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Independent Power Producers and Microgrid Development

Simon Gamble
Chief Operating Officer
IPS Connect, Maui, October 2018

OUTLINE

- Who is Enernet – What makes up an IPP?
- Business Case for a Microgrid IPP
- Market Opportunity – Scale and Attributes
- Role of the IPP
- Planning - Identifying the options and pathway
- Risk Mitigation – the name of the game
- Summary

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WHO IS ENERNET?

Enernet Global is an independent, technology-neutral renewable microgrid IPP

Mission

+ To develop, finance, build and operate hybrid power systems that benefit customers, communities and investors alike.

Value Proposition

+ Cleaner, lower cost, secure and reliable power with reduced price volatility.
+ Performance guaranteed, supported by experienced delivery and O&M partners.

Core Principles

+ Zero up-front cost: immediate ongoing savings to clients with no cost to their business
+ Technology-neutral: we draw from a wide spectrum of suppliers, integrating the most effective, reliable and cost efficient components to meet clients specific energy needs
+ Technical leadership: we have assembled a world-class team with decades of experience in all facets of hybrid power systems.

AUSPAC REGIONAL LEADERSHIP TEAM

Enernet's global and regional teams have originated, financed, built and operated over 500MW of renewables assets during their careers.

Global Team

Steve Hellman, Chairman
Serial entrepreneur built 14 successful companies in energy, oil and gas, real estate, software and media. Council on Foreign Relations member and former US State Department Advisor.

Paul Matthews, President
15+ years in strategic business development, building 3 global businesses in consumer and renewable energy fields, including commercial and utility-scale project development.

Chris Gerlach, Chief Financial Officer
20+ years of finance experience, heading SolarReserve's structured finance effort and as project financier/arranger/adviser at global banking institutions including HSBC and Société Générale.

Simon Gamble, Chief Operating Officer
20+ years in renewable sector, developer of multiple world leading megawatt class micro-grids. Previously Manager of Hybrid Energy Solutions at Hydro Tasmania.

Brian Gardner, Chief Development Officer
10+ years as senior market and energy analyst and consultant focused on global policy and international markets with EIU.

Dusan Nikolic, VP of Engineering
12+ years of renewable engineering expertise and project development, working on world-leading complex microgrids and the integration of renewable energy into islanded power systems.

Australia and Pacific Islands

Ashley Rogers, Regional Director of Development (East)
12+ years of sales and development within the Australian clean energy sector, commercializing varying PPA structures across multiple industry segments. .

Phil Maker, Electrical Engineer
18+ years of design, installation and commissioning of hybrid power systems in Australia, Antarctica , Alaska and the Azores

James Murray, Regional Director of Development (West)
10+ years of International business development experience in clean technology. Project advisory and strategic consulting experience covering renewable energy and energy efficiency.

Nic Jacobson, Senior Development Manager
15+ years senior renewable energy engineer with a depth of experience in policy, international development, project development and facilitation and renewable energy.

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WHY PURSUE MICROGRIDS?

THE PROBLEM

- Remote power generation has relied on expensive, polluting liquid fuels
- High capital costs and gaps in knowledge and finance limit clean-tech investment
- Electricity production not a core competency for many (industry/tourism/mining)
- Exposure to fossil price volatility and logistics and environmental risks

THE SOLUTION

+ Distributed renewable generation, storage and more efficient thermal generation
+ Secure, reliable 24/7 power, guaranteed performance
+ Lower, predictable, stable energy costs
+ Fully-funded, offering Energy-as-a-Service with no upfront cost to customer

Microgrids are viable solutions where:

High Energy Needs

Good Solar/ Wind Profile

High Electricity Prices

Remote or off-grid

Exposure to diesel price volatility

Poor Energy Reliability

COMMUNITY AND CLIENT BENEFITS

To be successful the IPP must ensure that all stakeholders share in the value created through bankable, stable and profitable projects.

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MARKET DRIVERS FOR IPP (OFF-GRID)

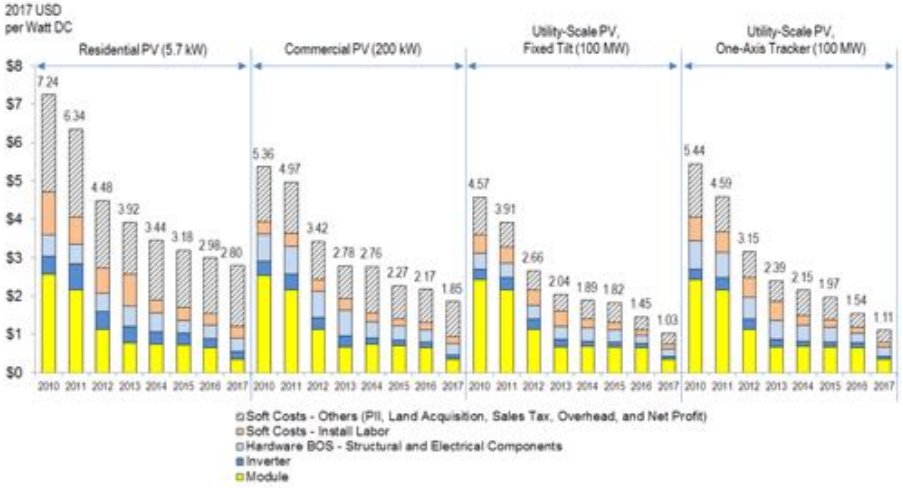
+ Globally, there is over 400 gigawatts of diesel capacity in operation as a result of existing grid limitations. Up to 250 gigawatts could be absorbed into microgrids*.

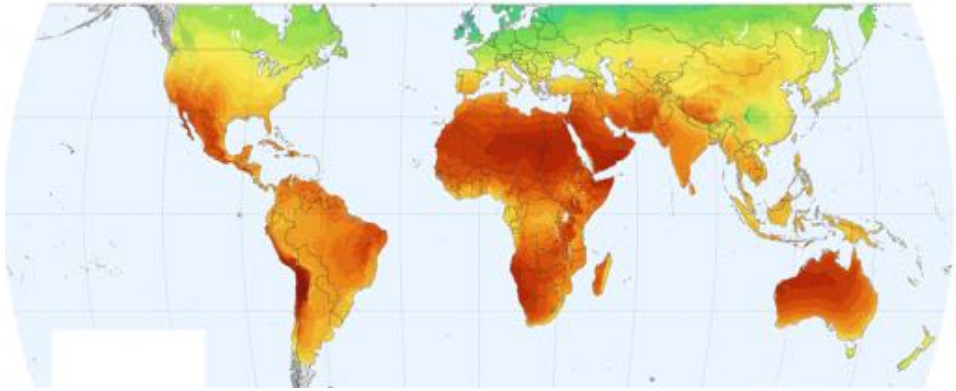
*Source: IRENA Off-Grid Renewable Energy Systems; 2015

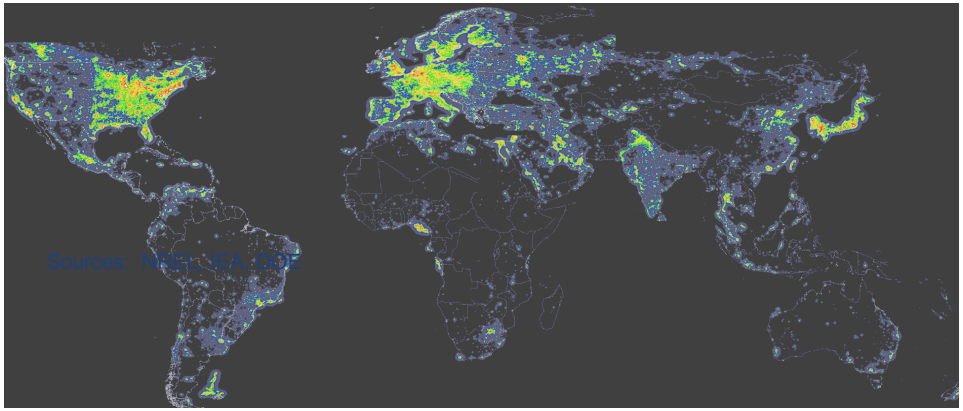
250 GIGAWATTS -> US$500bn

MARKET DRIVERS - SOLAR

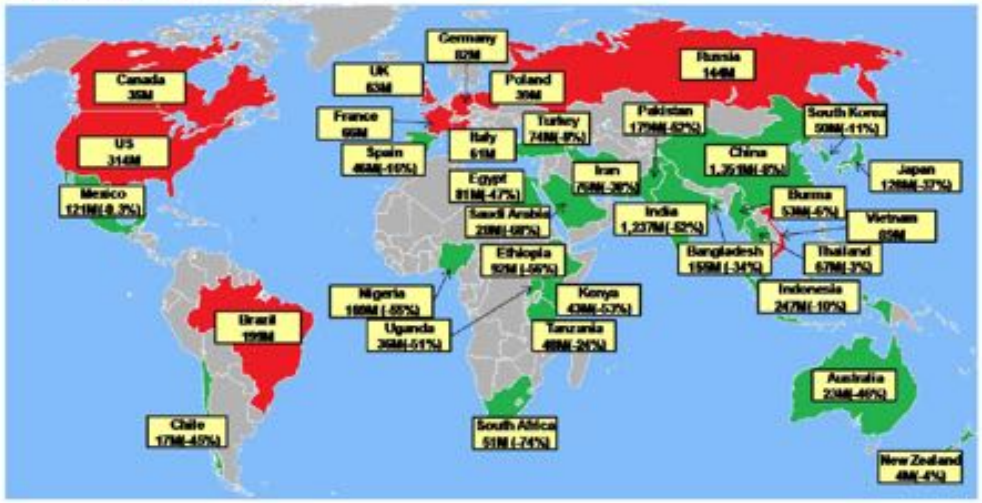
- The reduction in the cost of solar and the adoption rates are >20% yr on yr.
  - Trend is present across all scales and sectors
  - Risk premiums in off-grid are reducing – facilitating cost reductions in that sector
- The world's lower per capita GDP regions:
  - lowest access to energy (reliant on off-grid supply)
  - have the highest irradiation levels
  - will achieve significant economic benefits from cheaper more reliable power supply

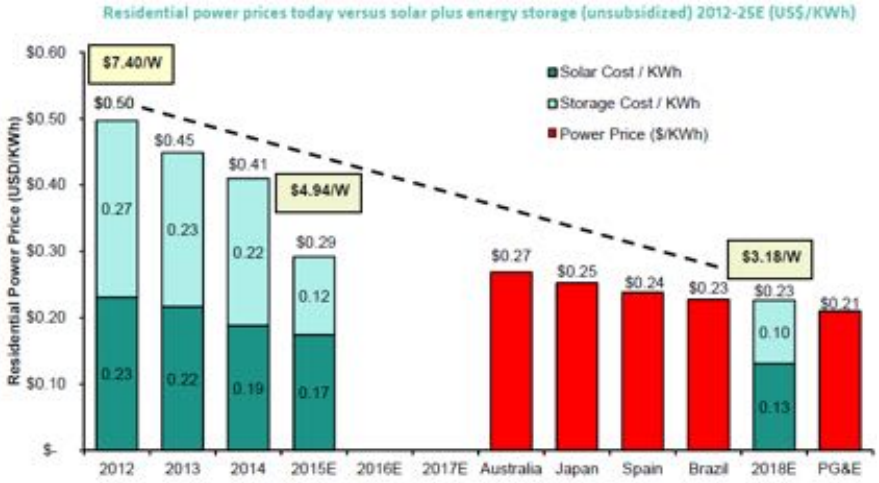






MARKET DRIVERS – BATTERIES (WITH SOLAR)





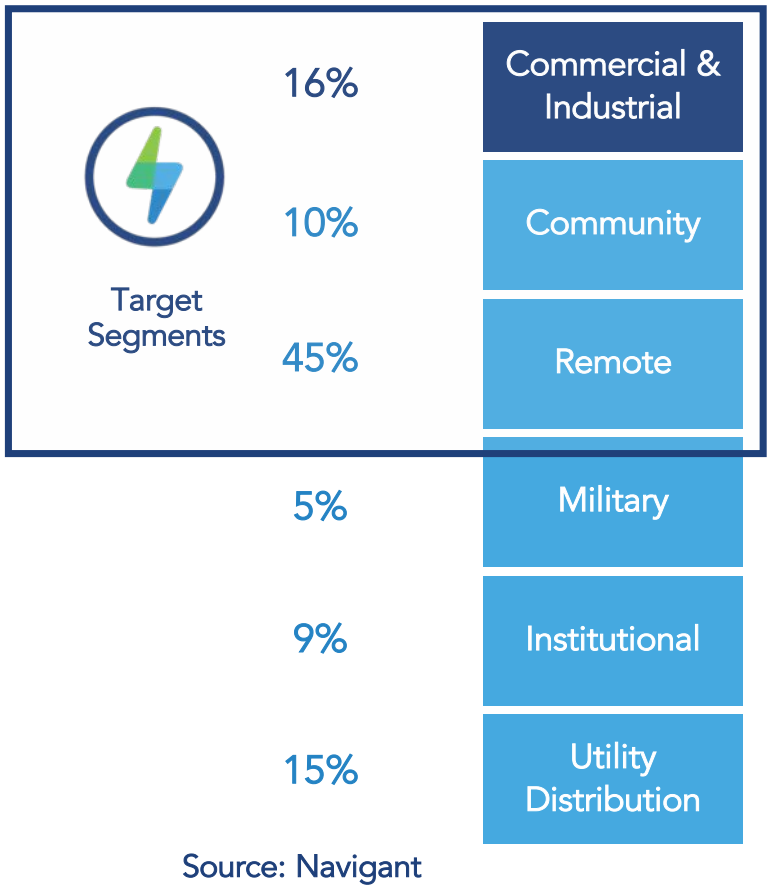
Source: Bernstein

- Solar/battery technology is now competitive with traditional supply in regions of high solar irradiation
  - Behind the meter (retail off-set) solutions are attractive and market is growing strongly
- Impact in off-grid has been tempered slightly by depressed diesel/gas pricing
  - Still a "no-brainer" to blend renewables into existing thermal supply
  - Cost effectiveness of high RE systems is improving – largely as a result of battery technology maturing and becoming more cost effective (and risk premiums reducing)

EMERGING MARKET OPPORTUNITY

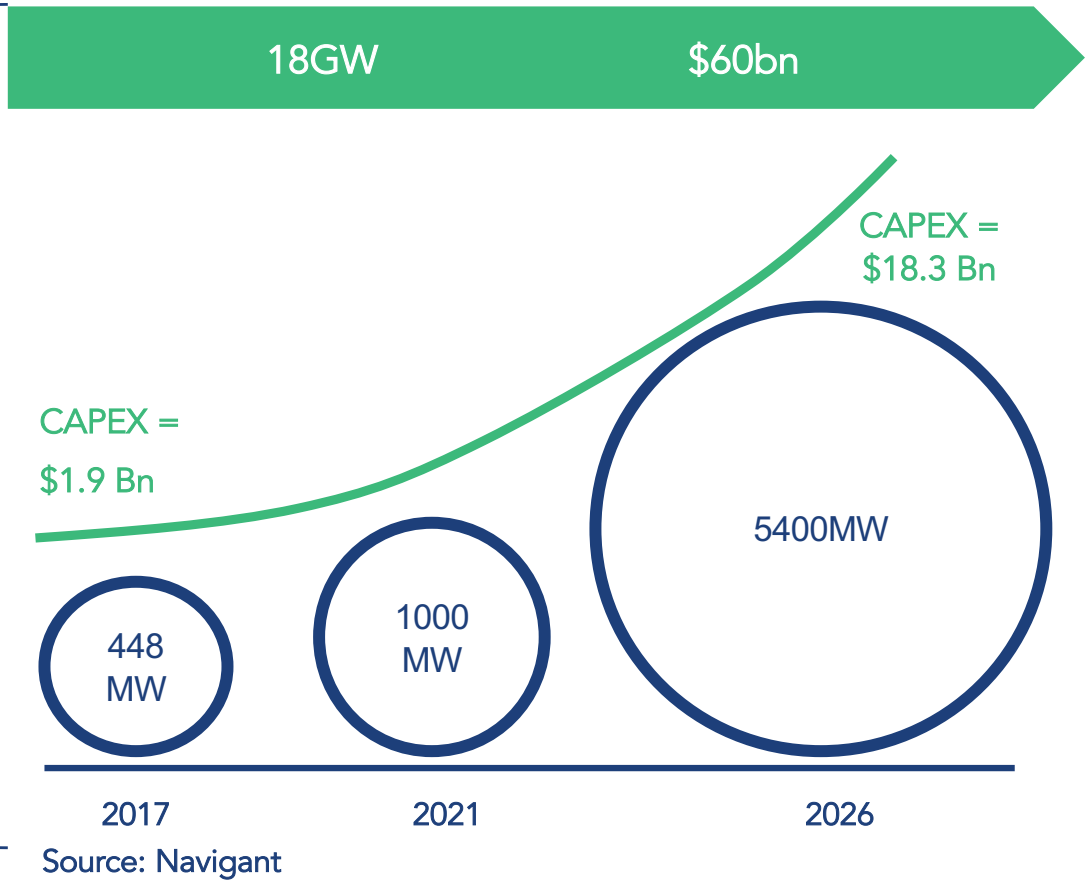
Globally, microgrids offer a significant opportunity for renewable energy investment, financing long term power purchase agreements with bankable off-takers.

Global Microgrid Power Capacity Market Share by Segment, Jun 2017



Source: Navigant

Total 2017-2026 C&I Microgrid Build



Source: Navigant

Who holds the opportunities?

What strategies are employed for market entry?

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CASE STUDY – IPP MARKET ENTRY

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CASE STUDY
IPP TECHNICAL DEMONSTRATION

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CASE STUDY
IPP FASTER TO MARKET

MARKET SECTORS – COMMUNITY / UTILITY

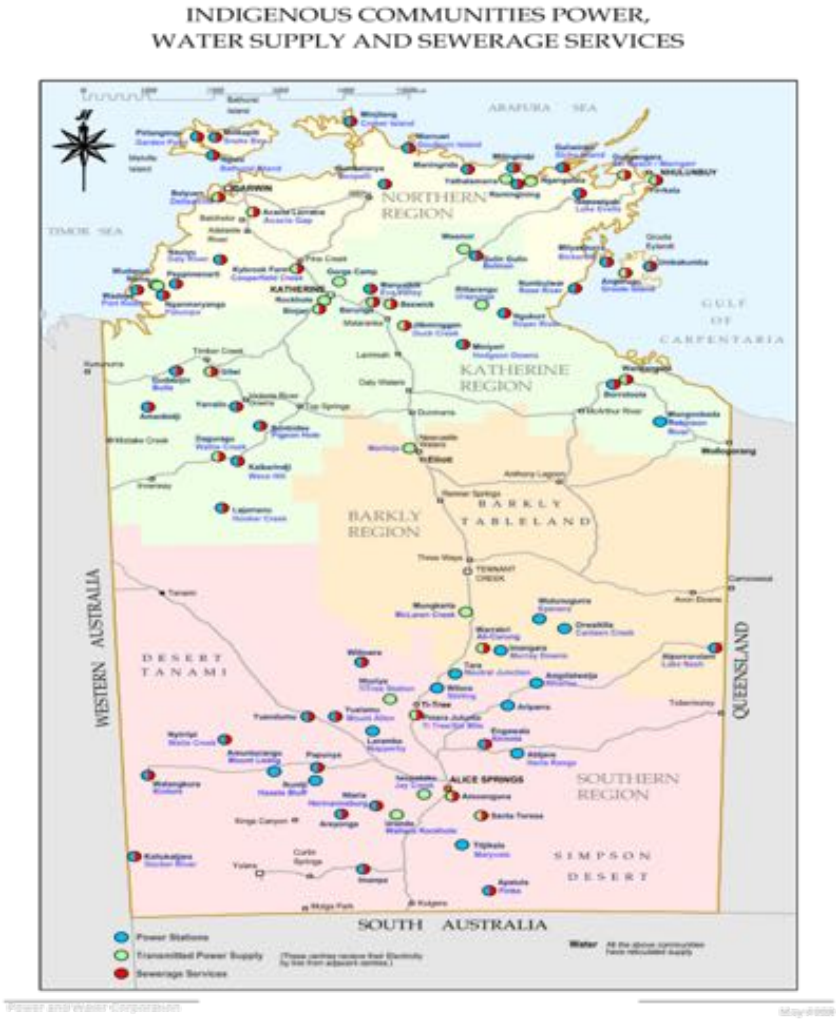
High barriers to entry

Aid has traditionally supported alternate models

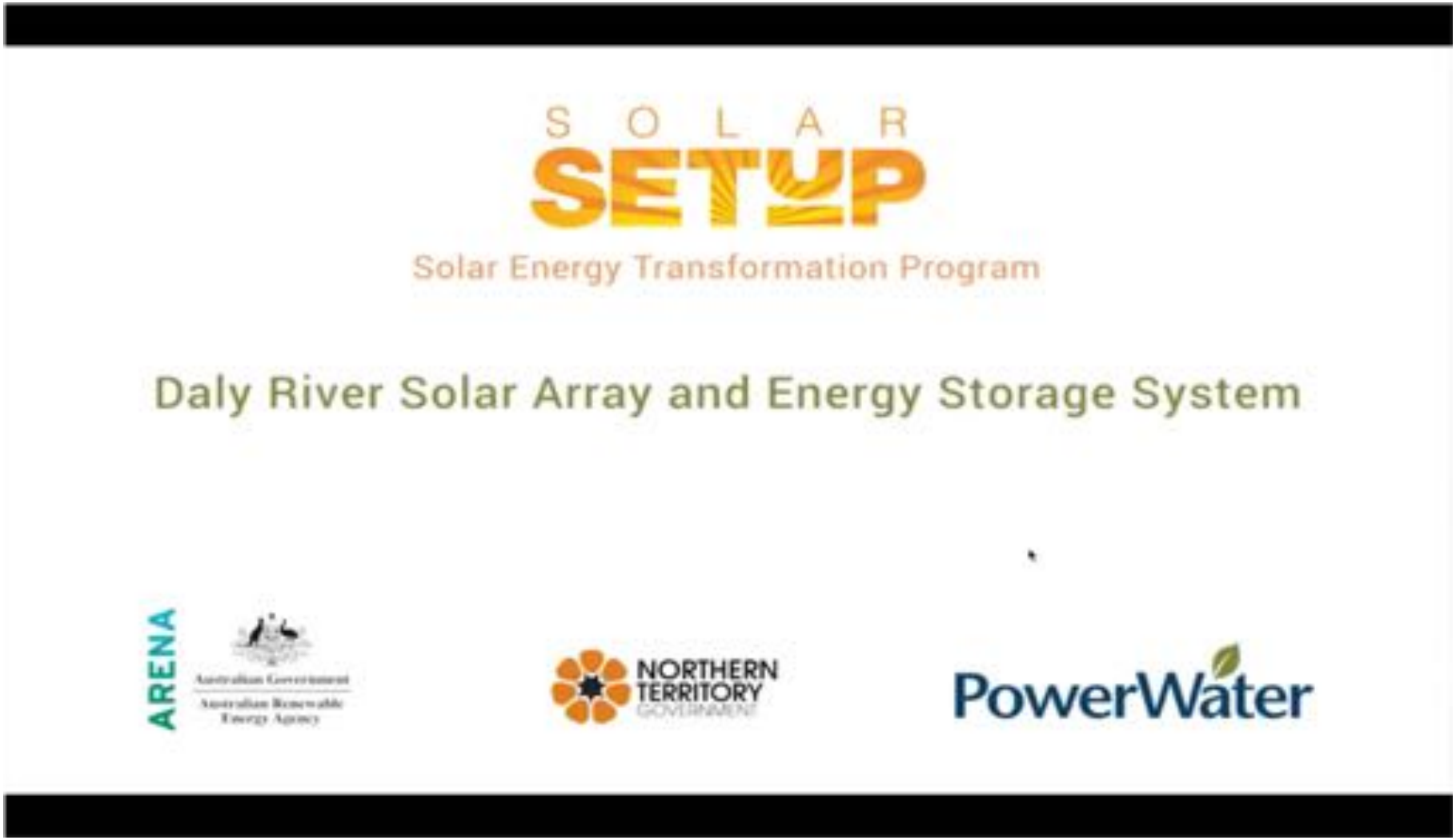
COMMUNITY CASE STUDY
SETuP & Daly River (NTPW)

Project Summary:

1. 10MW PV across Northern Australia Aboriginal Communities.
2. 9MW used for medium penetration operation resulting in 15% fuel savings. Peak contribution is 87% using Low Load Diesels at Ramingini.
3. 1MW and 800kVA/1.9MWh battery at Daly River resulting in 50% fuel savings.
4. Aim: to make PV/ESS business as usual, i.e. its about cultural change, education **not** technology



COMMUNITY CASE STUDY
SETuP & Daly River (NTPW)



MARKET SECTORS - TOURISM

MARKET SECTORS - MINING

“Locked” into diesel

Short mine life

MARKET SECTORS – COMMERCIAL/INDUSTRIAL

High value loads Interruptible/deferable load High arbitrage value

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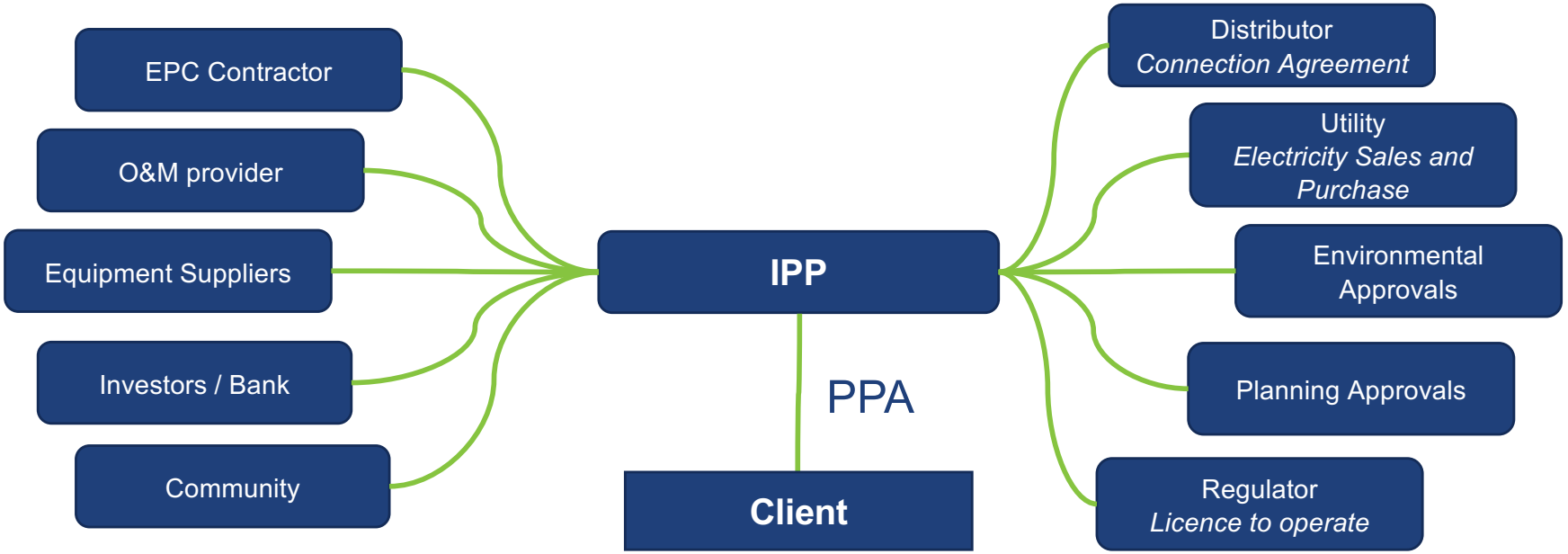
ROLE OF THE IPP

IPP is at the heart of commercial transactions



Requires a structured approach to ensure risks are identified, managed by the most appropriate party and contractually covered (for the lifetime of the assets).

PPA is primary commercial agreement : needs to be fair and balanced, performance based, long term

CLIENT ENGAGEMENT – WHERE IT ALL STARTS

Microgrids can be confusing

Client is normally the only off-taker

Client represents a credit risk

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CLIENT ASSET INTEGRATION

Automation of existing legacy equipment – more costly than replacement?

CLIENT ALTERED OPERATIONS

Source: Hydro Tasmania – Rottnest Island operator training

Adds perceived complexity and risk to client – education/training required

Split operational responsibilities – consolidate and align where possible

“CLIENT” DEMONSTRATION CASE STUDY
DALY RIVER TESTING

Technology selection can be a show-stopper – in particular where safety is concerned

Demonstration can be best and only way to prove system will work when called on

Testing ability of inverter to provide fault current to blow fuses

“CLIENT” DEMONSTRATION CASE STUDY
DALY RIVER TESTING

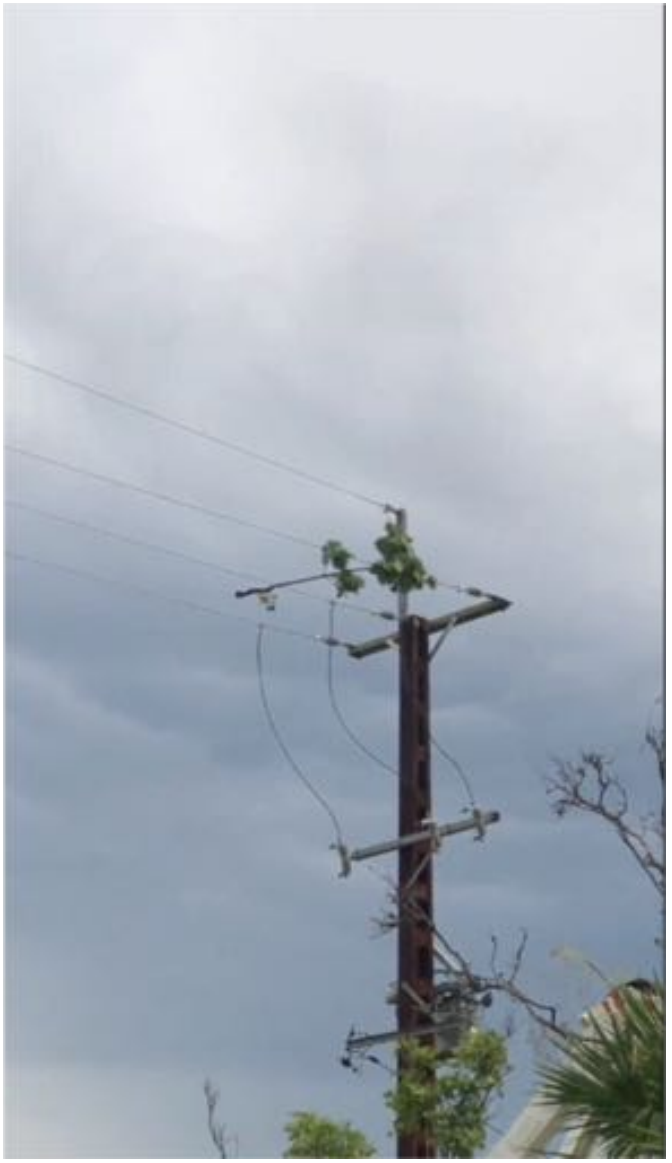
Technology selection can be a show-stopper – in particular where safety is concerned

Testing ability of inverter to ride through faults

What does a fault look like AND what is the appropriate test for a battery system?

Protection relays required new settings

Alternative – use test facilities (see ACEP)

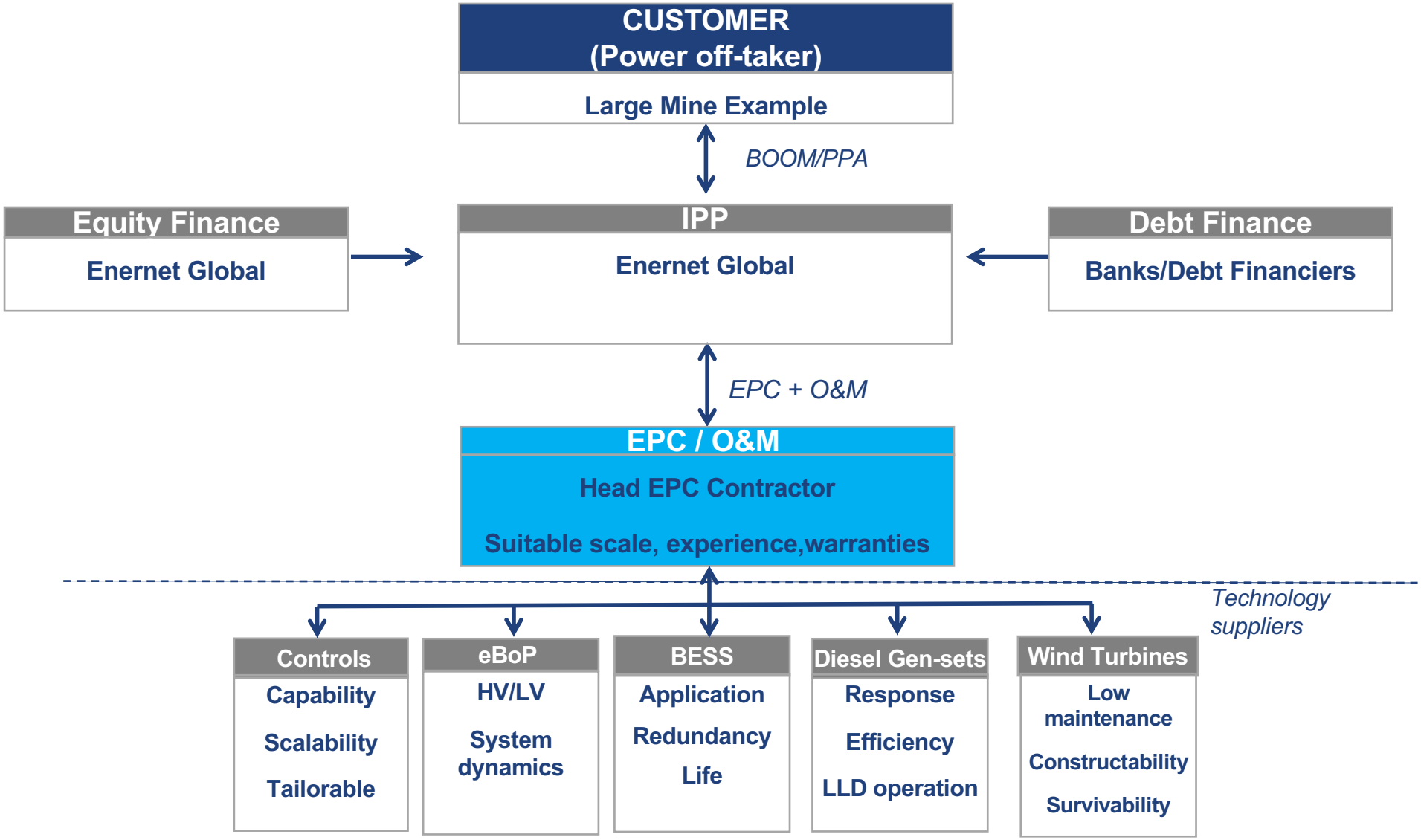


REGULATOR ENGAGEMENT

Regulators of isolated power systems can play an important role in supporting to success of hybrid microgrids:

- Prescriptive requirements – e.g. spinning reserve, plant redundancy
- Historical bias – favouring traditional approaches that prevent renewable deployment – e.g. minimum load requirements, diesel subsidies
- Technology bias - Picking winners vs system quality and reliability stds
- Connection regulations – preventing or restricting feed in, gross metering
- Land zoning – supporting land availability for solar generation, WTGs

CONTRACTOR ENGAGEMENT



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KEY VENDOR ENGAGEMENT

Enernet works with leading vendor partners to design, implement, operate and maintain our solutions over the tenure of a power purchase agreement. Examples include:

GENERATION

First Solar
CanadianSolar
Cummins
CAT
WÄRTSILÄ
SIEMENS Gamesa RENEWABLE ENERGY

STORAGE / CONTROL

QINOUS smart energy storage
SAMSUNG
SAMSUNG SDI
ABB
Greensmith A WÄRTSILÄ COMPANY
TESLA

EPC/INTEGATION/O&M

INFRATEC
RCR
juwi Energy is here
HARELEC solar power specialists
SIEMENS

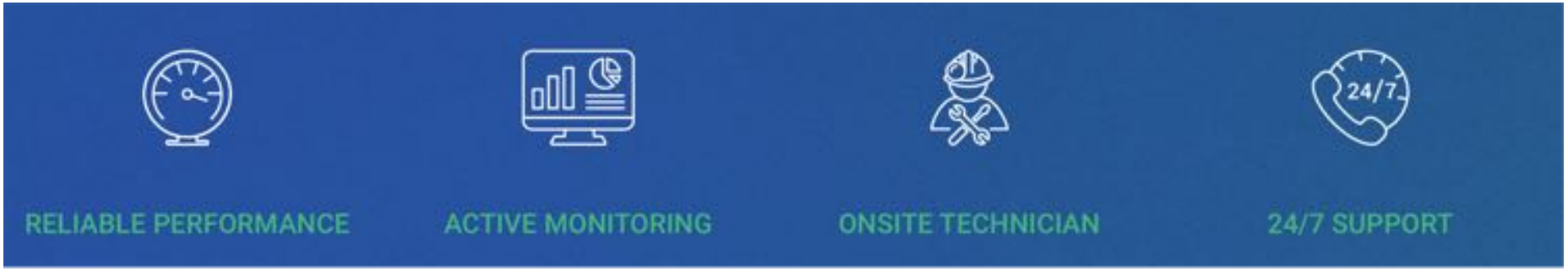
Fitness for purpose?

Detailed knowledge!

Collaborative engagement?

ASSET MANAGEMENT AND OPERATION

An IPP must manage all maintenance and operation processes – normally via a network of service providers.



RELIABLE PERFORMANCE	ACTIVE MONITORING	ONSITE TECHNICIAN	24/7 SUPPORT
System uptime and performance is wrapped. Back-up generation core to the solution.	Remote monitoring with automated alarms. Clear workflow and associated actions.	Local or onsite teams for active maintenance and system operation. Scheduled component maintenance and replacement.	Remote monitoring with automated alarms. Clear workflow and associated actions.

Systems are operated and maintained by local teams and closely monitored to ensure maximum up-time and minimum customer interruption.

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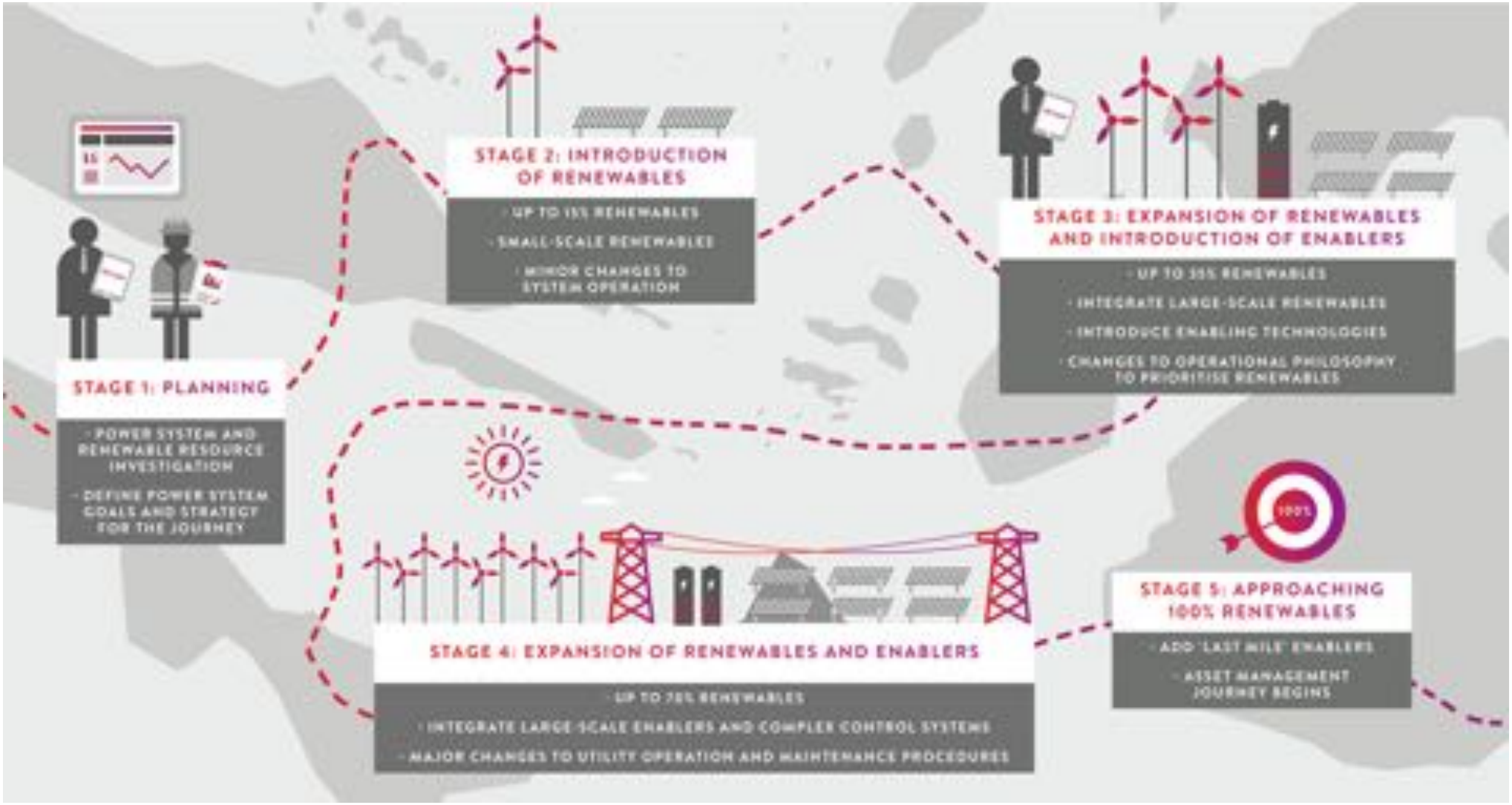
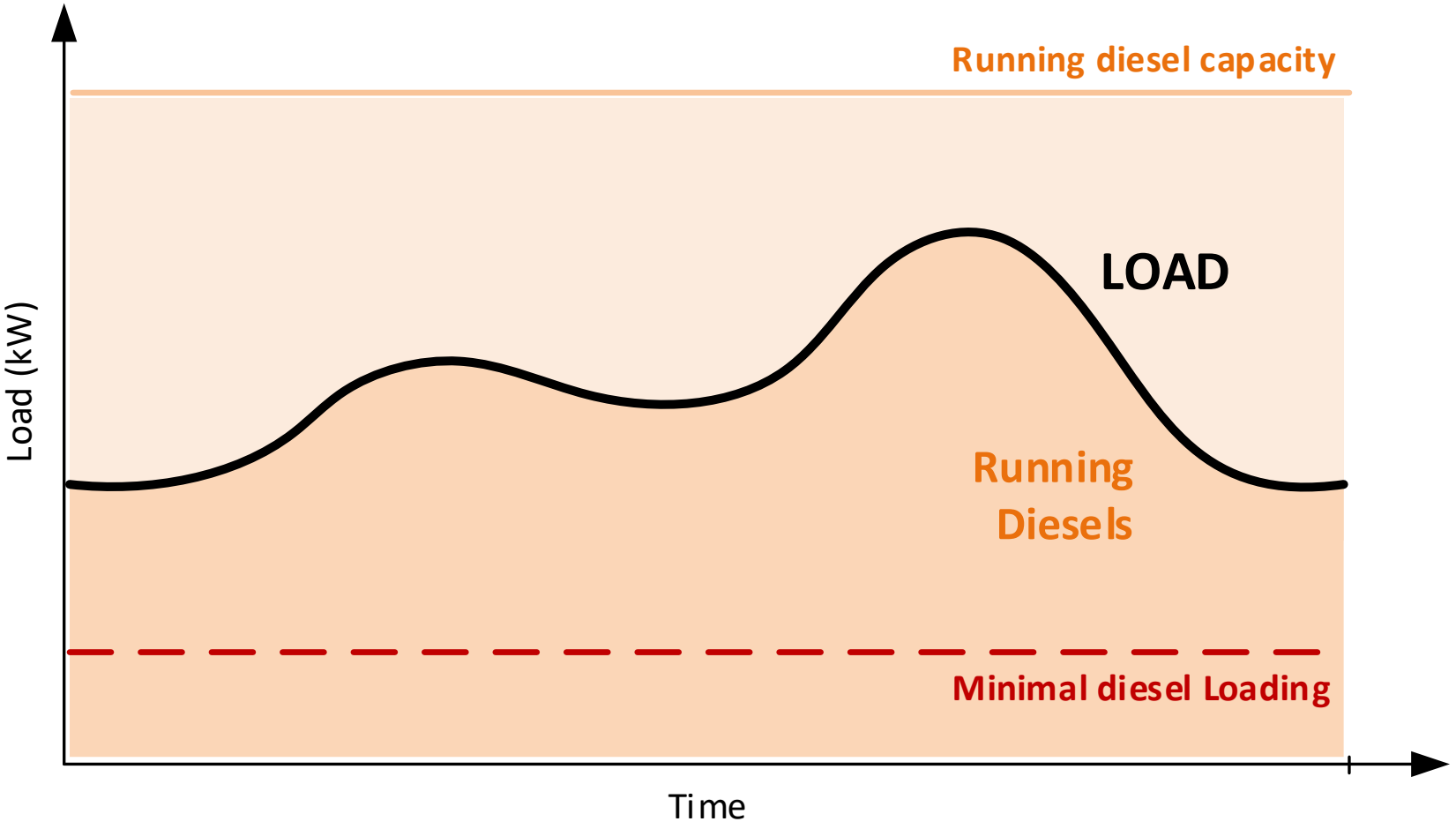
EMBARKING ON A JOURNEY



Source: entura.com.au

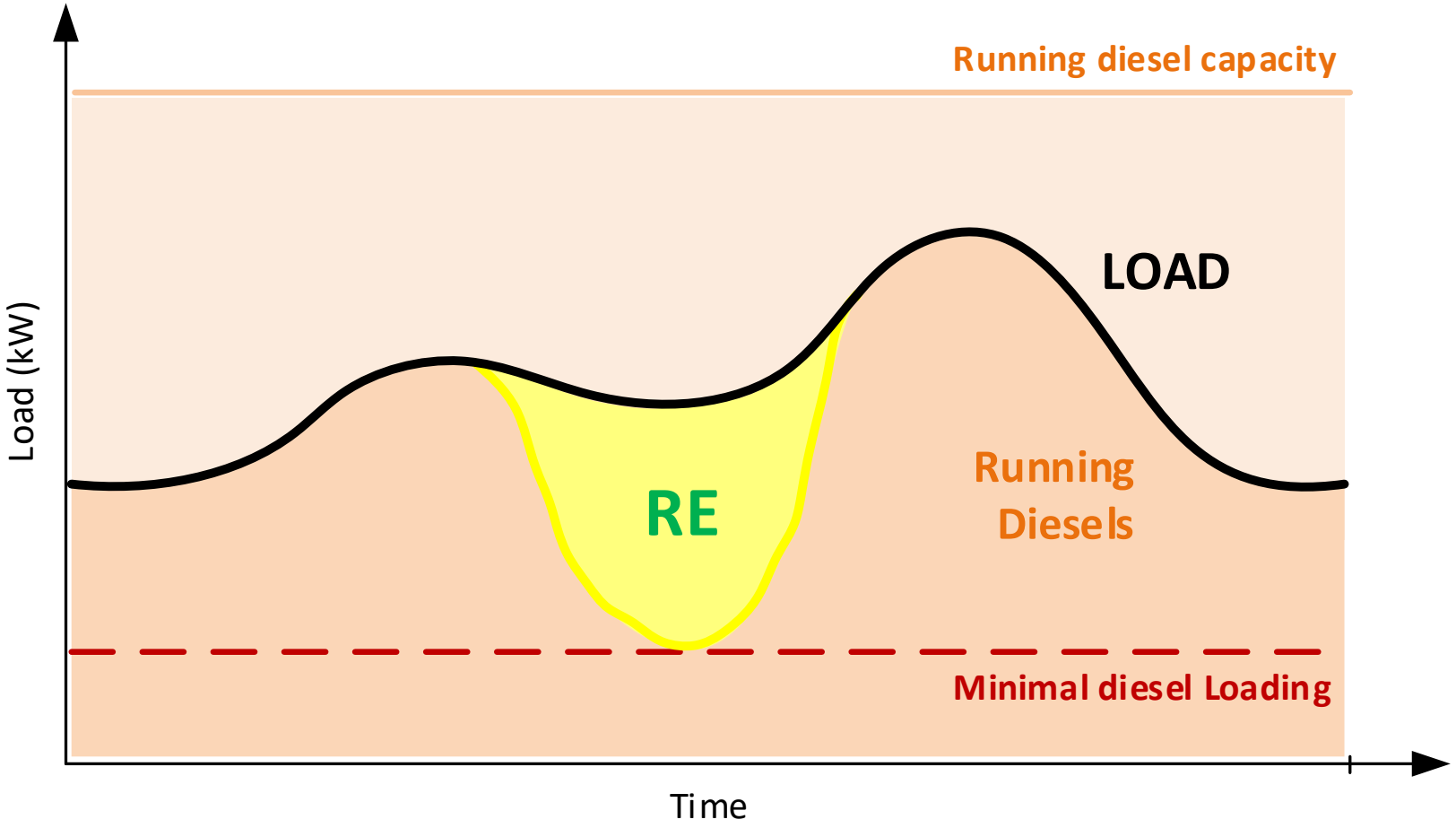
RENEWABLE ENERGY JOURNEY - PHASE 1



Diesel selection (size/number/type)

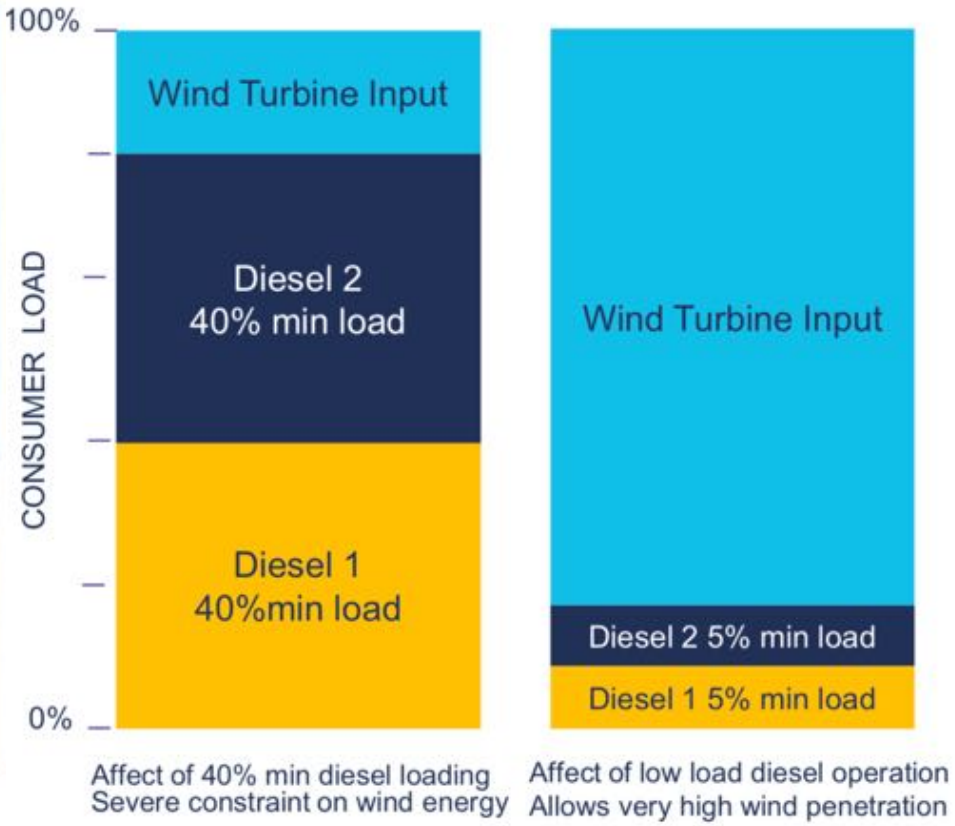
Automation

RENEWABLE ENERGY JOURNEY - PHASE 2



PHASE 2 CASE STUDY
DENHAM - SYNERGY

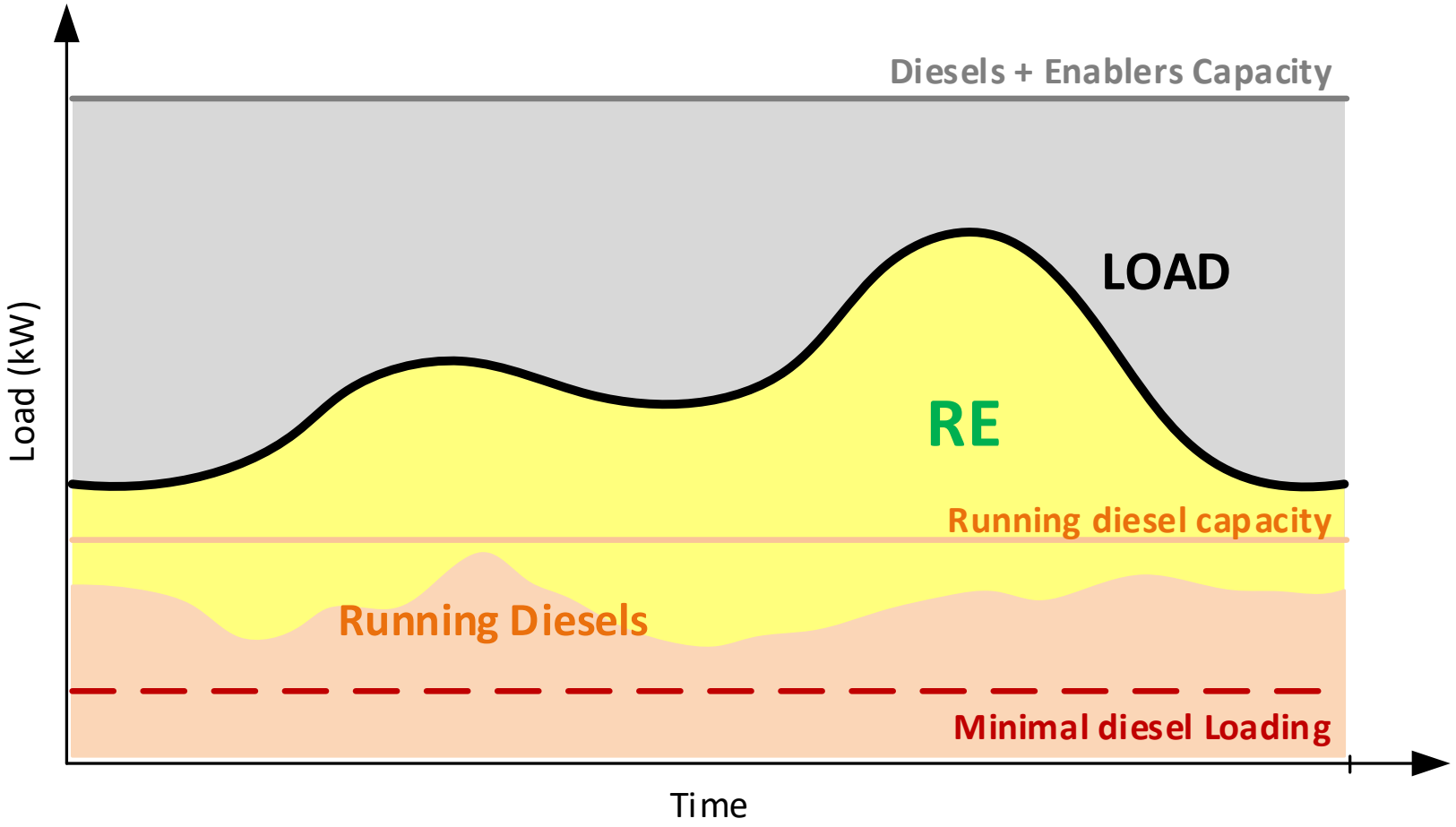
Wind / diesel integration in the absence of energy storage – use of low load diesel



Source: Synergy

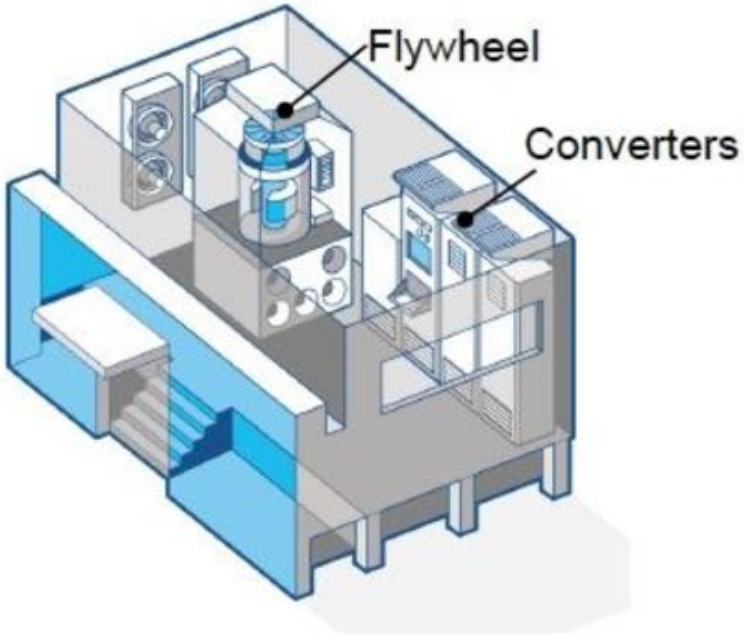
4xEnercon WTG, 7x Diesel generators, inc 3xLLD

RENEWABLE ENERGY JOURNEY - PHASE 3



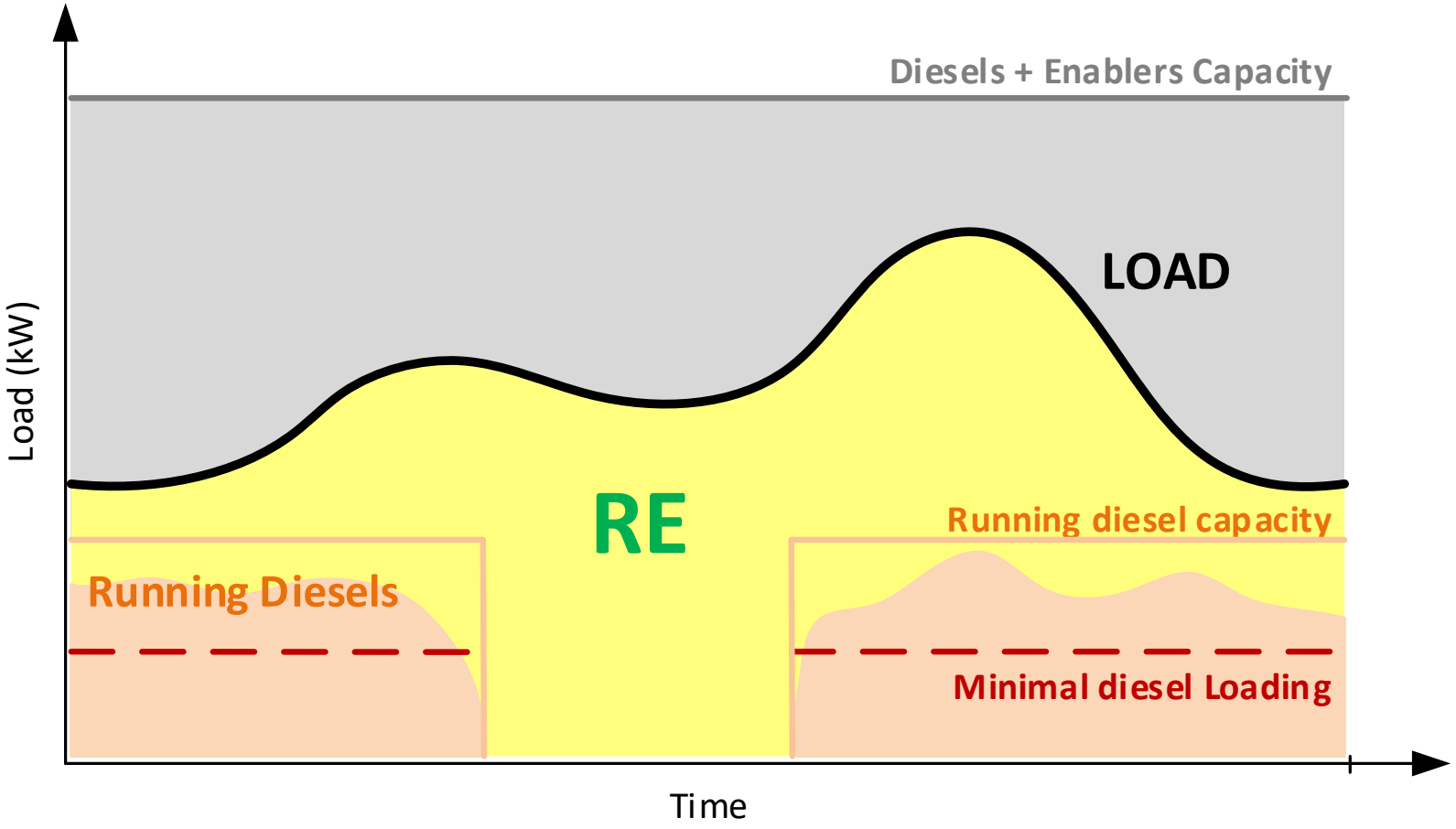
PHASE 3 CASE STUDY
MARBLE BAR – HORIZON POWER

Source : ABB



4x 320kW diesel generators, 300kW solar PV, 500kW flywheel

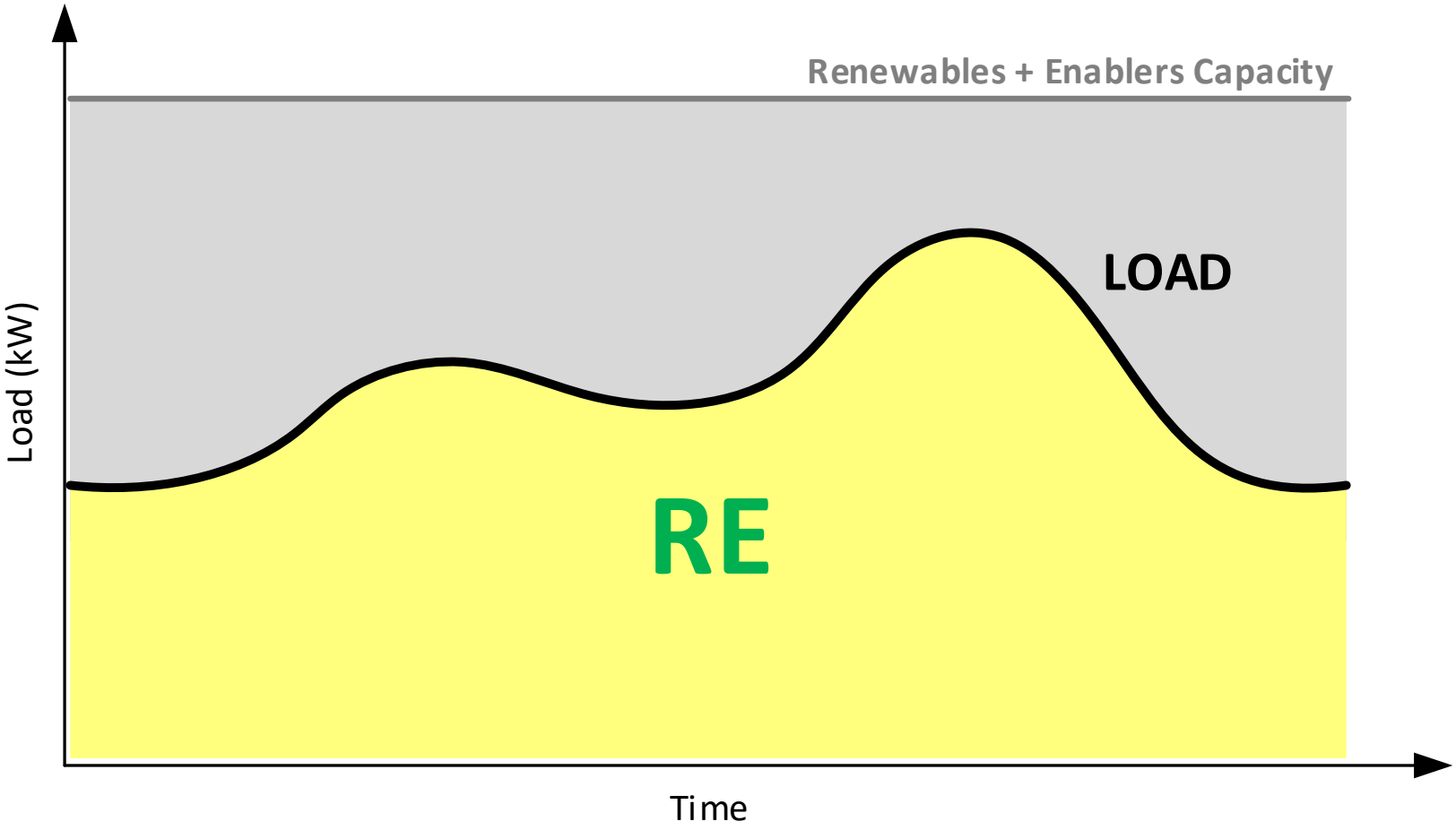
RENEWABLE ENERGY JOURNEY - PHASE 4



PHASE 4 CASE STUDY
FLINDERS ISLAND – HYDRO TASMANIA

Source: Hydro Tasmania – Flinders Island Hybrid Energy Hub

RENEWABLE ENERGY JOURNEY - PHASE 5

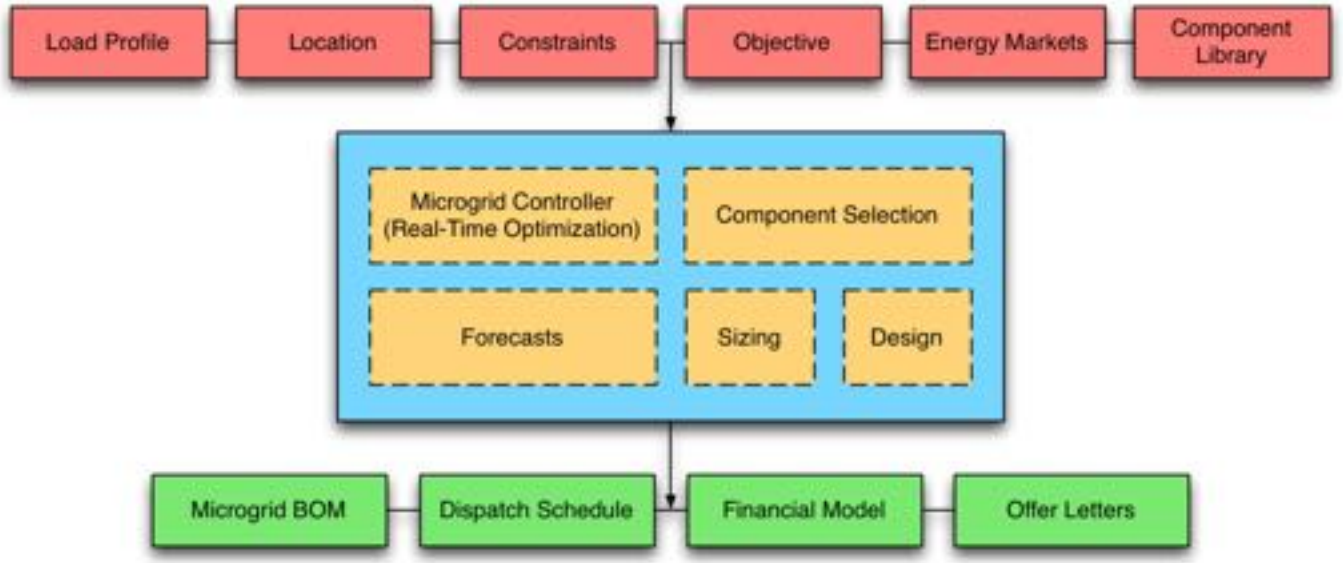


PHASE 5 CASE STUDY
TAU'– TESLA

Source: Tesla

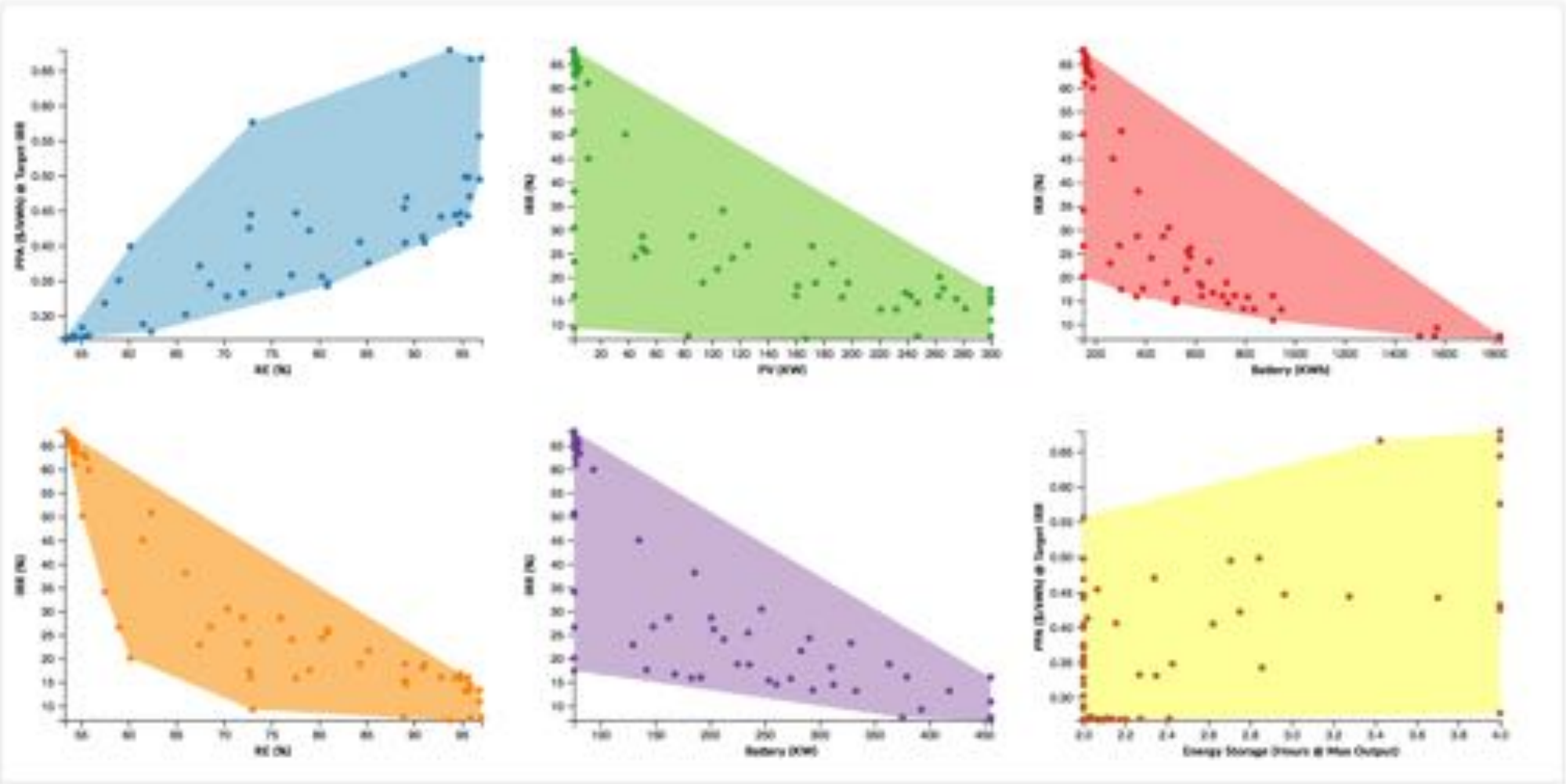
OPTIMISATION CAPABILITY - GRIDSCAPE

- Enernet has built a proprietary software platform providing fast, accurate and consistent sizing and pricing for microgrids, tailored to customer needs.



- Generates an optimized financial model and microgrid bill of materials using machine learning algorithms
- Incorporates weather and load forecasts to produce a dispatch schedule that minimizes operational cost

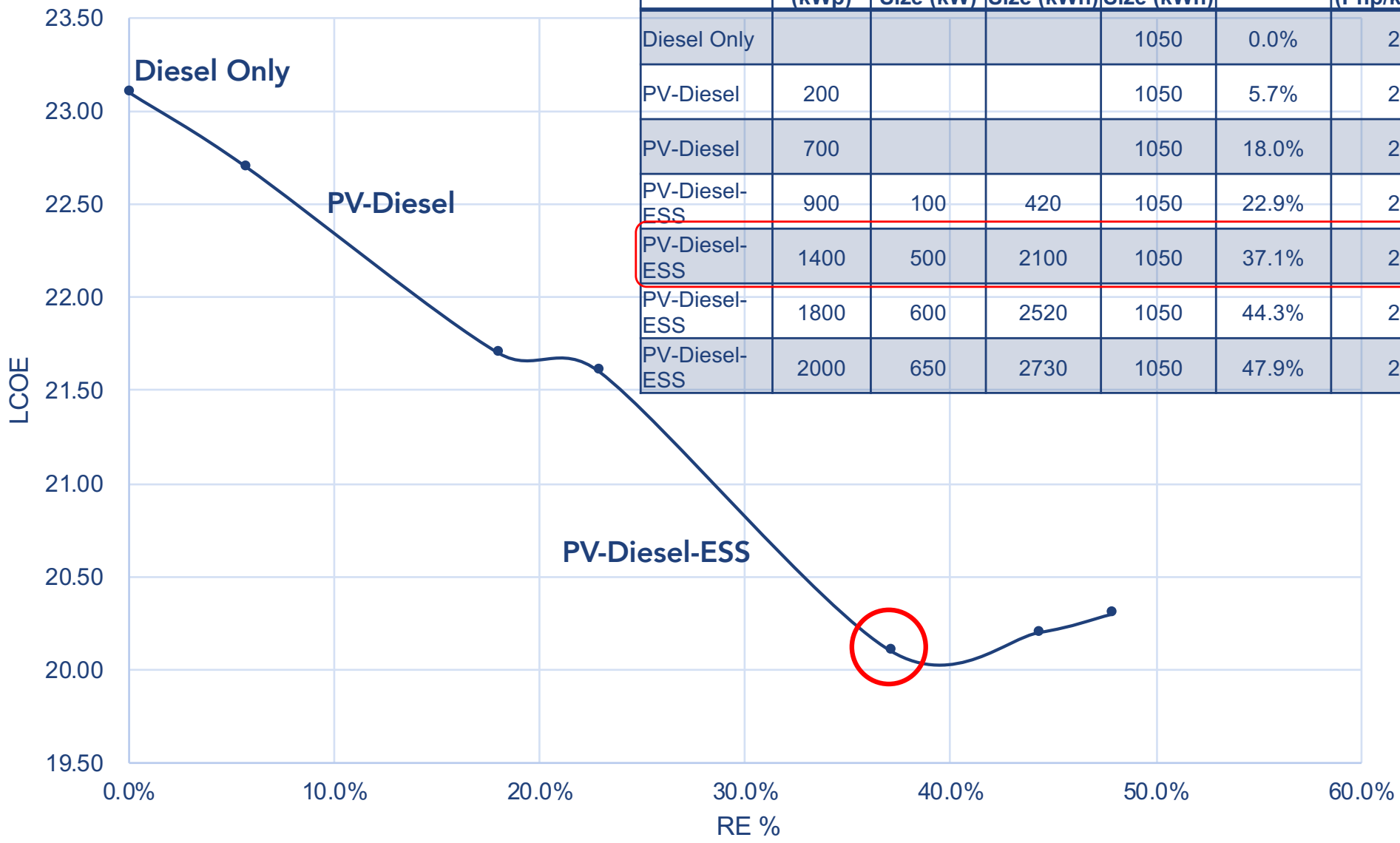
PARETO FRONTIER PLOT - GRIDSCAPE



- Multi dimensional solution landscape is created
- Allows solution space to be explored and performance/pricing trade offs made with client
- Projects offered to clients come directly from these frontiers

RAPID PROTOTYPING - GRIDSCAPE

	PV Size (kWp)	Battery Size (kW)	Battery Size (kWh)	Genset Size (kWh)	% RE	LCOE (Php/kWh)
Diesel Only				1050	0.0%	23.10
PV-Diesel	200			1050	5.7%	22.70
PV-Diesel	700			1050	18.0%	21.70
PV-Diesel-ESS	900	100	420	1050	22.9%	21.60
PV-Diesel-ESS	1400	500	2100	1050	37.1%	20.10
PV-Diesel-ESS	1800	600	2520	1050	44.3%	20.20
PV-Diesel-ESS	2000	650	2730	1050	47.9%	20.30



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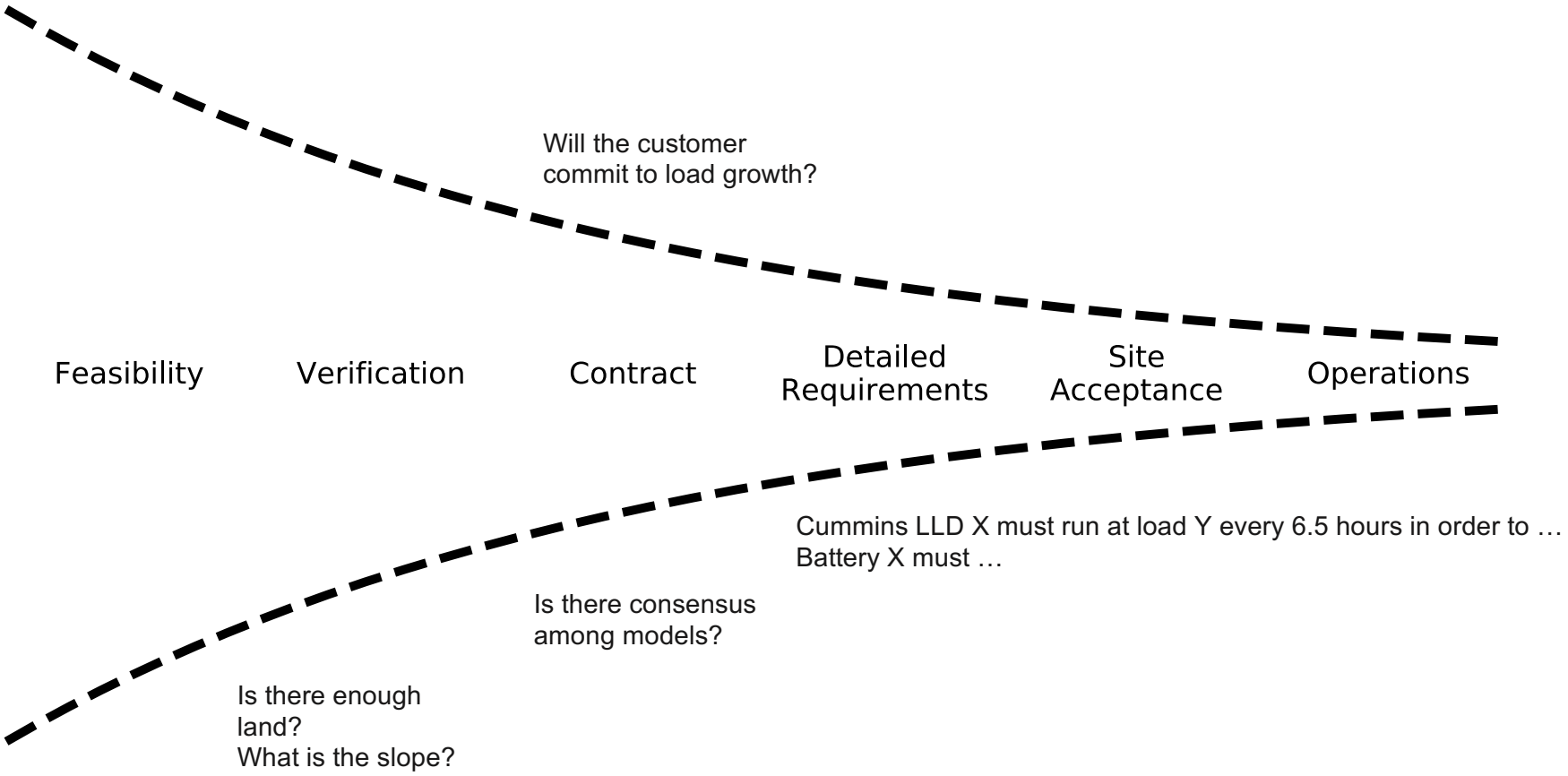
CONTINUOUS RISK MITIGATION



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COMMON IPP RISKS AND MITIGATIONS

Risk	Description	Mitigations
Permitting	• Achieving all environment, development and building permits in time for scheduled construction	• Early issue identification, development experience, outsourcing to experts, **CPs in construction contract**
Construction	• Completion on time and budget	• Lump-sum turn-key EPC arrangement with **robust performance and delay liquidated damages** • An independent engineer reviews and comment technical aspects
Technical Performance	• Inability to achieve reliability standards, production estimates	• **System level performance specifications** • Proven vendors and technology • System modelling – HIL / Bench tests • **FAT / SAT / Ongoing performance test**
Natural Resource	• Wind and solar components rely on natural resources that are available intermittently	• Natural resource assessments are based on satellite data combined with ground data. • Investor and lender base case numbers are based on **P50 and P90 output**, respectively
Political	• Political risks include expropriation, political violence and inconvertibility	• **Carefully selects markets** that are less likely to be affected by political risk events; • **Use PRG and insurance products** on a case by case basis

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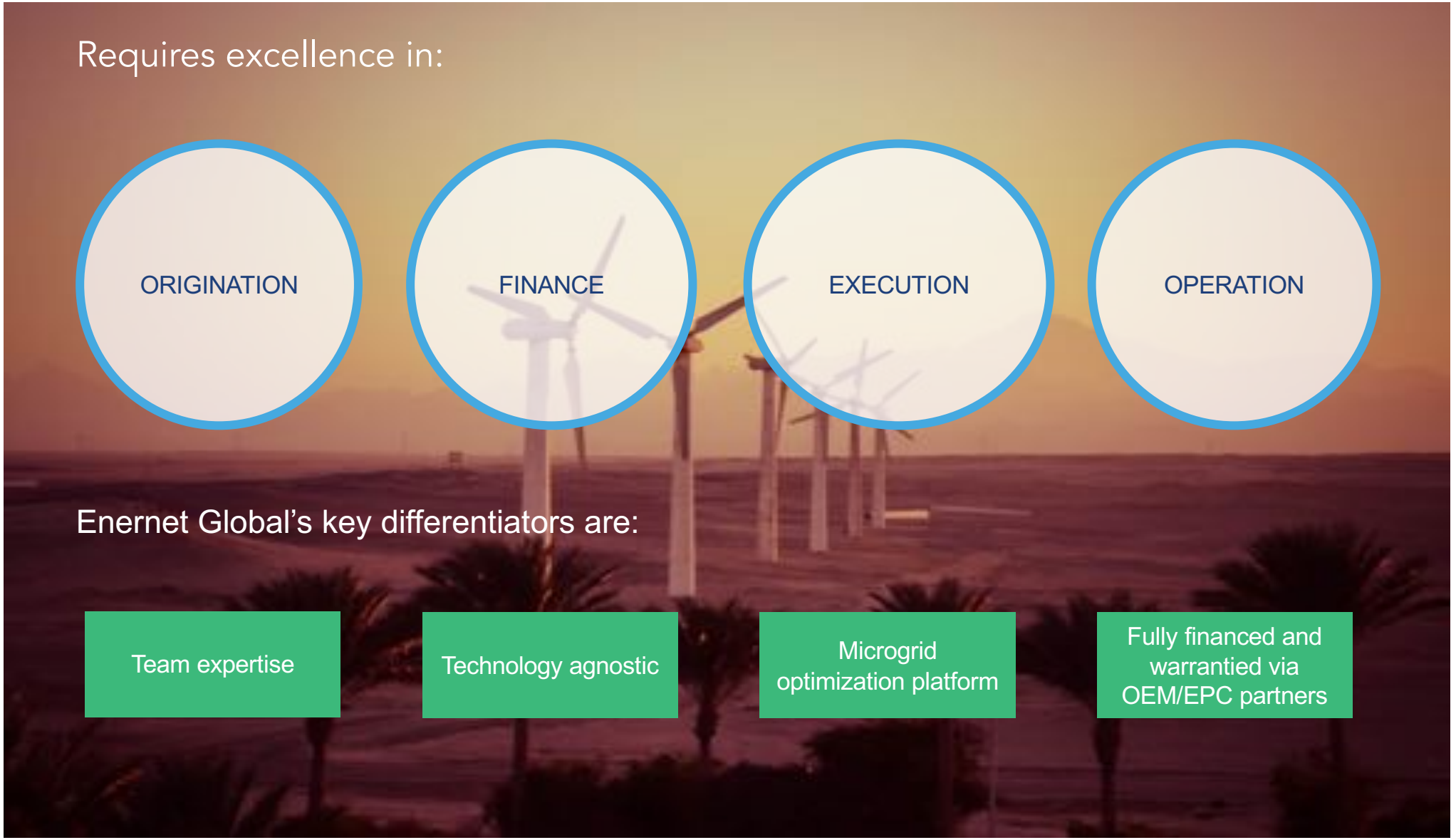
SUMMARY – MICROGRID IPPs ARE EMERGING

Large market

Attractive segments

Requires broad/deep skills

Significant client benefits



Enernet Global
169 Fullarton Rd
Dulwich
Adelaide, S.A.

AUSTRALIA / PACIFIC
Simon Gamble / sgamble@enernetglobal.com