



Conrad Energy Limited

03rd July 2019



Background

- Conrad Energy Limited (Conrad) is a power company backed by I-Squared Capital (a US based investor in energy and infrastructure assets) that is focused on:
 - Distributed Generation
 - Energy Storage &
 - Energy management services to corporates
- **Distributed Generation & Energy Storage**
 - Our main focus is on highly flexible small-scale embedded gas peaking generation in the UK at the 11kV and 33kV level (<50MW plants)
 - Plant size and locations are positioned to optimise opportunities in:
 - Access to Red Band GDUoS rates for 11 kV plant
 - The balancing services markets (reserve and response) managed by National Grid
 - The balancing mechanism which is becoming more accessible to embedded generation as traditional transmission connected assets like coal and older gas fired generation are retired
 - The annual capacity market auctions managed by the EMR Delivery body on behalf of National Grid & Ofgem
- **Energy Management Services to corporates**
 - Current expertise and experience in the team provides opportunities for energy management services to corporate clients
 - Conrad has submitted its supply licence application

• Business Plan/Targets

Organic Growth

- To locate, develop, construct and optimise a portfolio of 500-600MW minimum of distributed generation comprising gas peaking and battery storage assets
- To monetise its assets through its own asset optimisation / trading desk which will be operational in Nov-19
- To build an energy management services team and offering that generates revenue from consultancy, energy saving, in front and behind the meter asset optimisation, supply and demand side response

M&A

- Conrad has an experienced in house M&A team and an established due diligence network
- In the market at present a significant number of acquisition opportunities are available comprising development and operating assets and similar businesses to support the growth plan.
- Conrad has already acquired 100 MW of shovel-ready projects to complement its organic development pipeline and is positioned well to add more
- The M&A activity will compliment the organic development and ensure that Conrad is a fast growth business

Summary

- Conrad takes a pragmatic view of the changing UK Energy Market and is positioning itself to be able to take advantage of all revenue opportunities as they arise.



Conrad Energy Limited ambitions in the flexible power market



- **Operational Assets**

- 500MW-600MW of gas reciprocating engines under operation by 2021
 - 120MW of 33kv assets (across 5 assets)
 - 480MW of 11kv assets (across 40+ assets)

- **Operating Profiles**

- Flexible strategy assuming access to all available revenue streams
- Run Hours p.a.
 - 1500 for 11kv assets
 - 1200 for 33kv assets

- **Revenue Streams**

Revenue Stream	Comments
Wholesale Market	Own access to exchange and bilateral trading for forward, daya head and within day markets
Balancing Market	Access to the BM will be available via our asset optimisation desk software
Balancing Services	We will participate in STOR / Fast Reserve / Other
Capacity Market	We have CM16 £22.50/KW contracts already but will participate in all CM auctions
Embedded Benefits	GDUoS Red Band / Triad / BSUoS all relevant to our assets at 11kv or 33kv
DNO Flexibility Products	A growing market that we will participate in

- **Opportunities / Threats**

Opportunities	Threats
<ul style="list-style-type: none">• System margin reducing due to retirement of coal / nuclear / gas in the next 2-3 years	<ul style="list-style-type: none">• Regulatory reform – removal of the embedded benefits i.e Triad / GDUoS Red Band, BSUoS
<ul style="list-style-type: none">• Build out of intermittent renewables means more volatile price outlook	<ul style="list-style-type: none">• Capacity Mechanism Suspension – potential removal of the only long term revenue source available to generators
<ul style="list-style-type: none">• Changing European capacity outlook means interconnectors may not always point towards the UK - Germany 80GW of coal retirements next [20] years – France ageing nuclear fleet to be partially replaced by renewables next 5-10 years	<ul style="list-style-type: none">• EU ETS – UK Carbon Price Floor + EU ETS Regime make UK generation un-economic with European neighbours



Gas Peaking Generation – 11kV and 33kV

- Our strategy is to have access to all of the revenue streams available to us. Only the Capacity Market has long term contracts so Conrad will have the option to sell its assets flexibility in the highest priced market
- We are in the process of building our own Asset Optimisation desk – this will be ready by Nov-19

Revenue / Market	Commodity or Product	Comment
Wholesale	Power	<ul style="list-style-type: none"> • Optimisation around an assets Short Run Marginal Cost (SRMC)
	Gas	<ul style="list-style-type: none"> • Optimisation in forward markets (Weeks / Months / Quarters / Seasons)
	Carbon (EUA)	<ul style="list-style-type: none"> • Optimisation in prompt markets (day ahead / within day / imbalance) <p>Price volatility for power is expected to increase as thermal generation exits the market to be replaced by intermittent renewables and interconnectors</p>
Balancing Services	STOR	<ul style="list-style-type: none"> • Conrad already has a STOR Framework Agreement and is participating in the tender rounds for Year 13 (April-19 onwards) <p>National Grids System Needs and Product Strategy (SNAPs) document shows that the requirement for reserve (STOR) increases over time as the transition to renewables increases. The document also details how other markets will begin to be made available to distributed generation e.g. reactive power / black start</p>
Embedded Benefits	Power	<p>Triad – Win-18 £30k/MW / Win-19 £20k/MW / £3k/MW thereafter</p> <p>GDUoS – 11 kv projects benefit from generation during the Red Band Period – 16.00-19.00 Monday – Friday</p> <p>Conrad have targeted 11kV sites in the higher GDUoS Regions</p>
Capacity Mechanism	Power	<p>Currently suspended but all assets new build and existing can enter yearly auctions for a £/kw payment – Obligation placed on contract holder to generate during a stress event</p> <p>Conrad and market expectation is that the CM market will be re-established in 12-18 months. Conrad have four CM 16 £22.50 T-4 Contracts totalling 120 MW. These will not begin to deliver revenue until Oct 2020 so are currently unaffected by the market suspension</p>
Balancing Mechanism	Power	<p>This will become an increasingly attractive revenue stream to Distributed Generation as large thermal generation (coal / gas) begins to exit the system.</p> <p>National Grid have stated that 50% of all balancing services will come from the demand side / distributed assets by 2020. Project Terre (P344) is being implemented by NG in 2019 which will make access to the BM much easier for distributed generation</p>
DNO Markets	Power	<p>Many distribution network owners are starting the transition from a DNO to a DSO (Distribution Network Operator). WPD and UKPN are already starting local markets for reserve, demand turn up and reactive power. These revenue streams will be available for our assets connected to their local networks</p>

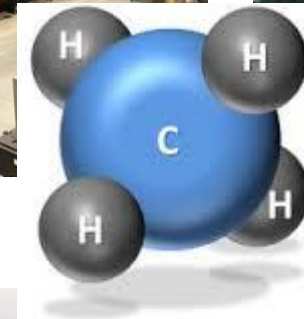
Why Reconditioned Engines?

- Against an ever changing landscape Conrad are seeking ways to continue to develop plants which provide the returns our investors are looking to achieve
- The bankable revenue from TRIAD payments no longer available
- Uncertainty over the Capacity Market, clearing prices in recent auctions unattractive
- By deploying reconditioned engines rather than new engines we can achieve circa 30% saving in capital expenditure

Where?

Potential sources for used equipment from:

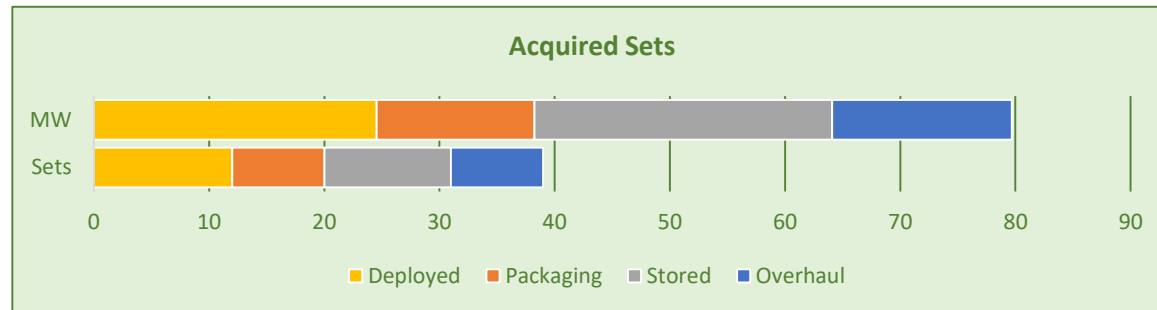
- Sectors
 - Base Load
 - AD / Biogas
 - Landfill Gas
 - Coal Mine Methane
 - Natural Gas / CHP
 - Flexible Power Response
 - Peak Lopping
 - STOR
 - Standby Market





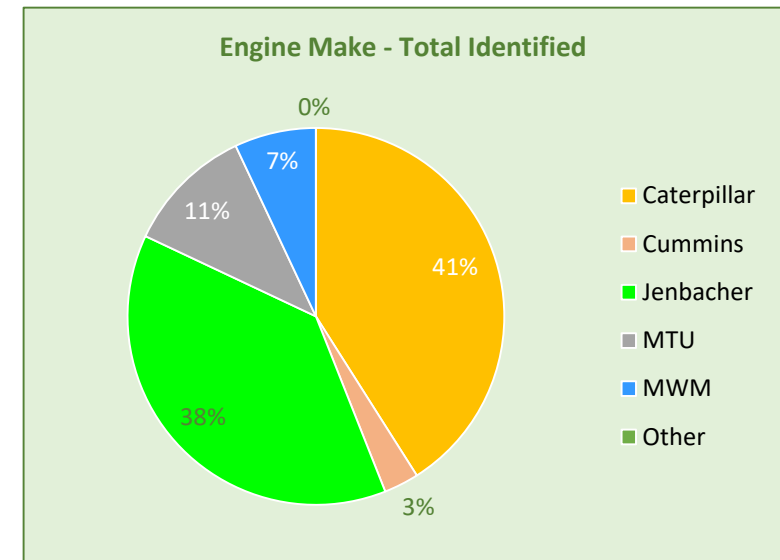
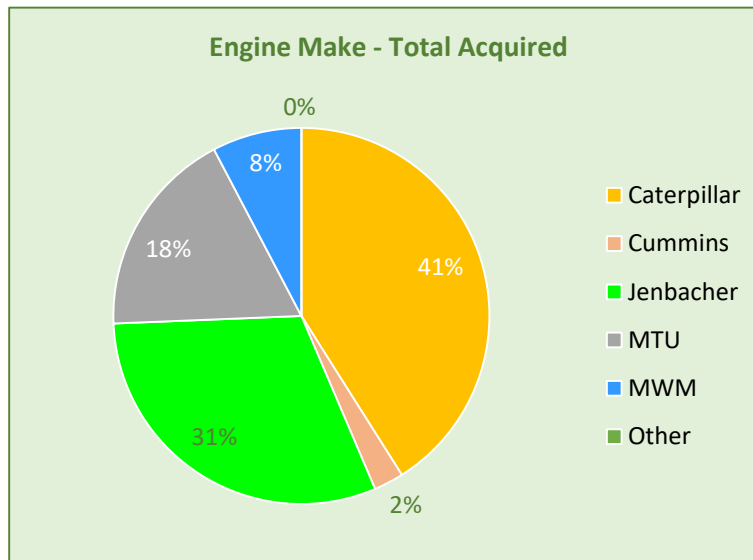
Engine Inventory

Target Sets	No.	MW
Identified	100	412.2
Dropped	13	25.5
Interested	19	245.0
Diligenced	10	28.0
Approved	58	113.7
Acquired	39	79.7

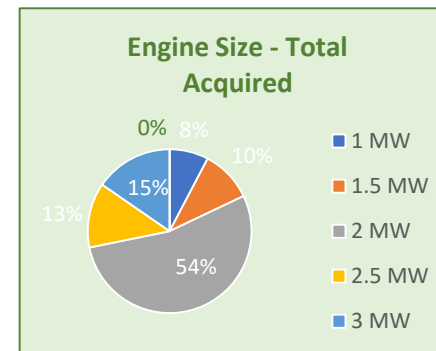


Sets Identified	No.
Caterpillar	41
Cummins	3
Jenbacher	38
MTU	11
MWM	7
Other	0

Sets Acquired	No.
Caterpillar	16
Cummins	1
Jenbacher	12
MTU	7
MWM	3
Other	0



Sets Acquired	No.
1 MW	3
1.5 MW	4
2 MW	21
2.5 MW	5
3 MW	6
Other	0
Total Sets	39
Total MW	79.7



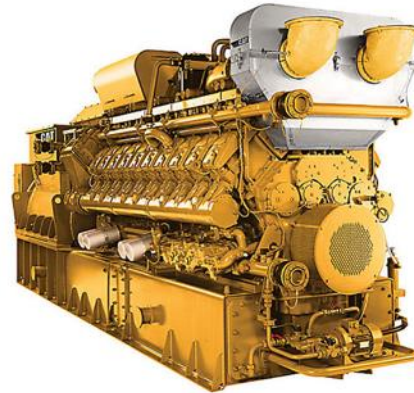
Progress to Date....

Engines

Typical range from 1MWe to 3MWe, some achieve up to 4.5MWe

Gas Engine Manufacturers

- GE Jenbacher
 - Type 3
 - Type 4
 - Type 6
- CATERPILLAR / MWM
 - TCG2020 V12,V60, V20
 - TCG2032 V16
 - CG170, V12,V60, V20
 - 3500, V16,V20
- Cummins
 - QSV91
 - QSK60





Information Required Prior to G99 Simulation Study

Equipment	Information Required	Comment
Alternator	Data Sheet	Ratings Reactance's Time Constants Inertia Constant Stator Resistances
Automatic Voltage Regulator	Data Sheet Control Block Diagram PI&D Controller Settings	Control Block Diagram unavailable/ unsupported by some AVR's manufactures, Simulation to use similar AVR model in absence of information
Gas Governor	Data Sheet Control Block Diagram PI&D Controller Settings	Gas Controller PI&D Settings unavailable / unsupported by manufacturer, example PI&D settings derived from standard model in Power Factory
DNO Technical Information	3Φ Fault Level 1Φ Fault Level	Information easily obtained by DNO
Technical Studies/ Supporting Information	P28 , Power factor and voltage study	Prepared in advance of simulation Study
Load Controller	Data sheet	Active power can be controlled on all sets, however the load controller requires modification to allow a frequency reference to reduce active power accordingly.

Main Problems encountered – Unsupported used equipment purchased by Conrad Energy

Gas Peaking Generation – 11kV and 33kV

Extension of May 2018 deadline to encompass current Conrad stock generation equipment

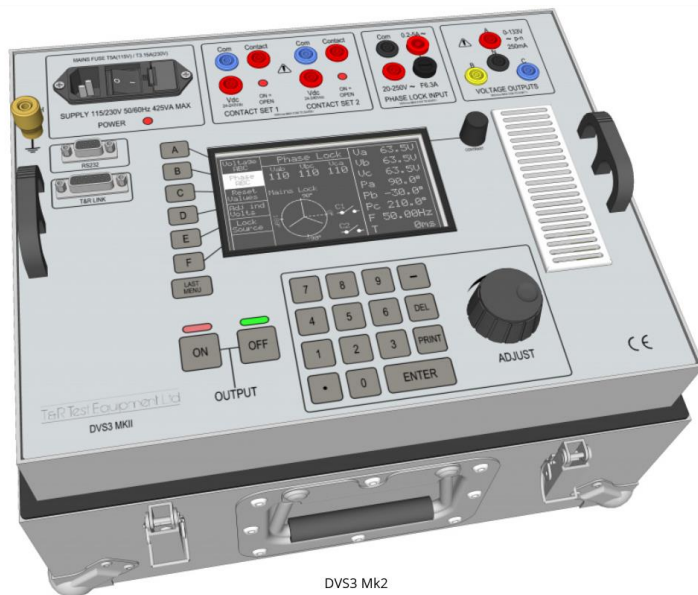
Part compliance to G99 and relaxation of some technical requirements

Accept some equipment info is unsupported and take a practical view on some compliance gaps to allow FON

Load bank tests witnessed by DNO / ENA (Type Test Recognition)

Step voltage and frequency injection to allow generator stability/ recovery to be fully demonstrated.

Once type/ model of generating unit proven G99 compliant witness test to be recognised as type tested by ENA/DNO



Gas Peaking Generation – 11kV and 33kV

Load Controller / Frequency – LFSM-O

All Conrad sites have FFR meters installed within the master control panel that can be used as a frequency reference and scaled against active power to achieve reduction in active power in an over-frequency condition

