



# An environmentally friendly investment

Lifecycle Assessment of a V80-2.0 MW onshore wind turbine

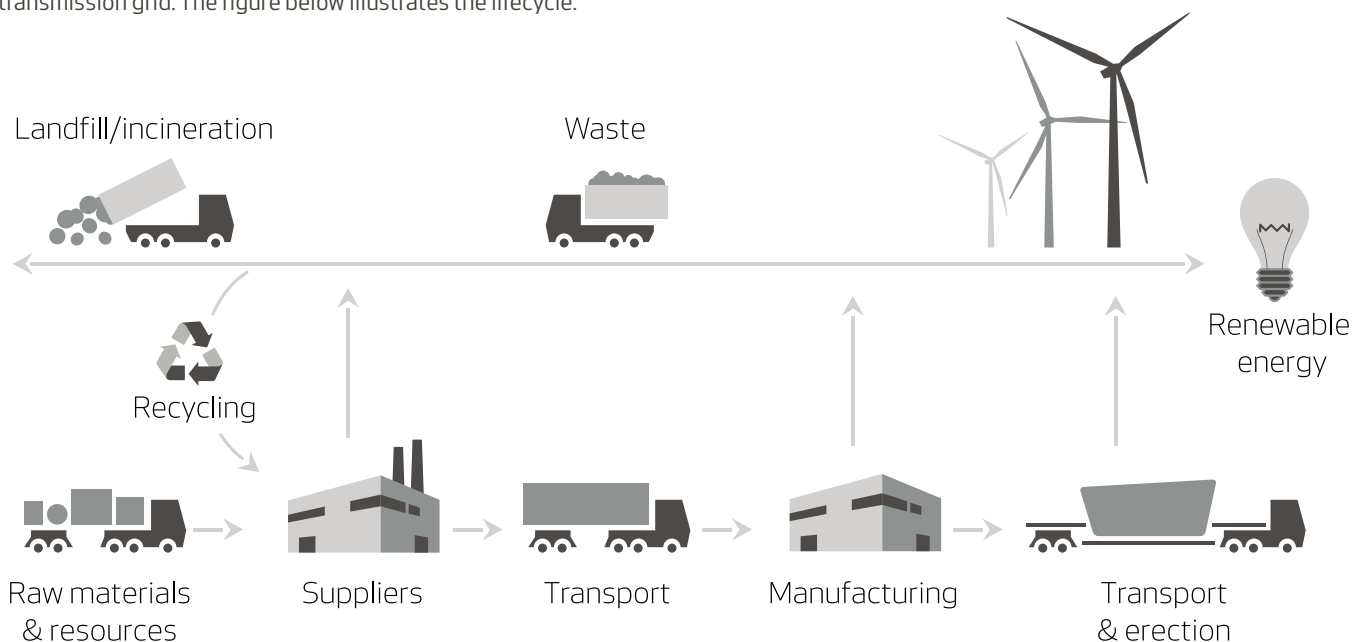


# A V80-2.0 MW ONSHORE WIND TURBINE ON AN AVERAGE LOCATION PRODUCES 31 TIMES MORE RENEWABLE ENERGY THAN IT CONSUMES DURING A 20 YEAR PERIOD.

## Assessing a Wind Turbine's Lifecycle

In 2006, Vestas conducted a Lifecycle Assessment (LCA) of a V80-2.0 MW onshore wind power plant. The LCA surveys and evaluates the environmental impact of the wind power plant throughout its lifecycle. The LCA proves that wind power offers a strong environmental performance over the lifecycle of a wind turbine.

The LCA assesses the entire lifecycle of a wind turbine: Extraction and manufacturing of raw materials and production of wind turbines, transportation, erection, operation, maintenance, dismantling and disposal of the wind turbines, their foundation and the transmission grid. The figure below illustrates the lifecycle.

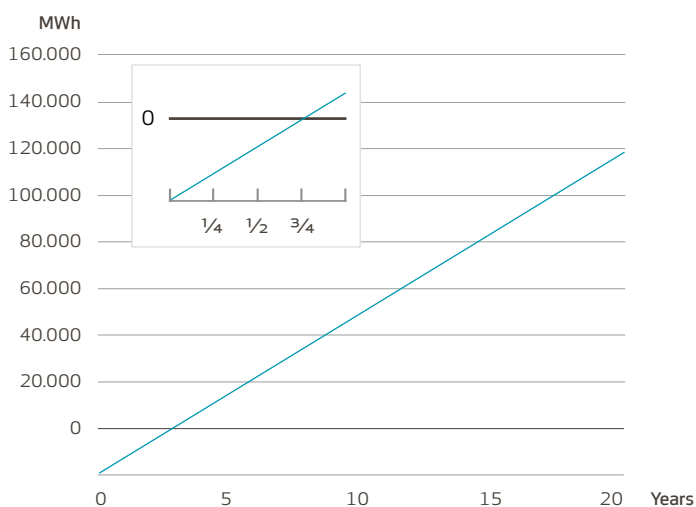




# THE ENERGY BALANCE OF A V80-2.0 MW ONSHORE WIND TURBINE IS ONLY 7.7 MONTHS

## Outstanding energy balance

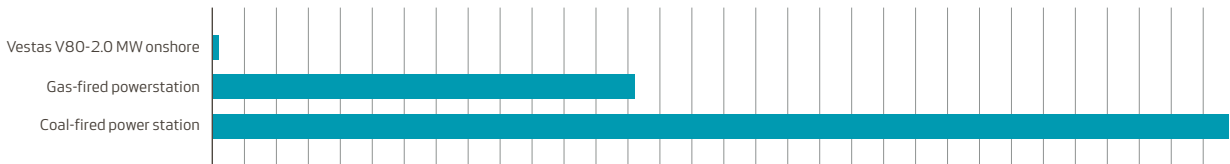
A wind turbine's energy balance reflects the time the turbine needs to be in operation before it has produced as much energy as it consumes throughout its lifecycle. The figure below illustrates how much energy a V80-2.0 MW onshore wind turbine produces through its entire lifecycle. It will generate approximately 113,000 MWh during a 20 year period, which is 20 years. The average energy balance of a V80-2.0 MW is just 7.7 months.





# VESTAS WIND TURBINES REDUCE CO<sub>2</sub> EMISSIONS BY MORE THAN 40 MILLION TONS PER YEAR

CO<sub>2</sub> emissions for 1 kWh electricity produced by:

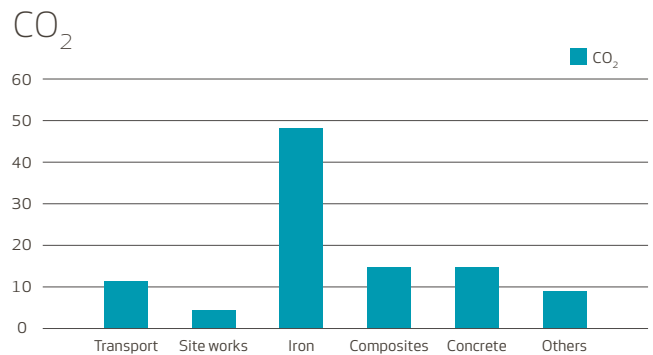


## Low CO<sub>2</sub> emissions

On an average location, A V80-2.0 MW onshore wind turbine will generate around 113,000 MWh during a 20 year period, sparing the environment approx. 93,000 tons of CO<sub>2</sub> compared to energy production at a coal-fired power plant. The figure above compares the CO<sub>2</sub> emissions per 1 kWh produced by a V80-2.0 MW onshore, wind turbine and a gas- and coal-fired power plant.

## Energy consumption

The most energy-intensive part of a wind turbine's lifetime involves metal extraction and processing, which account for about 50 per cent of the total energy consumption. This is illustrated in the figure below, which shows the CO<sub>2</sub> emission of the turbine in its expected life time divided into main categories.



A person wearing a white hard hat and a dark shirt is seen from behind, looking out through a large circular opening. In the distance, a tall, three-bladed wind turbine stands on a grassy hill under a clear blue sky. The foreground is a dry, sandy area.

ABOUT 80% OF A V80-2.0 MW  
ONSHORE WIND TURBINE CAN BE RECYCLED



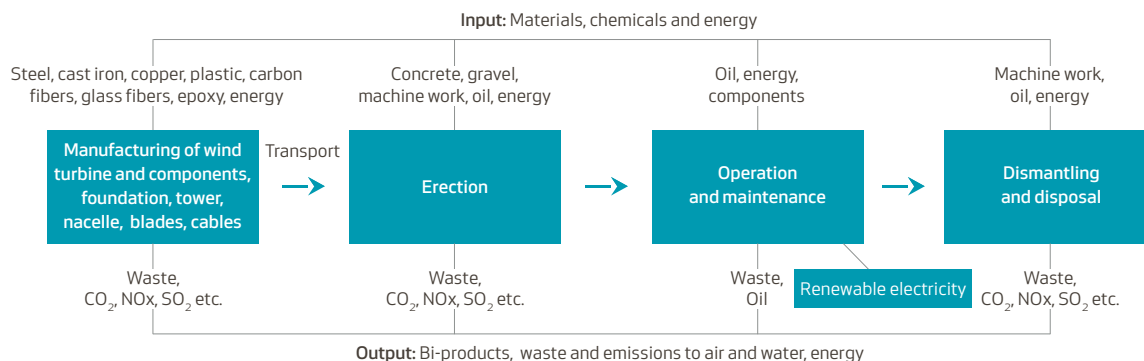
## Lifecycle of a V80-2.0 MW onshore wind turbine

Most of the resources used by wind power plants are consumed during production – which is also the lifecycle phase where a turbine has the biggest impact on the environment. It is primarily the extraction of iron ore for the production of steel components and the casting of these that impacts the environment. 100% of the iron and steel is recycled when the turbine is dismantled.

The manufacturing phase covers the extraction of raw materials, sub-contractor manufacturing and Vestas' own production of the foundation, tower, nacelle and blades.

The entire lifecycle is illustrated in the figure below.

## Ressources used to produce, erect and commision a wind turbine



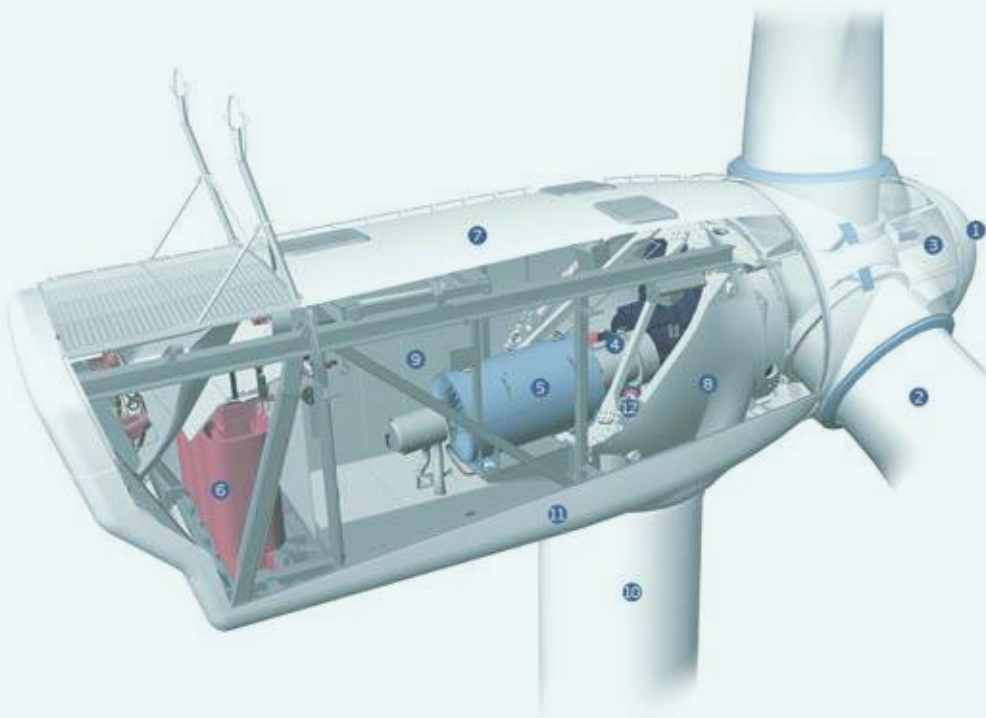


## Recycling reduces global warming

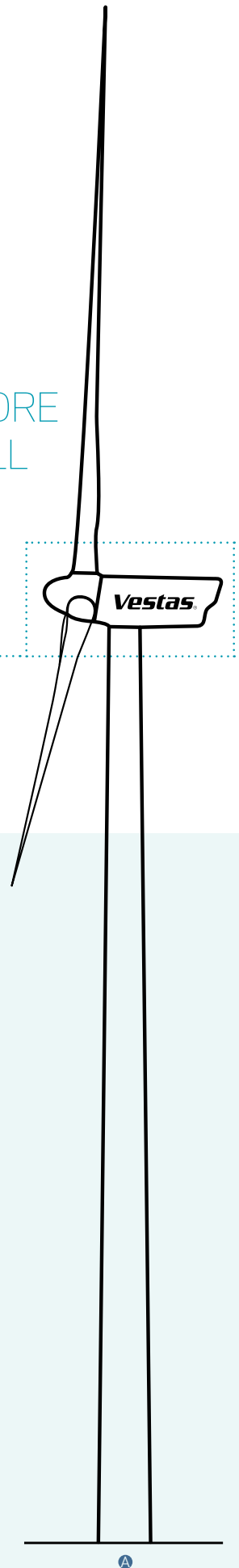
A wind turbine is designed to produce renewable energy for up to 20 years. During the phase of operation and maintenance, the turbine's impact on the environment is minimal. When the turbine is dismantled, about 80% of a V80-2.0 MW onshore wind turbine on a 78-meter tower can be recycled, sparing the environment the impact of extracting new materials.

Fiberglass elements are incinerated in a system that uses heat recovery, and the waste are carefully deposited.

Some types of steel, iron, copper, aluminum and lead are expected to be recycled 100%, which is an important target for Vestas. In the production of a V80-2.0 MW, a 10% increase in recycling of metal will reduce global warming by 8%.



IN THE PRODUCTION OF A V80-2.0 MW ONSHORE  
A 10% INCREASE IN RECYCLING OF METAL WILL  
REDUCE GLOBAL WARMING BY 8%



### Ressources used to produce, erect and commision a wind turbine

		Materials	Weight
1	Rotor	Blades and hub incl. spinner	37 tons
2	Blade	Fiberglass, epoxy and carbon fiber	20 tons
3	Hub incl. spinner	Cast iron, steel, fiberglass and polyester	17 tons
4	Gear	Cast iron and steel	
5	Generator	Cast iron, steel and copper	
6	Transformer	Steel, copper, aluminum and epoxy	
7	Nacelle		61 tons
8	Main foundation	Cast iron	
9	Electricity switchboard	approx	
10	Tower (78m)	Steel with surface coating	165 tons
11	Cover	Fiberglass, steel and plastic	
12	Yaw system	Cast iron, steel and plastic	
A	Foundation	Steel, aluminum and concrete	832 tons
	Various	Electronic components, cables, plastic, oil, etc.	

PVC plastic, which can be sorted, is deposited. The rest is incinerated.  
The rest of the plastic and rubber is incinerated with heat recovery.

## Impact on local surroundings

The impact of a finished turbine on the local surroundings can largely be divided into:

- Emissions of noise
- The visual impact
- Impact on birds, bats, etc.

When planning a wind power plant, its impact on local surroundings must be taken in to careful consideration. Vestas offers the means to reduce noise levels, and we keep the wind turbines' visual impact and their impact on birds, animals and marine life at acceptable levels.

The impact on the local surroundings of a wind turbine is different at various sites, so we assess it separately at each project.

## Information

The assessment is based on ISO 14040-43 and EDIP methods. This environmental product declaration is based on the LCA, which you will find at [www.vestas.com](http://www.vestas.com). Lifecycle assessments for V90-3.0 MW, V82-1.65 MW and V80-2.0 MW wind turbines are available at [www.vestas.com](http://www.vestas.com) under "Sustainability" – where environmental product declarations for each wind turbine type will also be published as LCAs are prepared. General assumptions for the environmental product declaration: Verified structural design lifetime of a wind turbine: 20 years Average annual production: 5,634,000 kWh. All the data in this environmental product declaration is calculated per kWh of electricity generated.





No. 1 in Modern Energy

Vestas Wind Systems A/S

Alsvej 21  
DK-8940 Randers SV  
Denmark

Tel: +45 9730 5000  
Fax: +45 9730 5001

[vestas@vestas.com](mailto:vestas@vestas.com)

**Vestas**<sup>®</sup>

[vestas.com](http://vestas.com)