# OUR GOAL:TO DECARBONIZE DRILLING OPERATIONS WITH SMART, SUSTAINABLE SOLUTIONS

Nabors aims to help shape the future of energy and accelerate the transition to a lower carbon world. Our Energy Transition Solutions portfolio of advanced and automated technologies is purpose-built to reduce carbon emissions and improve fuel efficiencies of drilling operations.

## AREAS OF FOCUS Decarbonizing the Oilfield



#### Advisory & Management Systems

Engine advisory and management solutions allow rigs to run engines at their most efficient levels and reduce the overall amount of emissions generated.



#### Technology

Technology solutions that reduce fuel consumption and emissions through energy storage & green fuels in an effort to diversify from pure diesel into cleaner fuels.



## Automation and Centralization

Utilization and further development of automation and centralization translates into additional remote support and operations, reducing onsite support and increasing safety.



## Training, Education, and Awareness

Instituting required trainings for all employees to understand the impact of our operations on the environment and our carbon footprint reduction objectives.

## REDUCING SCOPE 1 EMISSIONS Emissions Map





#### *NABORS*

REDUCING SCOPE 1 EMISSIONS

## **Scope 1 Focus**

Operational efficiencies and capabilities have reduced scope 1 emissions since 2016.

We continue to target innovative technologies in support of lower carbon intensity.

30%

Reduction of Pounds of CO2 Per Foot Drilled



## our methods to achieve energy transition effectiveness Energy Transition Objectives

#### Efficient Energy Use and Improved Fuel Economy

Peak shaving, efficient load sharing and regeneration during tripping and casing running operations

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#### Optimization of Power Distribution

Automated generator operations, reduced power inefficiencies and blackout downtime events



#### Reduced Secondary Impact

Fewer diesel delivery trucks, translating into reduced road wear and engine maintenance



#### Reduced Rig Emissions

Green house gases, light pollution and noise



#### Green Incentives

Carbon Credits from government and end-users





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## EMISSIONS REPORTING Rig Emission KPIs

The rig is equipped with controls and modules, installed on the engines to track engine loads and transmit the data back to a central server, calculating the fuel usage and emissions information which is afterwards consolidated in the End of Well report.





Breakdown by activity enables identifying engine efficiency improvement opportunities



Live visibility of generator loads can that can be accessed through RigCloud®



Monthly reports are generated and distributed throughout the business to:

- Drive reduction in emissions
- Helps identify rigs and areas with improvement opportunities
- Identify where training can be developed to drive a more efficient operations



## GREEN FUELS nanO<sub>2</sub><sup>®</sup> Combustion Catalyst

nanO2<sup>®</sup> is a combustion catalyst diesel fuel additive that reduces emissions, improves fuel efficiency and increases engine performance; reducing combustion temperatures

Testing in real-world environments has resulted in up to 8% Fuel consumption reduction and 20-50% reductions of emission without the requirement of costly engine modifications.





#### ENERGY STORAGE

## Hybrid Energy Management System (hEMS) with CleanDesign Battery

The hEMS upgrades any drilling rig into a hybrid rig, using CleanDesign battery energy storage and an automated engine management system to reduce the number of gensets operating.

#### **Proven Results:**





\*One rig, compared to it's baseline

#### NABORS

#### ENERGY STORAGE

## Canrig PowerFLOW<sup>™</sup> Super Capacitor Energy Storage Solution (ESS)

Canrig PowerFLOW<sup>™</sup> combines a Super Capacitor Energy Storage Solution (ESS) and a Power Management System to provide a true Peak Shaving® Solution, reducing the required number of on-line gen-sets.

Patented DC bus technology, and with the use of Super Capacitors, allow PowerFLOW<sup>™</sup> to provide immediate power for load spikes during tripping and other operations, and maximizes energy capture during drawworks braking, Improving the drawworks motor acceleration curve and reduces the need for diesel generated power above base load.



The patented DC bus technology provides immediate and highly efficient capture of regeneration during drawworks braking.

No Maintenance Required for Capacitors



Reduces fuel requirements and cost ALTERNATIVE ENERGY High-Line Power

Reduces rig site emissions reduction impact through reduced fuel Canrig can provide the transformer required to implement the connection to the grid

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Where High-Line power is available, a Canrig PowerTAP<sup>™</sup> module can be installed to accept grid power and interface with the VFD system – directly providing all electric power to the rig without the need to run engines.



### POWER& ENGINE MANAGEMENT SmartPOWER™

Today, most engines are not actively managed on drilling rigs.

Successfully optimizing engine usage can reduce emissions, provide fuel costs savings, streamline maintenance and enhance energy storage solutions.

Nabors is deploying solutions to provide drillers with recommended number of engines to run for different operations based on historical data and is bringing to market solutions that automate those controls.



#### **Plan Based Advisory**

Utilizing drill plans and physics based data to advise the driller on optimal number of engines to run per task through SmartPLAN.



#### **Activity Based Advisory**

Apply Artificial Intelligence based algorithms to real-time drilling data to advise the driller on the optimal number of engines to run per task.



#### **Automated: Controls**

Better manage generators by automating the start and stop of engines based on advisories. Develop engine de-rating module to account for altitude, coolant temperature, oil condition and filter condition to further optimize decision making.