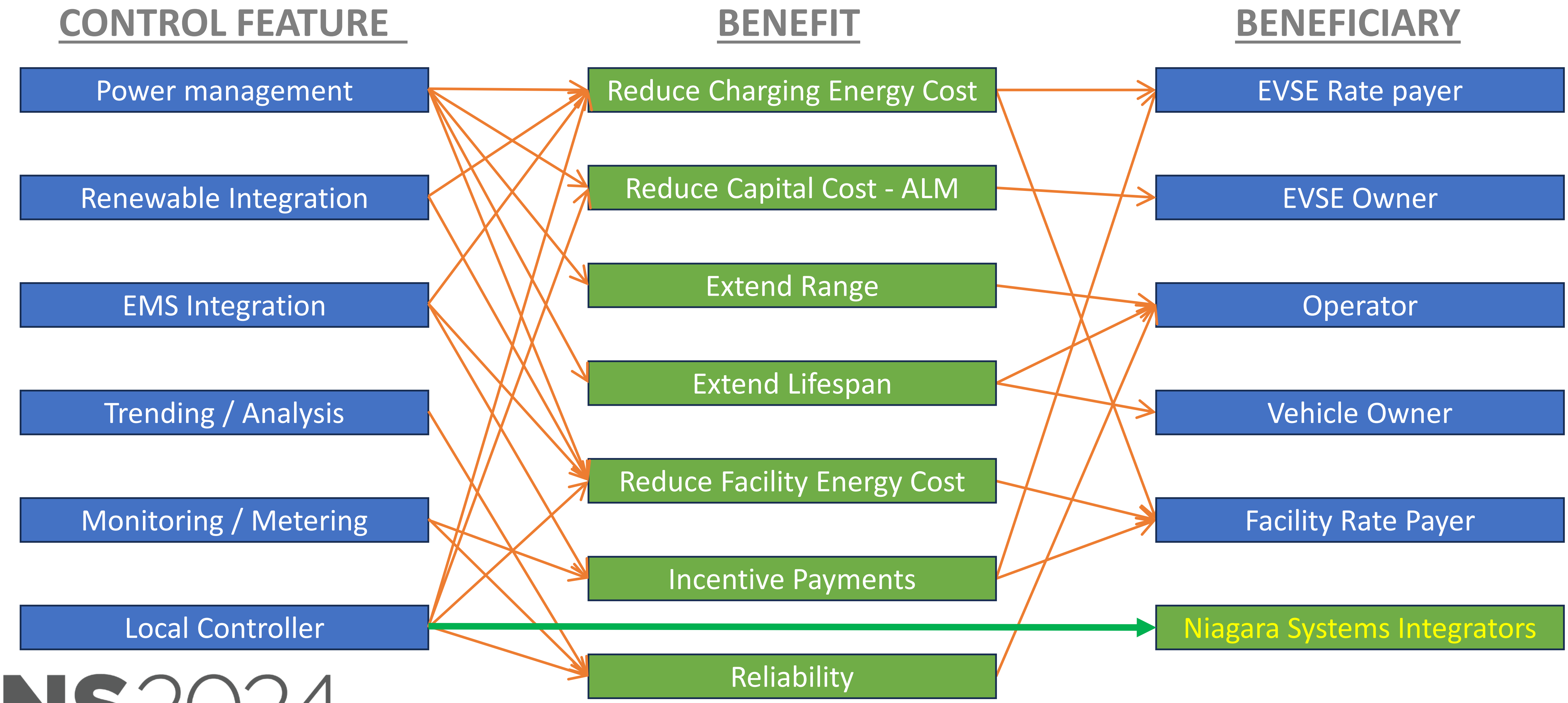
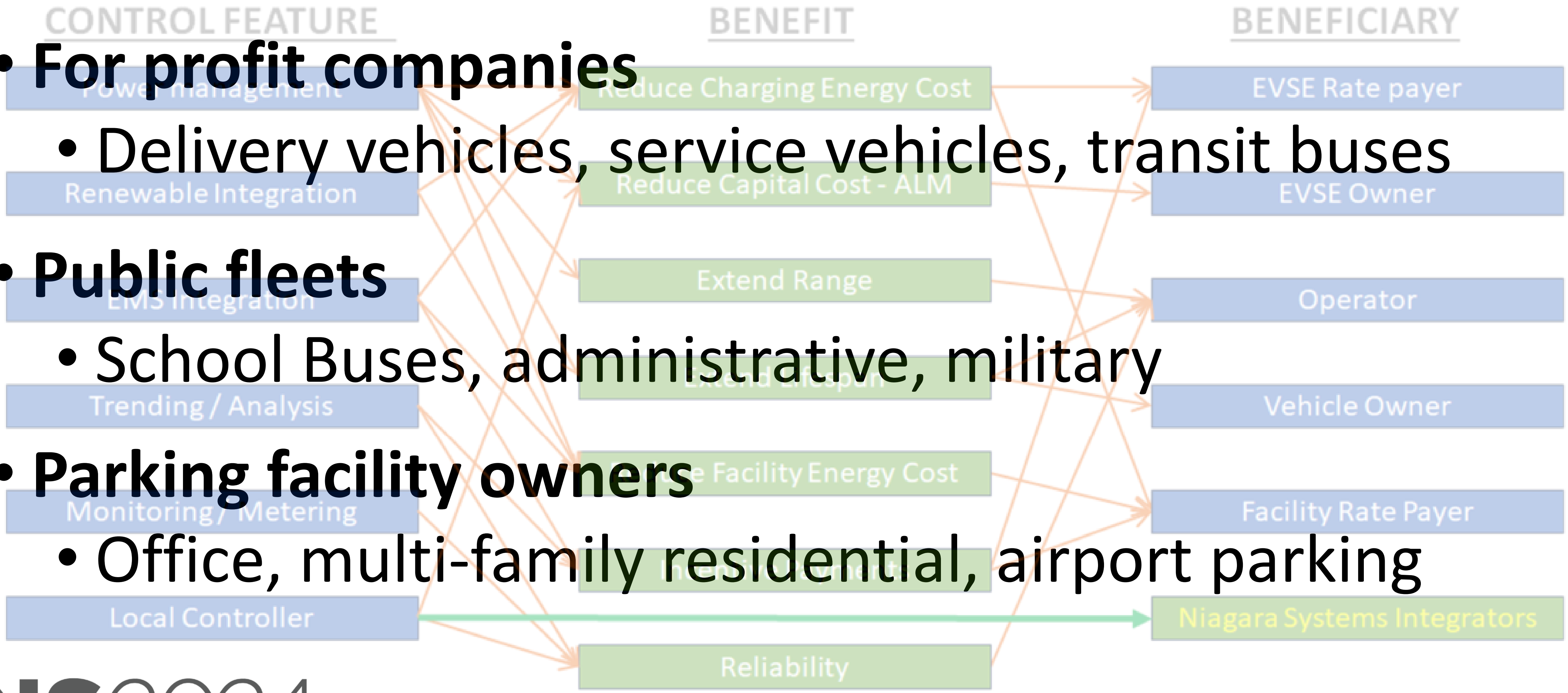
Who benefits from Charge control?



Ideal Customer Profile



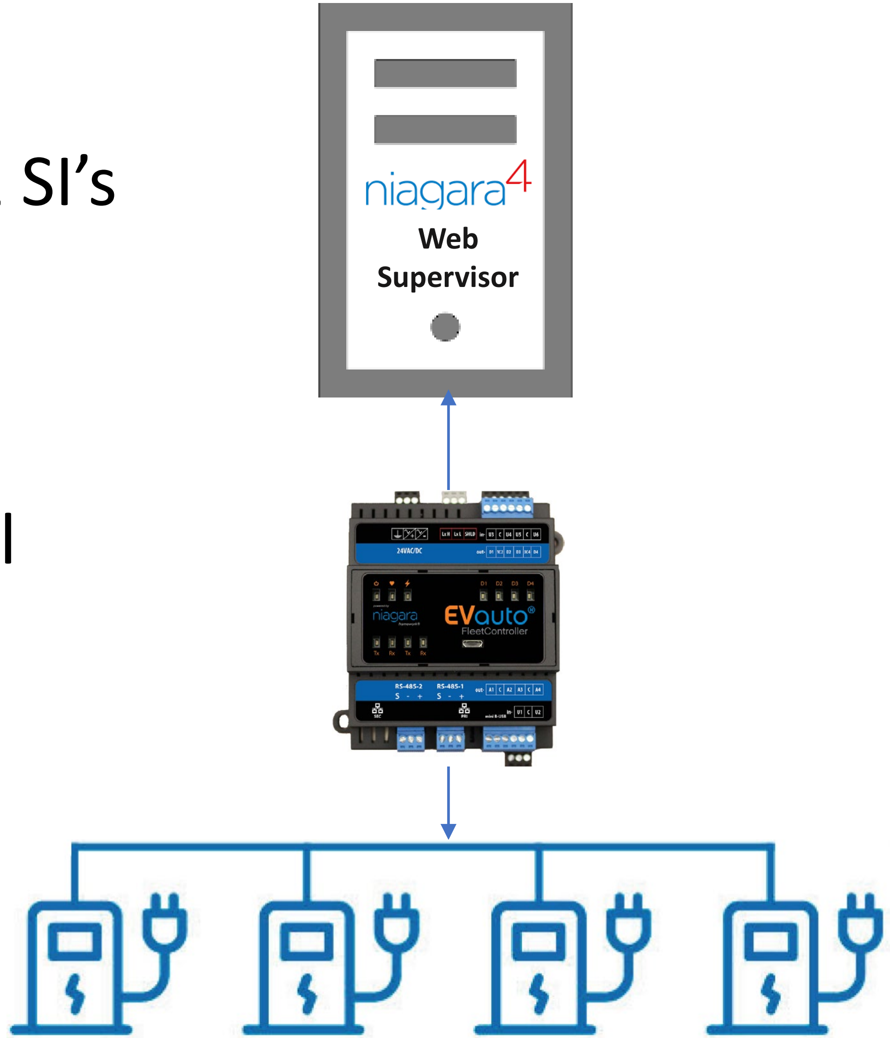
- **For profit companies**
  - Delivery vehicles, service vehicles, transit buses
- **Public fleets**
  - School Buses, administrative, military
- **Parking facility owners**
  - Office, multi-family residential, airport parking

EVauto® for system integrators

fleet charging control system

How can your firm profit?

- We sell EVauto® through resellers: EVSE firms & SI's
  - Hardware at "cost" / then subscription
- Ideal targets include your existing customers:
  - Existing built space
    - Office, hospitality, multi-family residential
  - School Districts
- Grow and Protect Revenue
  - Avoid a competing control system



Questions?

EVauto®

fleet charging control system

Andy Abrams

770/559-1668

Friends don't let friends buy locked chargers

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