

ENERGY

Age considers; youth ventures: Considerations for windfarm repowering

New Zealand Wind Energy Conference 2017

Dr. Avishek Kumar

12 April 2017

Ungraded



**NEW ZEALAND
SITUATION**



**LIFECYCLE
STRATEGY**



**UNIQUE
OPPORTUNITES**

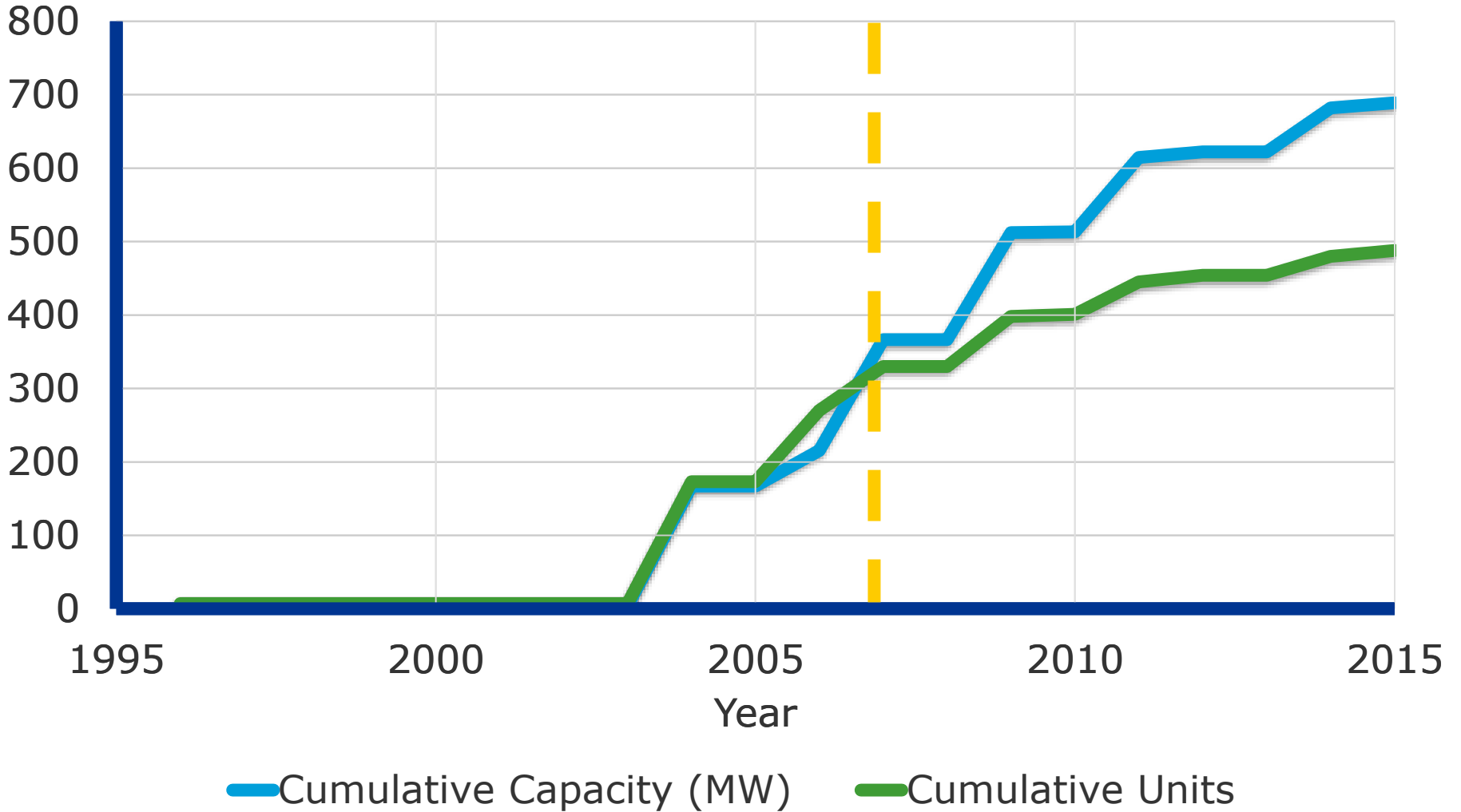


**INTERNATIONAL
EXPERIENCE**

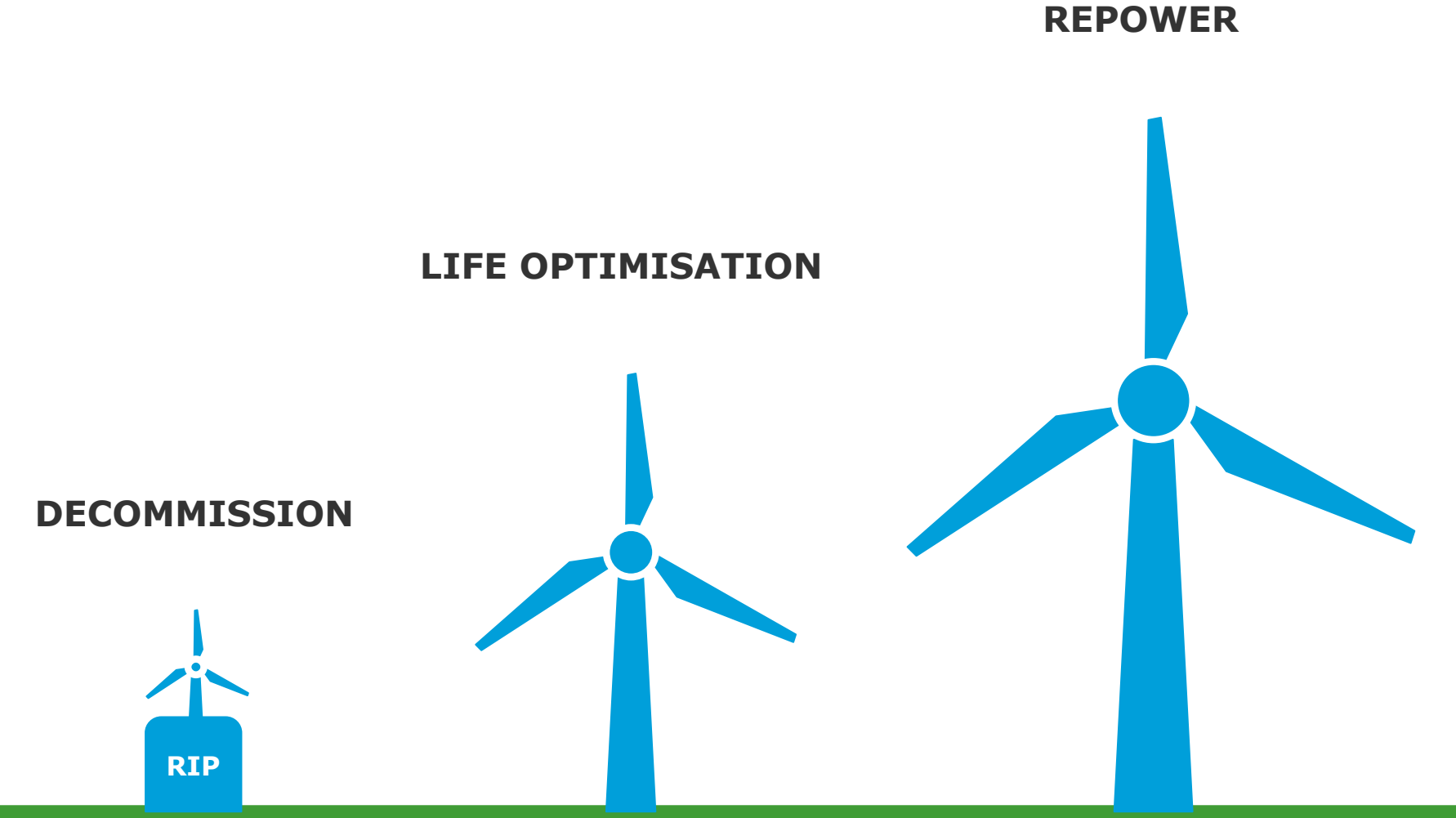


RISKS

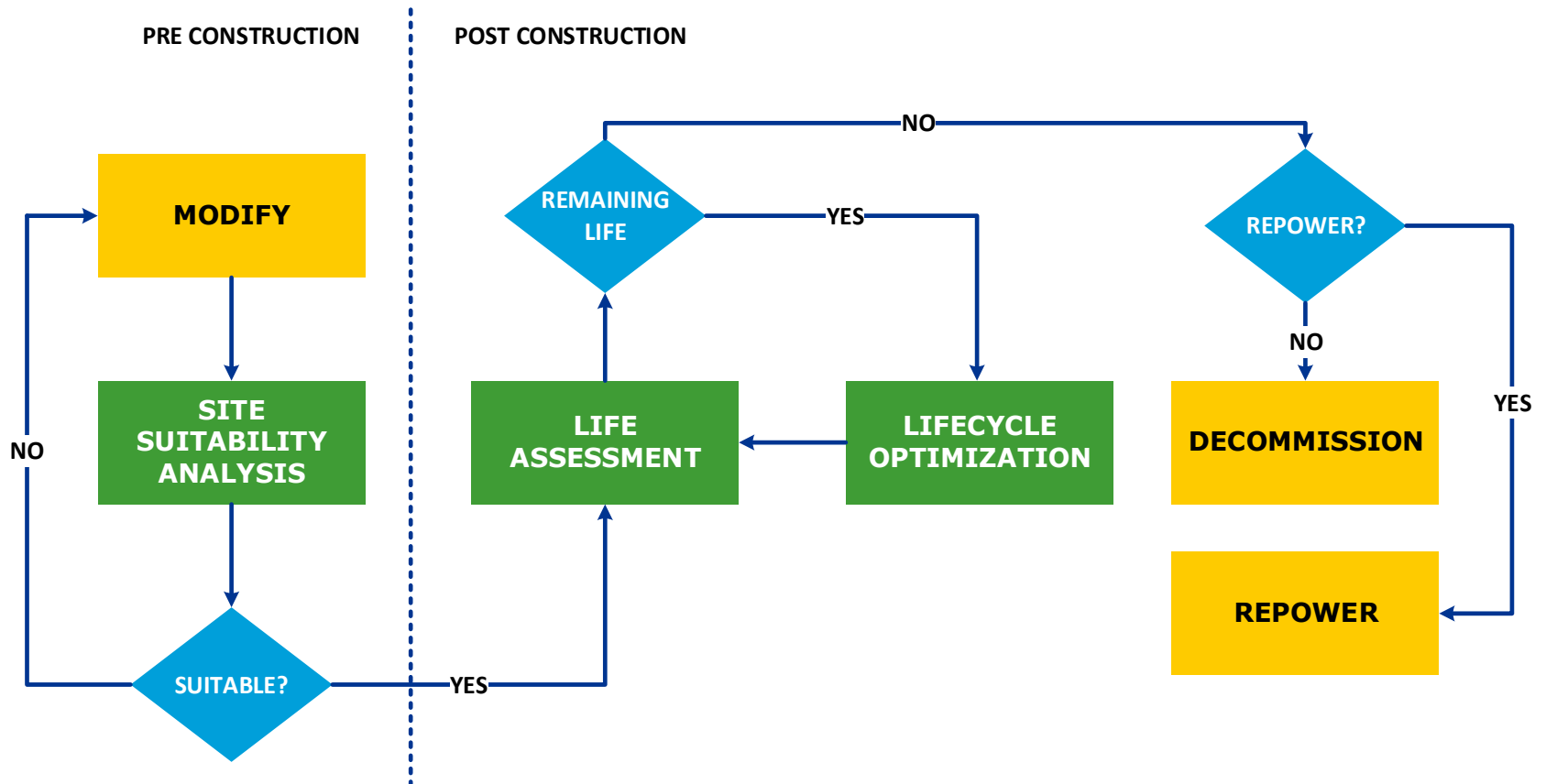
The NZ opportunity



Post Construction Options



The Lifecycle Strategy Process



The Lifecycle Strategy Process

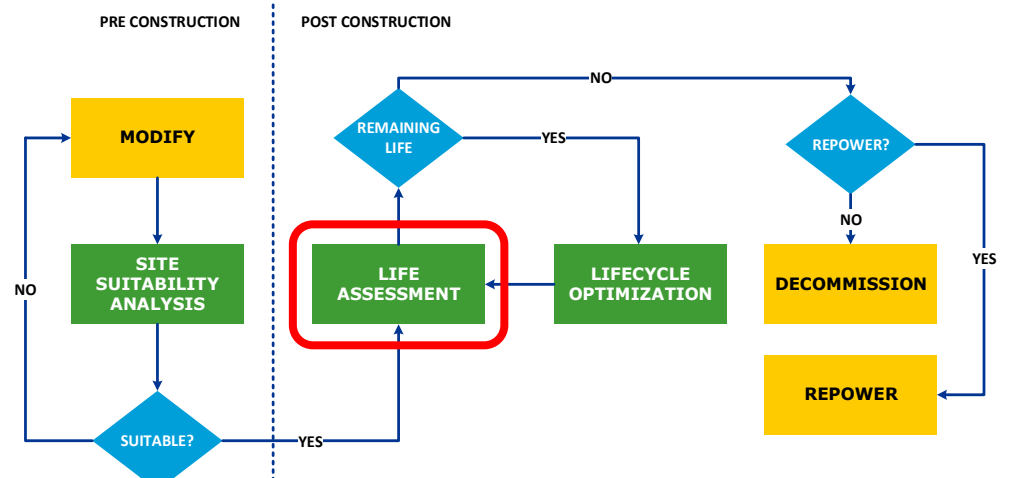
Basic

- Generic Turbine
- Met Data

Advanced

- SCADA
- Specific Turbine Model
- Probabilistic Analysis

Site Conditions
Operational Data
Turbine Design
Inspection Data

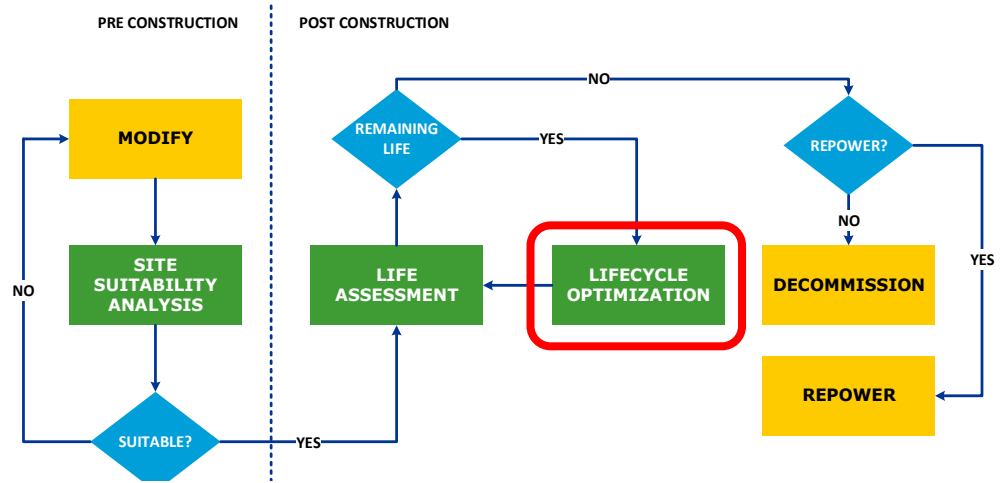


The Lifecycle Strategy Process

Retrofits
Controller Upgrades
Windfarm Control
Targeted Inspections
Operational Modifications
Site specific upgrades

Economic Parameters
O&M Inputs

- Maintenance Strategy
- SCADA Data
- Probabilistic Analysis
- Turbine Specifications



Turbine life gauge

FULL REPOWER

Complete decommission and replacement
Includes foundation work

LIFE EXTENSION

Certification exercise
Keep running turbines beyond life



PARTIAL REPOWER OR RETROFIT

Replace specific parts
Increase gross power capture
Increase reliability

Opportunities

REPOWERED PROJECTS

Leverage productive sites

Improved site/operational knowledge

Re-use existing services

Second hand turbine market

NEW PROJECTS

Increased production per hectare

Advanced grid support features

Increased reliability

Reduced supply chain risk

Reduced noise

Opportunities

REPOWERED PROJECTS

Leverage productive sites

Improved site/operational knowledge

Re-use existing services

Second hand turbine market

NEW PROJECTS

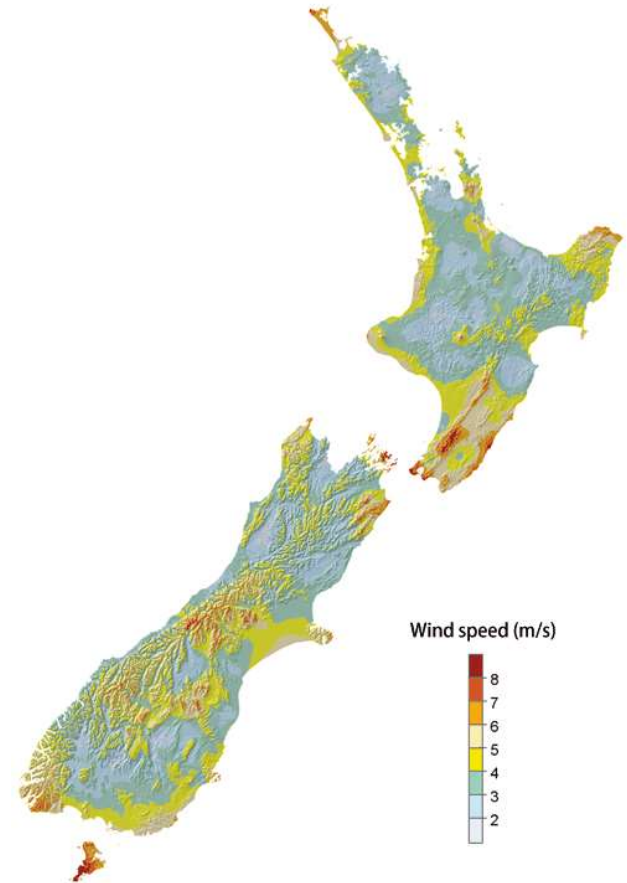
Increased production per hectare

Advanced grid support features

Increased reliability

Reduced supply chain risk

Reduced noise



Opportunities

REPOWERED PROJECTS

- Leverage productive sites
- Improved site/operational knowledge
- Re-use existing services
- Second hand turbine market

NEW PROJECTS

- Increased production per hectare
- Advanced grid support features
- Increased reliability
- Reduced supply chain risk
- Reduced noise



Opportunities

REPOWERED PROJECTS

Leverage productive sites

Improved site/operational knowledge

Re-use existing services

Second hand turbine market

NEW PROJECTS

Increased production per hectare

Advanced grid support features

Increased reliability

Reduced supply chain risk

Reduced noise



Opportunities

REPOWERED PROJECTS

Leverage productive sites

Improved site/operational knowledge

Re-use existing services

Second hand turbine market

NEW PROJECTS

Increased production per hectare

Advanced grid support features

Increased reliability

Reduced supply chain risk

Reduced noise



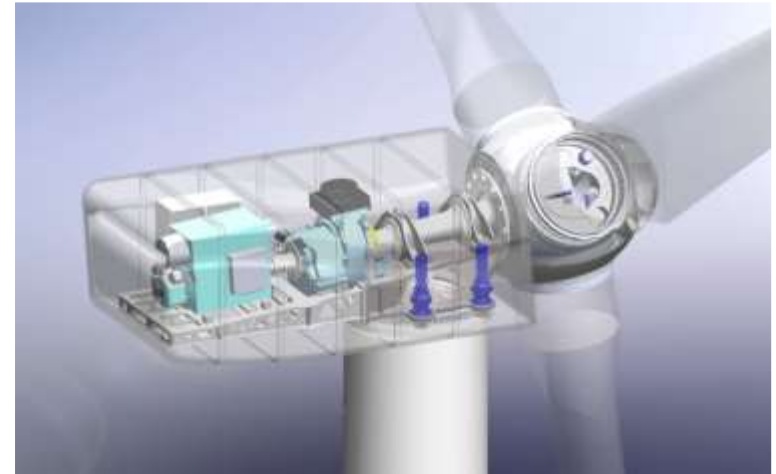
Opportunities

REPOWERED PROJECTS

- Leverage productive sites
- Improved site/operational knowledge
- Re-use existing services
- Second hand turbine market

NEW PROJECTS

- Increased production per hectare
- Advanced grid support features
- Increased reliability
- Reduced supply chain risk
- Reduced noise



International Experience

GERMANY

Incentives ended
2014
484 MW in 2015
(>1 GW in 2014)



DENMARK

Premium pricing
75 MW in 2014
1.3 GW goal (2012-
2020)



USA

Possible PTC
75 MW in 2014



International Experience

GERMANY

Incentives ended
2014
484 MW in 2015
(>1 GW in 2014)

DENMARK

Premium pricing
75 MW in 2014
1.3 GW goal (2012-
2020)

USA

Possible PTC
75 MW in 2014

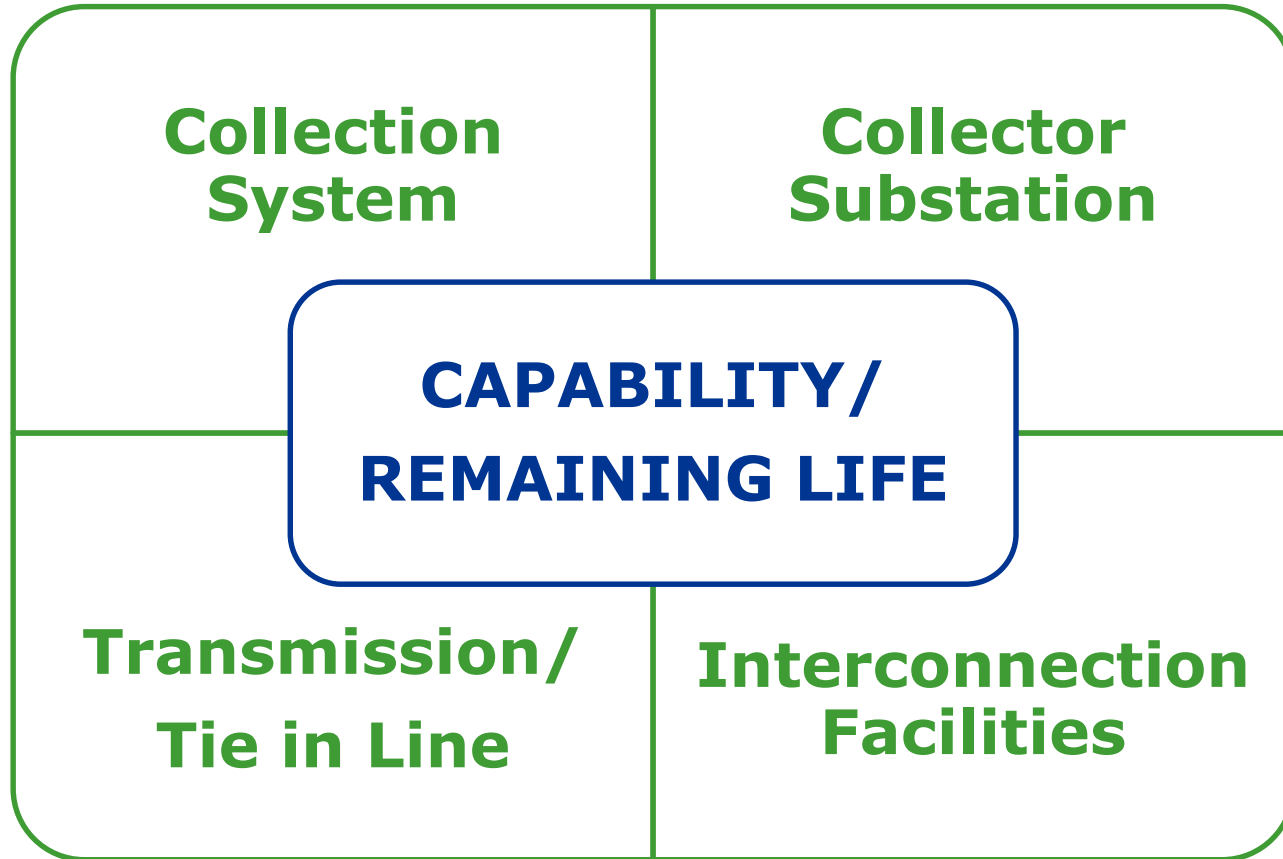
FOR

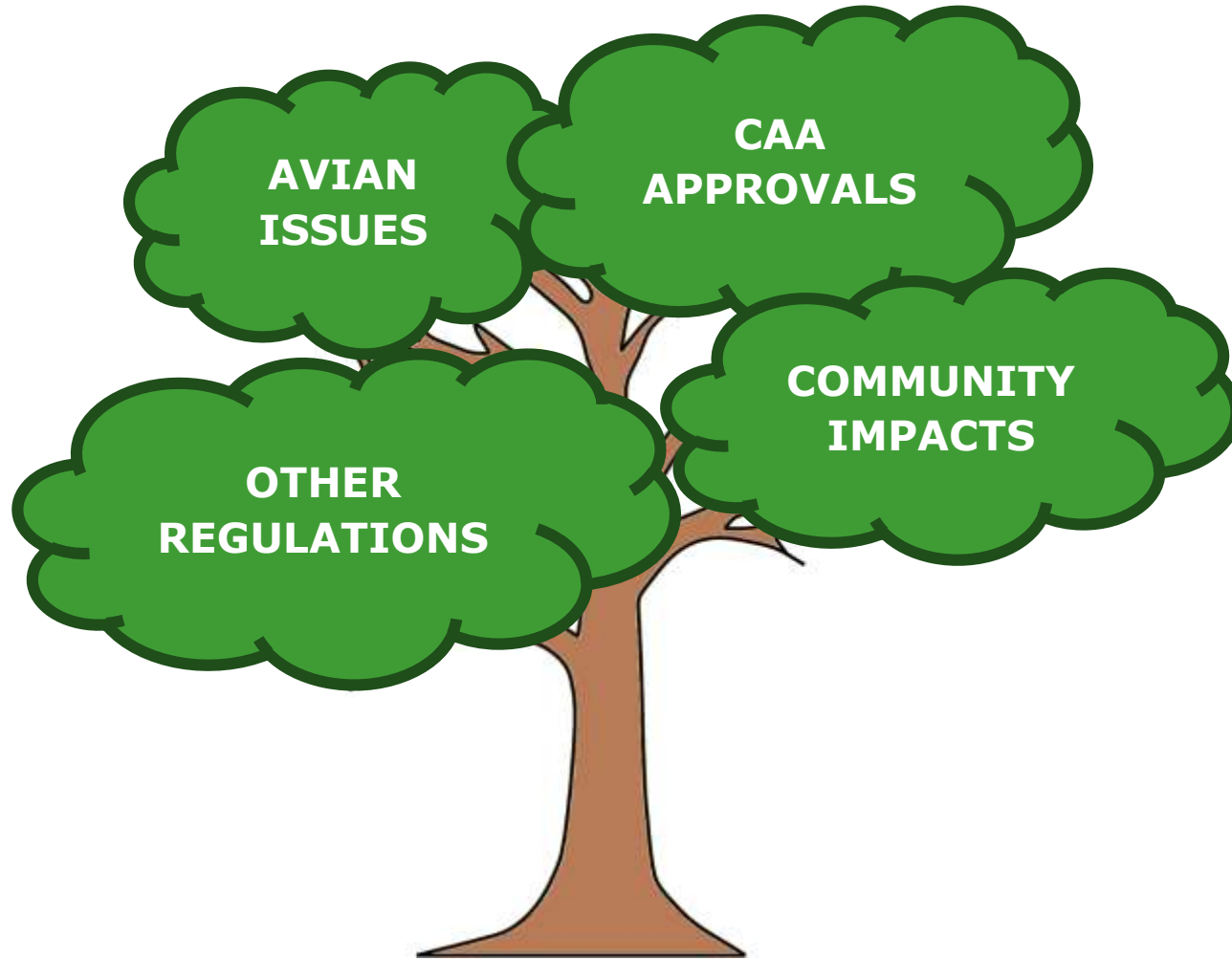
Policy incentives
Poor greenfield sites
Fast technology changes
Strong PPA
Rising O&M costs
High cost savings
Public support

AGAINST

Business as usual
Productive greenfield sites
Slow technology changes
Price taker
Stable O&M costs
Poor cost savings
Public opposition

Risks – Electrical Balance of Plant





And for the future, optimise from Day 1

RECORD KEEPING

Escrow design information
Create document preservation plan

ADVANCED MODELLING AND DESIGN

Site specific designs
Design Foundations and BOP for 30+
years

ADVANCED MONITORING

Add structural inspections to O&M
plans
Digital Twins





**NZ's first generation
of turbines reaching
end of design life**



**Leverage repowering
opportunities**



**Full repowering
favours replacing
older technology**



**Modern turbines
benefit from lifetime
optimisation**



**Plan early to
avoid/overcome risk**



avishek.kumar@dnvgl.com

www.dnvgl.com

SAFER, SMARTER, GREENER

References

- *DNV GL White Paper on Technical and Contractual Considerations in Partial Repowering of Wind Turbines.* (2016)
- DNVGL-SE-0263 Certification of lifetime extension of wind turbines
- DNVGL-SE-0262 Lifetime extension of wind turbines
- Lantz et. al, *Wind Power Project Repowering: Financial Feasibility, Decision Drivers, and Supply Chain Effects.* TP-6A20-60535. NREL. (2013)
- *Global Wind Report: Annual Market Update.* GWEC. (2016)
- *Global Wind Report: Annual Market Update.* GWEC. (2015)
- *Global Wind Report: Annual Market Update.* GWEC. (2014)