

## Wind Turbines

Love them or loath them? A source of sustainable green power or a blot on the landscape? The ubiquitous wind turbine is seen all over our region; eleven 190m high turbines have even been planted offshore from our beautiful beach. The onshore ones aren't as big but you certainly won't fail to spot them when you're driving on the A90 dual carriageway between Aberdeen and Dundee:



- a group of 12 on hills north of Stonehaven
- 8 on the right at Cloch-na Hill 2.5 miles after passing the A90 / A92 junction south of Stonehaven
- 6 in the distance on the left on St John's Hill which you can see from the same long straight beyond the south A90 / A92 junction
- 25 on the left on the Hill of Garvock near Laurencekirk

We're sure you often wonder how high they are, how much power they're generating, etc. Here are some key facts to ponder:

### Power:

The big onshore turbines that you see (e.g. the type NK80's manufactured by a German company, Nordex) generate 2500kW (2.5MW) each. That's about 33 times more power than a typical 100bhp saloon car or enough to charge up about 50 electric cars such as the Jaguar i-Pace via a 50kW public charging station..

### Height:

The height of the tower to the nacelle, which houses the gearbox and generator is usually 60m, 80m or 100m high. The rotor blades are 40m long so the overall height of a turbine is anything between 100m and 140m. As a comparison, the size of Pittodrie football pitch is 100m x 65m so the turbine is at least as tall as Pittodrie is long. Or, if you want to think about distance travelled while you're driving your car at 70 mph, it would take you 4½ seconds to cover 140m. (Plus 0.7s needed as the national speed limit is 60 mph for a van or bus and nearly 6½ seconds if you're driving a big truck over 7.5te where speed limit is 50 mph on the A90.)



### Weight:

The tower weighs over 110te, the nacelle unit some 95te and the rotor nearly 50te (the blades weigh just under 9te each). Thus, overall weight of each onshore turbine is typically just over 250te; about the same weight as a convoy of 6 of these big fully-laden, articulated trucks that you're overtaking.

### Rotor:

The area swept by the rotor is over 5000m<sup>2</sup>. That's equivalent to about 70% of the area of the football pitch at Pittodrie.

The speed at the tip of each rotor blade when it is generating 2.5MW is 80m/s or about 200 mph so nearly 3 times the speed that you're travelling at in your car, if you're keeping at the national speed limit.

The turbine's rotors start turning when the wind speed gets to 9 mph and when windspeed reaches 33mph, the turbine is generating its maximum output. If the wind increases beyond 33 mph, the pitch of the blades alters so that the rotors continue to turn at the same speed, maintaining a constant 2.5MW output. When the wind reaches 55 mph, the blades are feathered and the turbine cuts out to protect the blades from over-speeding. The turbines are designed to withstand 155 mph winds.

### Keeping the lights on:

Generating power from the wind is not new, the Persians used wind turbines more than 1800 years ago! However, probably not at the same scale that we've become used to. In Scotland by the 2<sup>nd</sup> quarter of 2018, onshore installed wind turbine capacity had reached 7635MW, enough for about 5½ million homes during periods of average electricity consumption. Oh, and if you're wondering about the 11 turbines offshore from Balmedie, their nacelles are 120m above the surface of the sea and each turbine generates 8.8MW.