ACMA
American Composites Manufacturers Association

RECOVER. TRANSFORM. INNOVATE.

Composites Recycling Conference 2020 | Online

May 19 – 21, 2020

Composites Recycling Supply Chain Insights

Michelle Simpson

Technology Leader, Services Productivity

GE Renewable Energy

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ACMA
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Global Wind Power Adoption

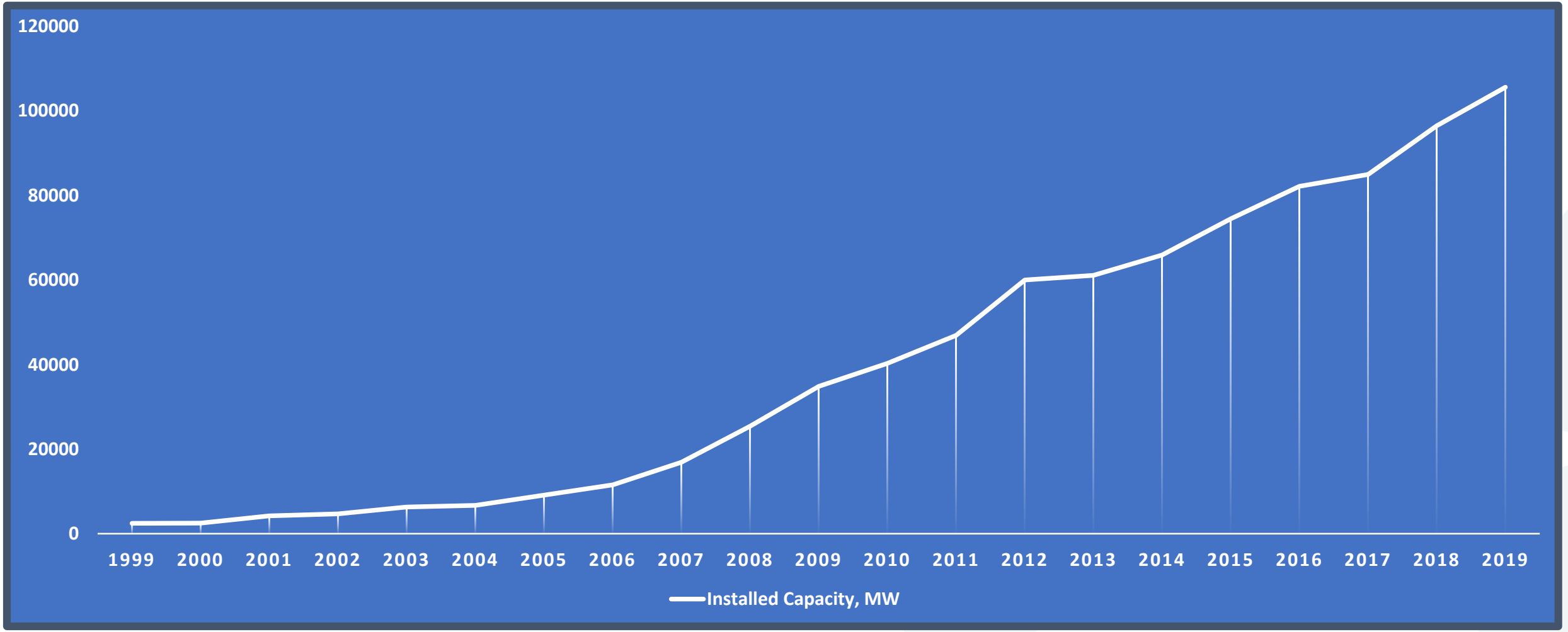
14.8 %CAGR, ‘10-’18**

59.7 GW Capacity added ‘19*

650.8 GW Total Capacity*

*World Wind Energy Association, April, 2020 (https://wwindea.org/blog/2020/04/16/world-wind-capacity-at-650-gw/)
**GlobalData Energy, November, 2019 (https://www.power-technology.com/comment/global-wind-power-market-expected-to-approach-125bn-by-2030/)

US Installed Wind Capacity … *2.5X* '10-'19



Source: https://windexchange.energy.gov/maps-data/321

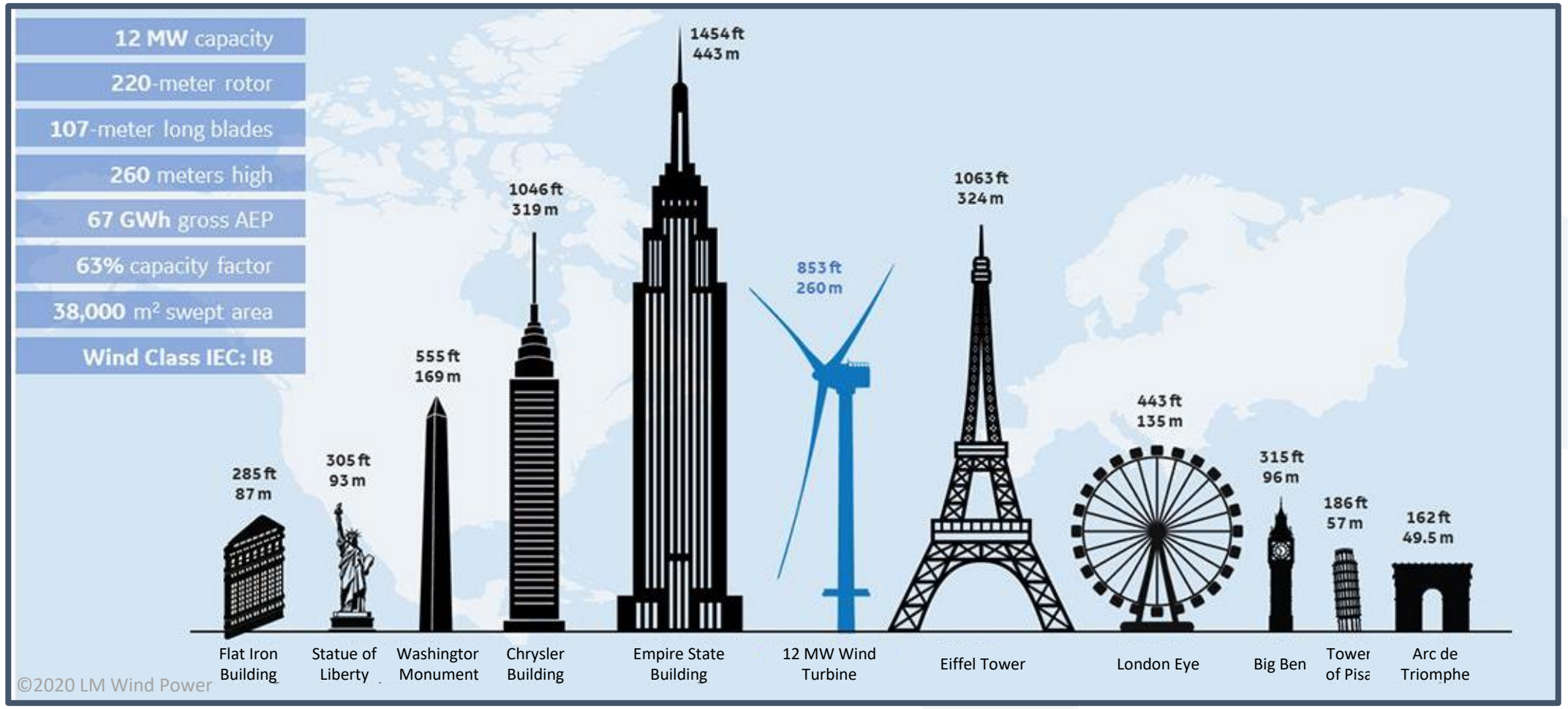
Sustainable Progress

“In a First, Renewable Energy Is Poised to Eclipse Coal in U.S.”

The New York Times
May 13, 2020

Source: https://www.nytimes.com/2020/05/13/climate/coronavirus-coal-electricity-renewables.html

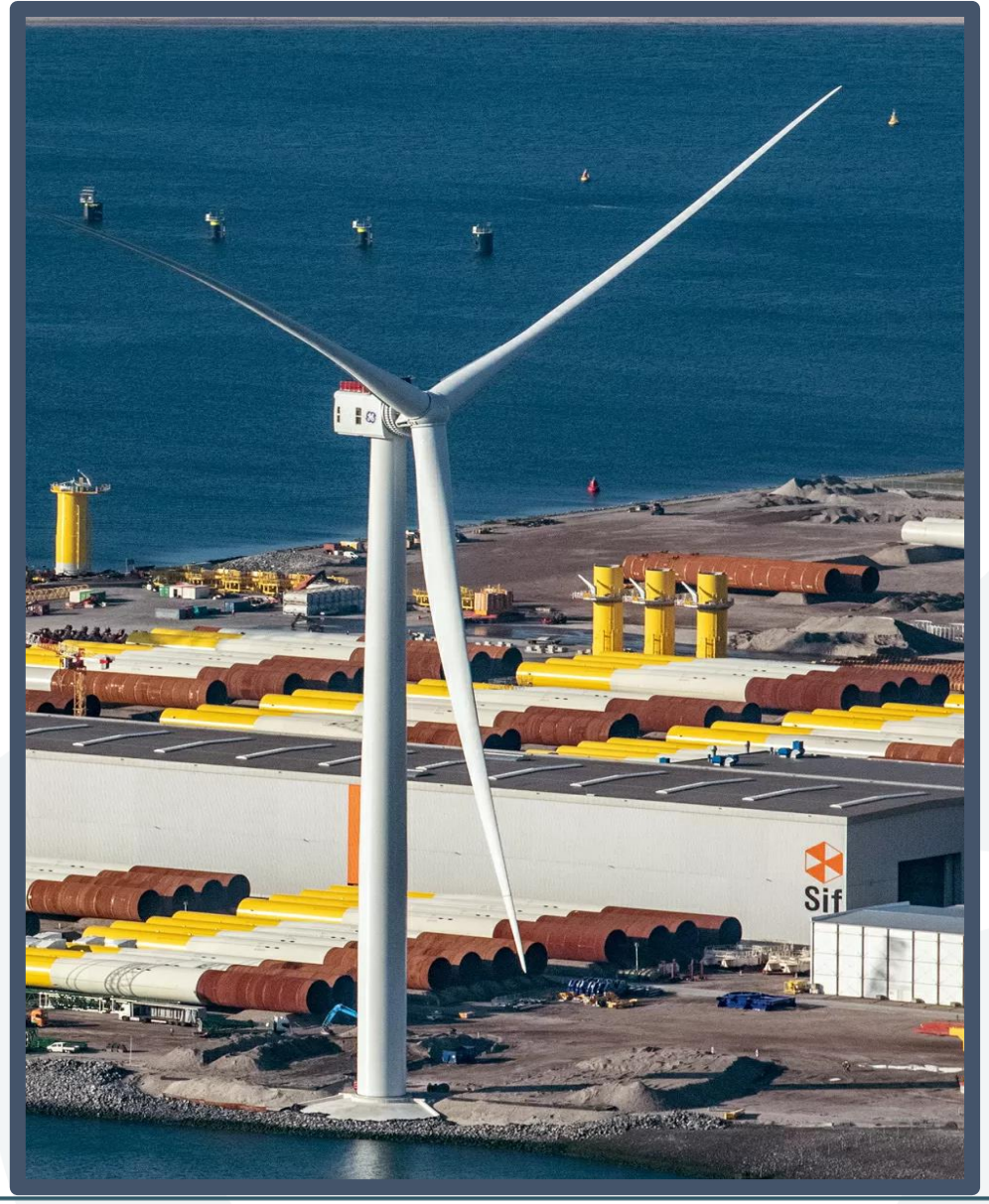
Powerful Turbines



Source: https://www.lmwindpower.com/en/stories-and-press/stories/news-from-lm-places/ge-announces-haliade-x-the-worlds-largest-offshore-wind-turbine

Composites-Enabled Performance

1	Blade
103	mph Tip Speed
107	Meters Length
40	Elephants*

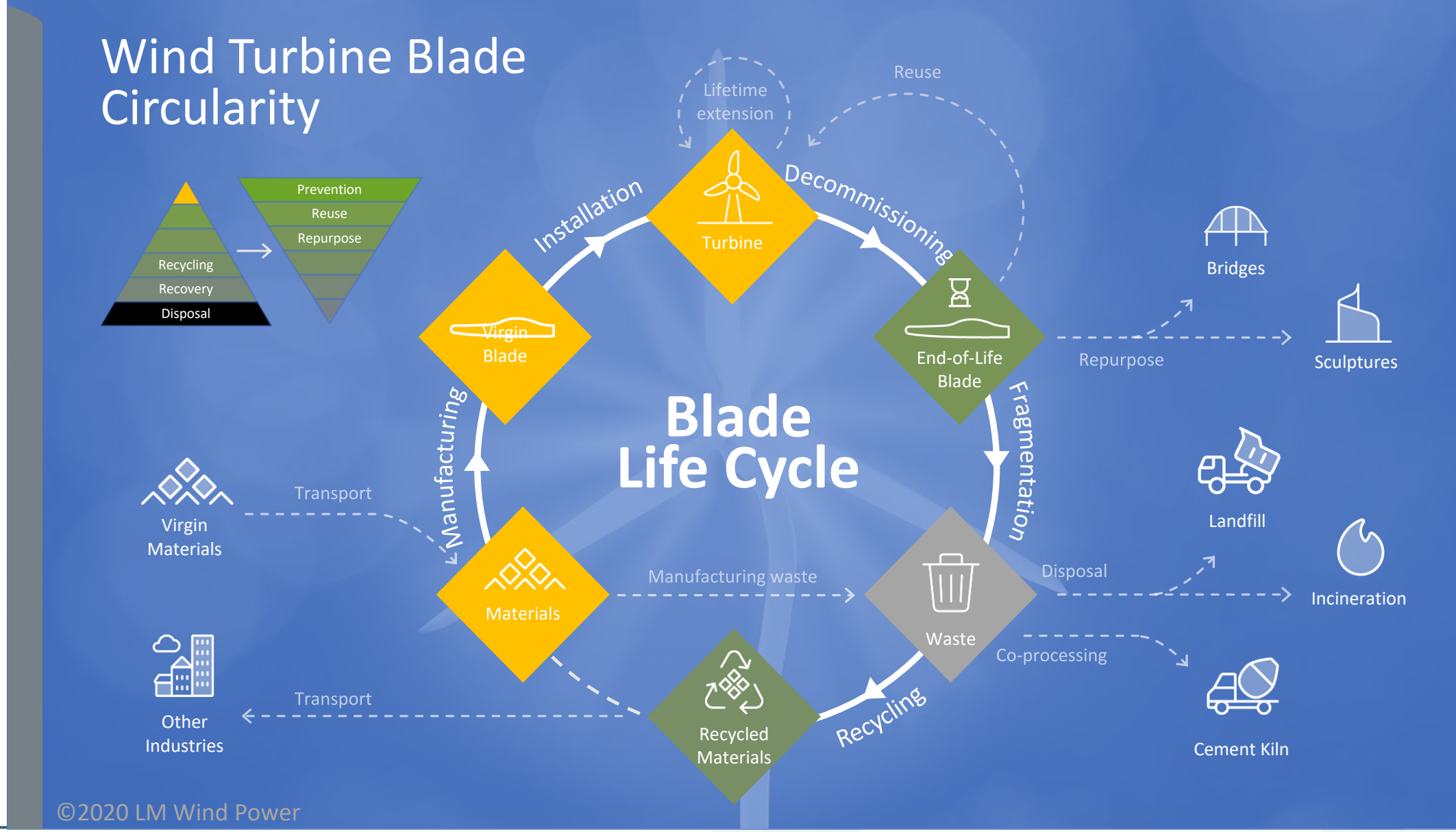


*Based on max flap applied root moment

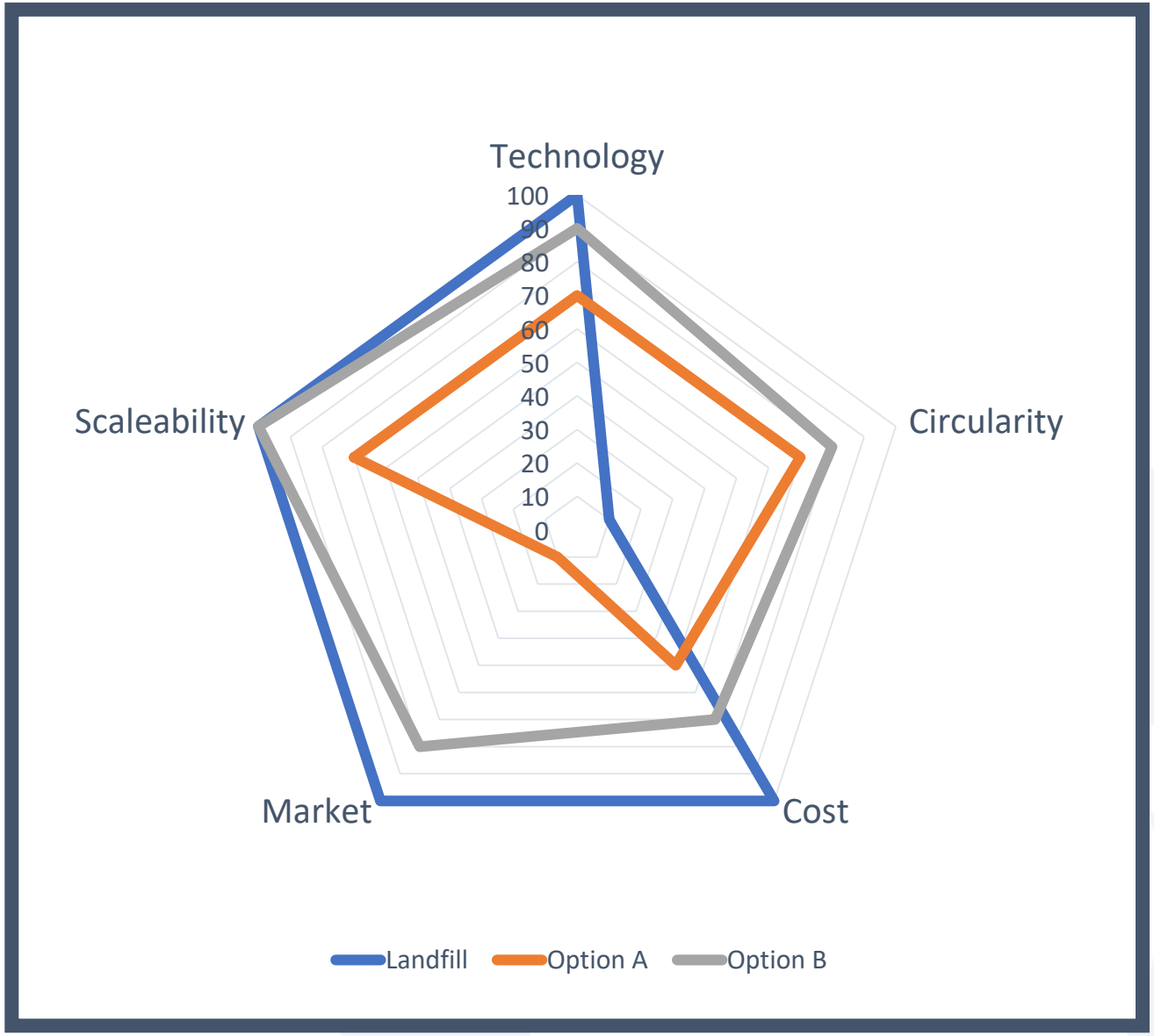
Beyond Green Electrons

~73%
Recycleable*

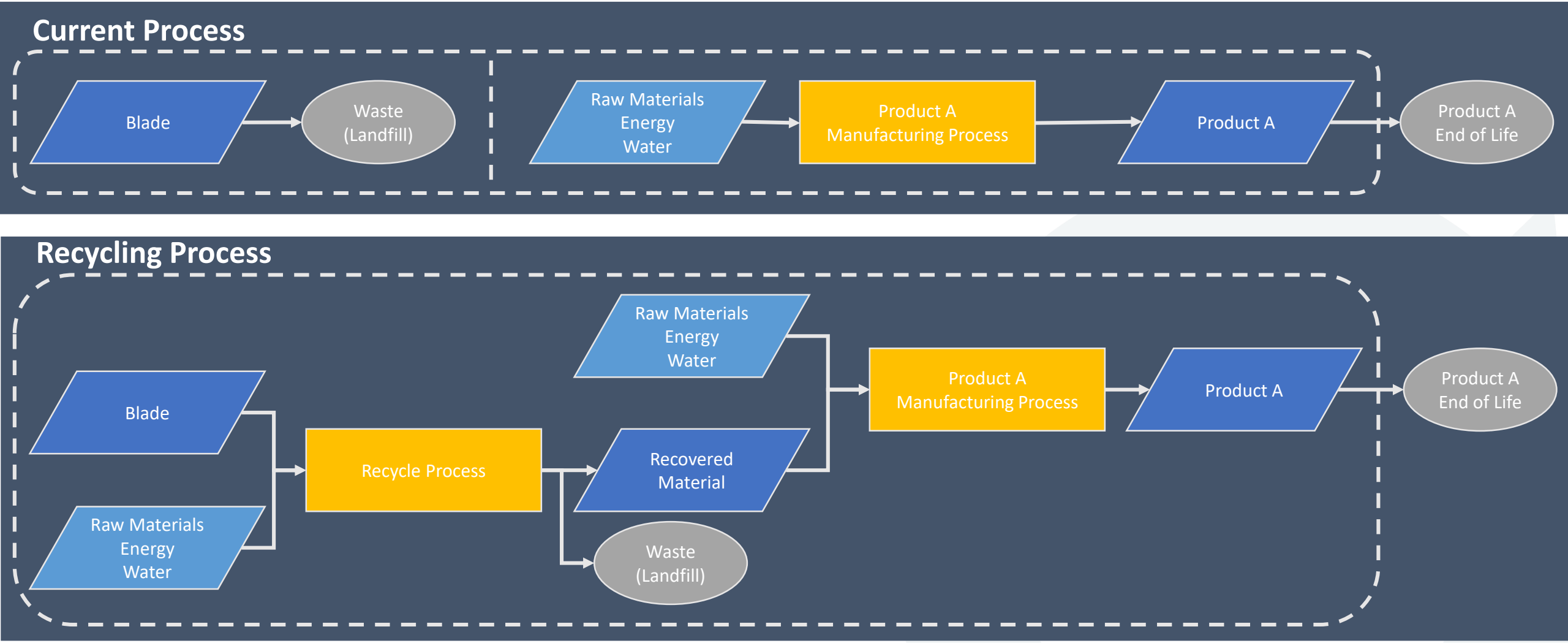
*Without foundation.
"Waste and material flow analysis in the end-of-life wind energy system", Tazi et. al., Resources, Conservation and Recycling, Volume 145, June 2019, Pages 199-207; https://www.sciencedirect.com/science/article/abs/pii/S0921344919301028



The Challenge: System Optimization



Circularity Considerations: Full Boundaries



Circularity Considerations: Impacts*

CARBON FOOTPRINT

Release of CO_2 and other greenhouse gasses that contribute to global climate change

Unit: Kg CO2-eq

WATER FOOTPRINT

Freshwater withdrawal (water that is withdrawn from natural reservoirs)

Unit: m^3 of water

HUMAN HEALTH

Effects on human health including respiratory effects, cancer and non cancer outcomes

Unit: DALY (Disability-adjusted life years)

ECOSYSTEM QUALITY

A decrease in biodiversity (density of wildlife species) through destruction of habitat, pollution and other causes

Unit: PDF.m^2.y (potentially disappearing fractions)

RESOURCES

Resources demand for specific process or product, mainly due to non-renewable energy consumption and mineral extraction

Unit: MJ

*Provided courtesy of Quantis US

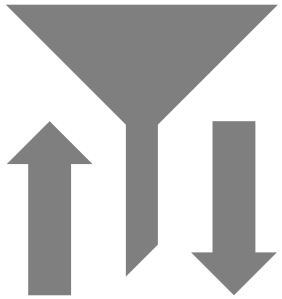
Composite Recycling – Technical Considerations

- **Composition of incoming material**
- **Separation of incoming material**
- Cutting, grinding, shredding methods
- **Properties of recovered material**
- **Energy recovered**
- **Compounding, joining, forming methods**
- **Emissions (dust, gasses, etc.)**

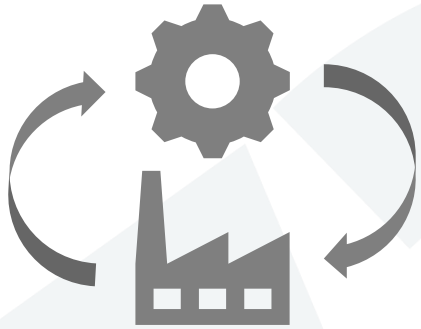
What is in your recyclate?

Composite Recycling –Economic Considerations

Transportation



Sorting



Manufacturing

Product value

Recyclate source drives cost

Composite Recycling – Market Considerations

- Market size
- Market maturity
- Product replaced
- Qualifications required
- **Alternative material availability**
- **Sensitivity to property variation**
- **Sensitivity to volume variation**

Source: https://commons.wikimedia.org/wiki/File:Childrens_Game_Park_01621.jpg
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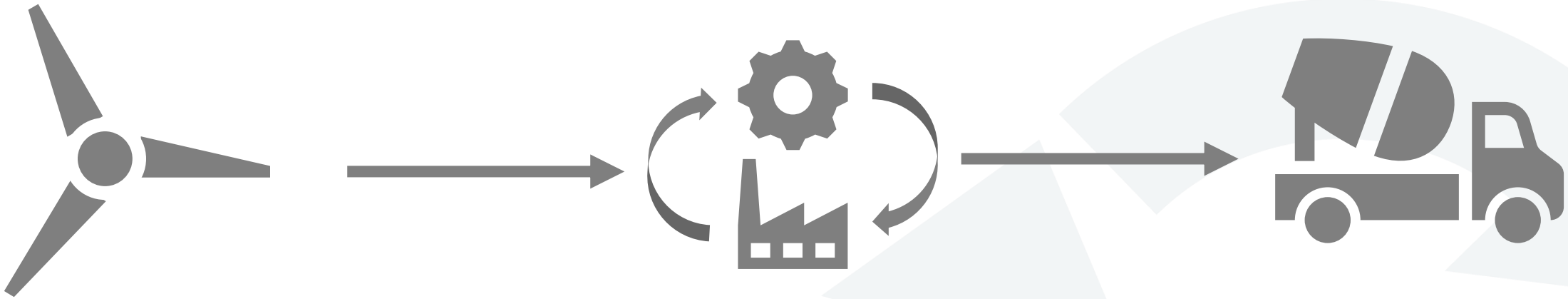
Market need must match supply capability

Option 1: Single Stream

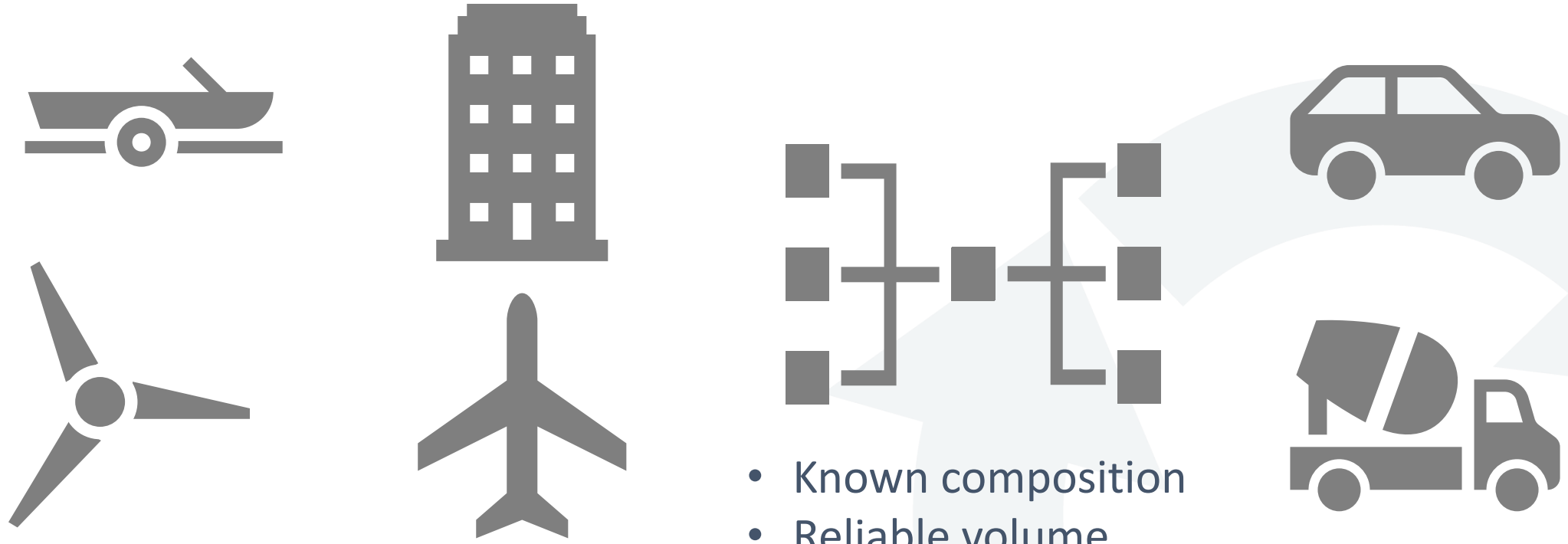


Stable volume
& composition

OR

Flexible volume
& composition

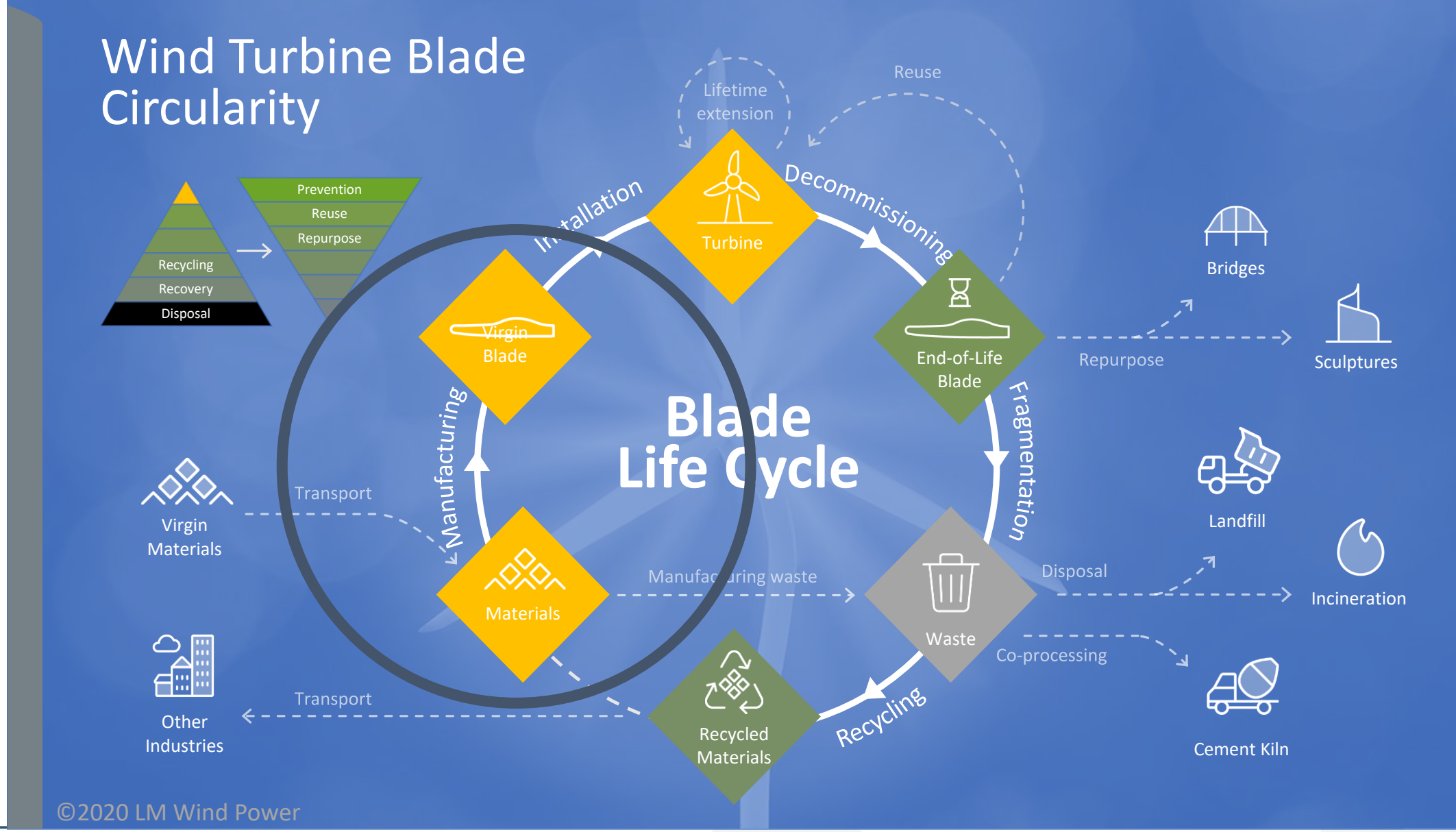
Option 2: Supply Chain Consolidation



- Known composition
- Reliable volume
- Efficient distribution

Go back to the beginning

Design for Circularity



Thank You

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