

Repowering: understanding technical, tax and contractual considerations in repowering and how they impact availability of financing

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January 29, 2019
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- ## RePower Overview
- What is RePowering?
 - Benefits
 - Results to date



Overview

- Repowering : Retrofit vs. “Full scrape”
- Conversion of legacy turbines → improve output, reliability and extend life

GE examples:

| Legacy Unit | Repowered Configuration Options |
|-----------------------------|-------------------------------------|
| 1.5 S (70.5m rotor) | 1.5/1.62 (77m, 82.5m, or 91m rotor) |
| 1.5 SLE (77m rotor) | 1.5/1.62 (87m or 91m rotor) |
| 1.5 XLE (82.5m rotor) | 1.5/1.62 (91m rotor) |
| Clipper C96-2.5 (96m rotor) | GE 2.5 (116m rotor) |

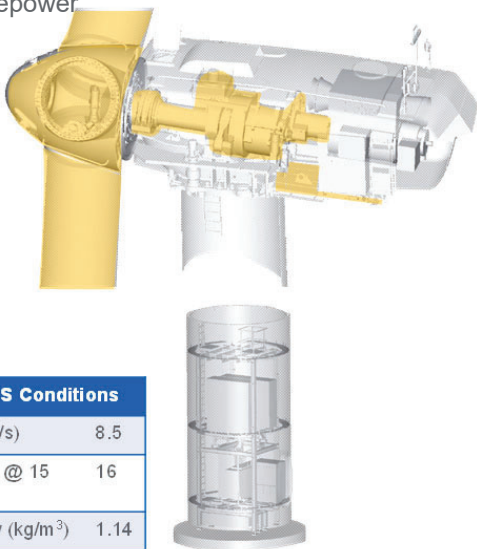
- **Basis:** leverage existing current mechanical configurations (1.x and 2.x platforms)
- **Re-use:** Components evaluated to new wind conditions & 20 years of additional life from repower COD: Towers, Foundation, BOP and existing siting, other
- **Replace:** Components being used in other GE new unit designs



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Scope of replaced and reused components

Example scope based on 1.5 SLE Repower



| IEC 2S Conditions | |
|------------------------------|------|
| V _{avg} (m/s) | 8.5 |
| CTI (% @ 15 m/s) | 16 |
| Density (kg/m ³) | 1.14 |
| V _{ref} (m/s) | 40 |
| Shear | 0.2 |

| Component | Re-Use | Replace | Warranty | Description |
|-----------------------|--------|---------|----------|--|
| Blade | | ✓ | ✓ | LM42 Blade Design |
| Pitch bearing | | ✓ | ✓ | AR500, Gleitmo Pitch Bearing |
| Pitch system | | ✓ | ✓ | Non-ESS 575V GE Pitch System w/ Spline |
| Hub | | ✓ | ✓ | Current 1.85-87 Hub |
| Main shaft | | ✓ | ✓ | Current 1.85-87 Main Shaft |
| Main bearing | | ✓ | ✓ | Current 1.85-87 Main Bearing |
| Gearbox | | ✓ | ✓ | 1.6-100 GBX with Non-ESS Auxiliaries |
| Flex Coupling | | ✓ | ✓ | Current 1.85-87 Coupling |
| Slipring | | ✓ | ✓ | Non-ESS compatible slip ring |
| Bedplate | ✓ | | | No change to existing component |
| Gen Frame | | ✓ | ✓ | Modified gen frame with shear plates |
| Yaw system | ✓ | | | No change to existing component |
| Nacelle | ✓ | | | No change to existing component |
| Top Box | ✓ | | New IO | Retrofit Kit for compatibility with GE Pitch |
| Tower | ✓ | | | No change to existing component |
| DTA | ✓ | | | On site Upgrade/Refurbishment |
| Generator | | ✓ | ✓ | On site refurbishment kit |
| Electrical Power Path | ✓ | | | No change to existing component |
| Controls HW | ✓ | ✓ | ✓ | Upgrade to MC205 |
| Controls SW | | ✓ | ✓ | New SW to have equivalent capability of the MK0e GEN1 controllers with the new mechanical platform |



Not to be

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2019 Renewable Energy Law session
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