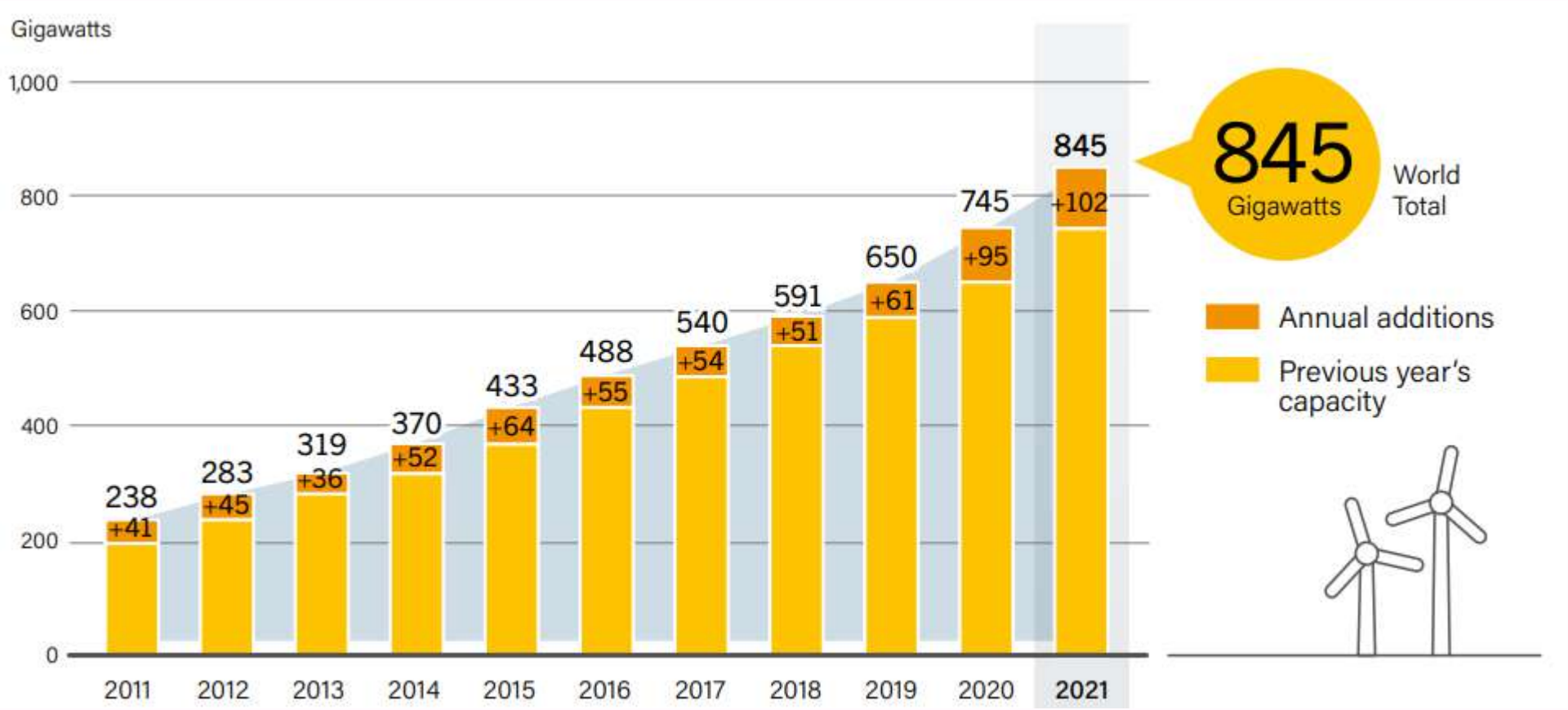
ENVIRONMENTAL IMPACT OF WIND ENERGY

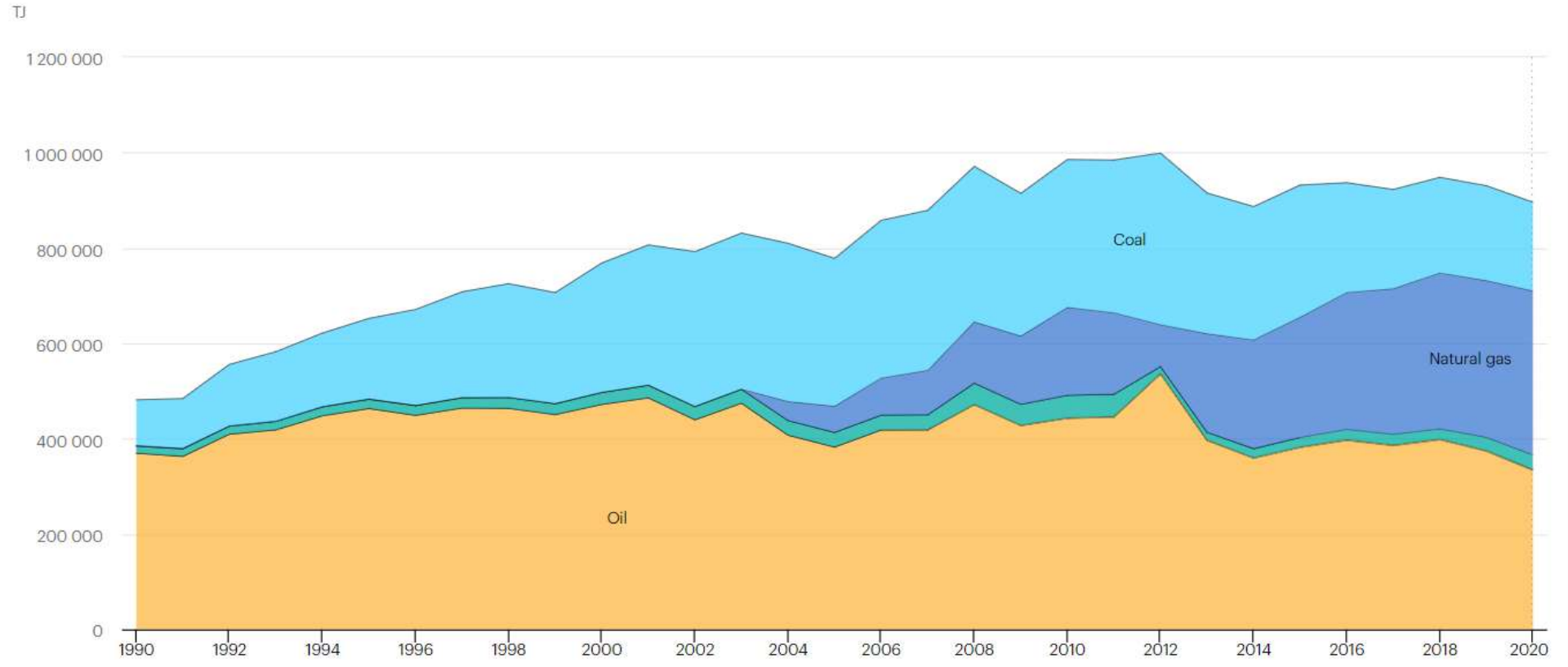
Tareq Abu Hamed tareq@arava.org

Wind Power Global Capacity and Annual Additions, 2011-2021



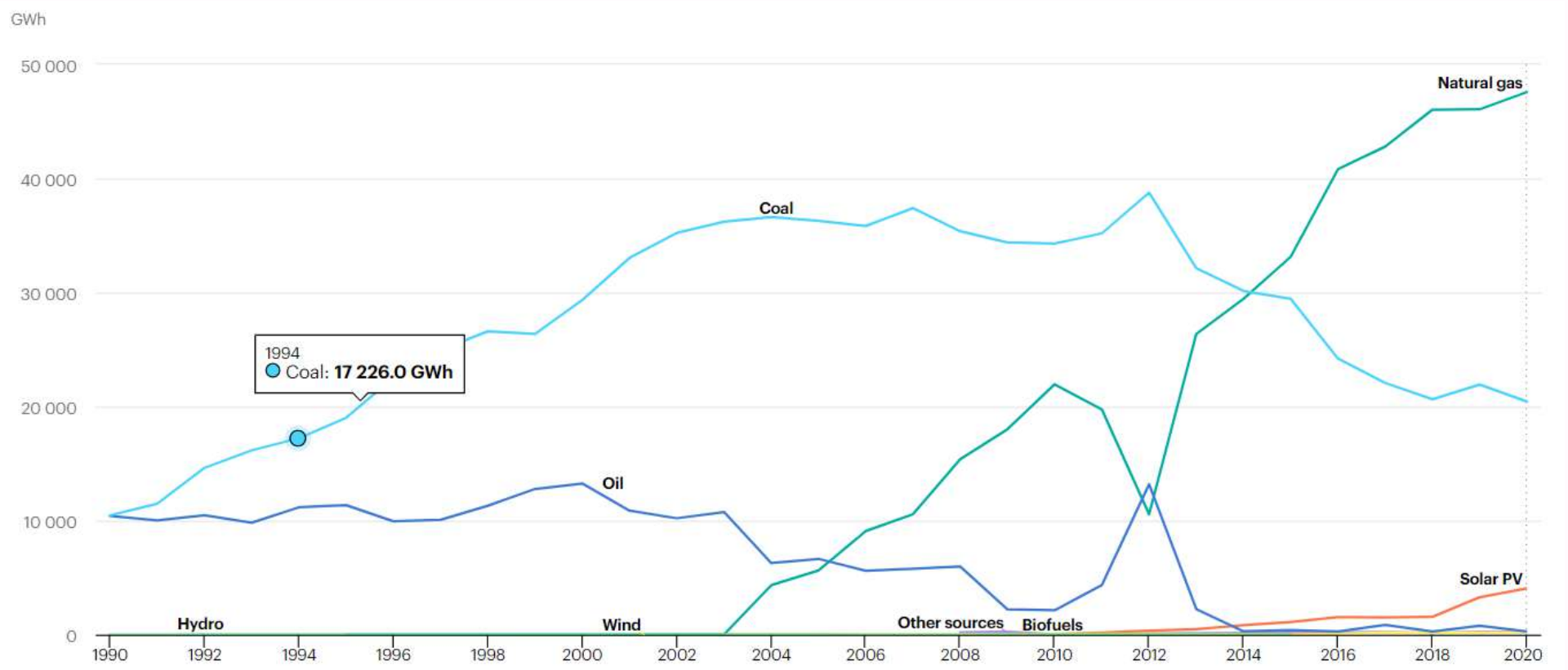
Source: REN21

Total energy supply (TES) by source, Israel 1990-2020



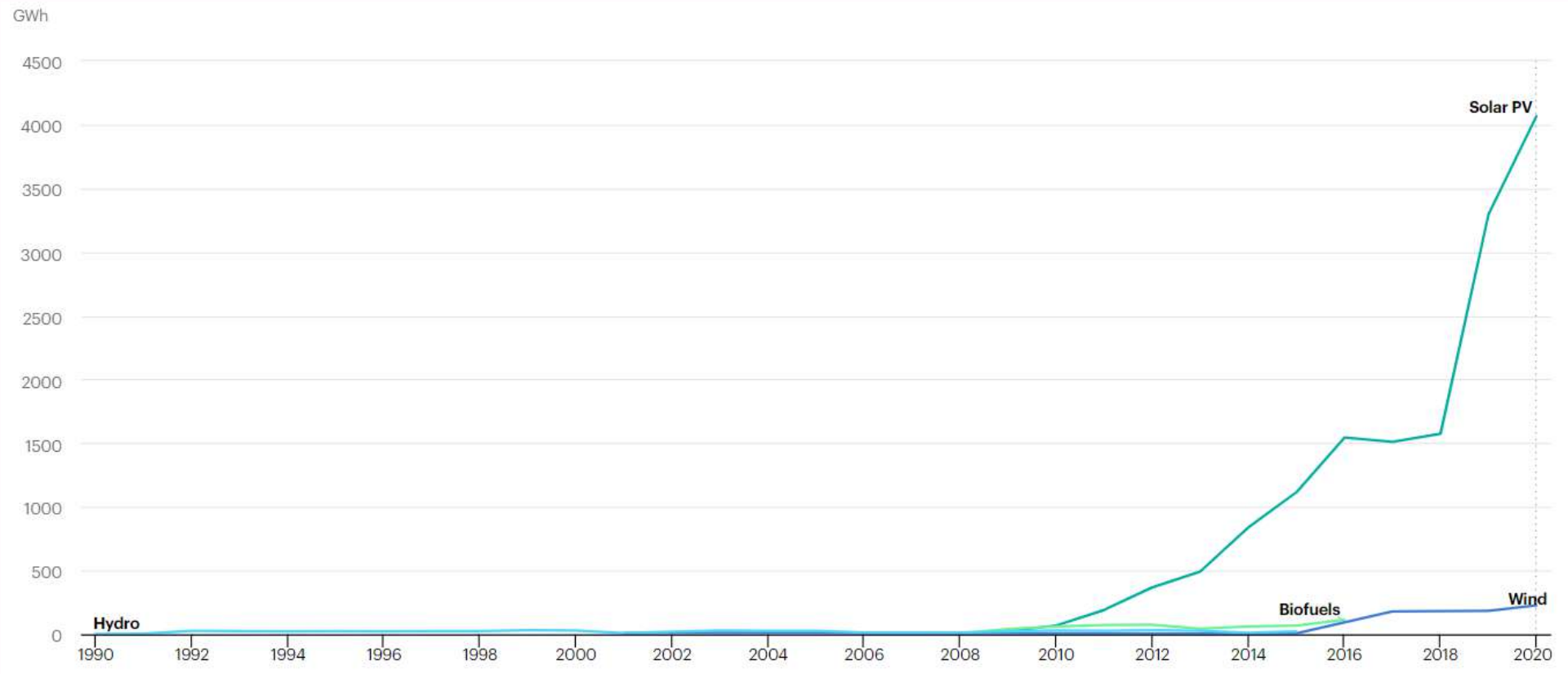
Source: IEA

Electricity generation by source, Israel 1990-2020



Source: IEA

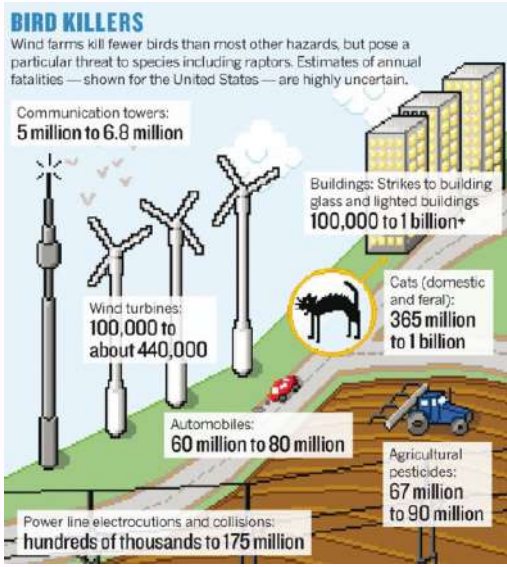
Low-carbon electricity generation by source, Israel 1990-2020



Source: IEA

Wildlife impact of wind energy

- Bird disturbance is known as a major issue for wind energy development,
- The direct impact of wind energy is the death caused by the collisions of birds with wind energy plants. Birds are considered the largest victim groups in mortality caused by collision with wind turbines around the world.
- However, deforestation and urban expansion can cause much higher bird fatalities.
- Sovacool argues that wind turbines kill about 95% fewer birds compared to fossil fuels. For example, for a 1GW wind power plant, the annual birds killed, is only 20, while 2000 were killed by vehicles and high voltage transmission lines, and 1500 were killed by hunting. Some studies indicate that birds can quickly adapt to newly installed wind turbines.
- The indirect wind energy impacts are habitat disruption, avoidance, and displacement. For example, sea creatures are impacted by offshore wind turbines. Thomsen et al, reported that dab and salmon's behaviors can be influenced by the perceived pile-driving pulses caused by wind turbines construction and operation.



Factors affecting birds' collision with wind turbines

- **Flashlights**

The light emitted from wind towers attracts birds especially during foggy nights and poor weather conditions. Thus, birds fly toward the wind turbines, and this increases collision possibilities with wind towers and blades.

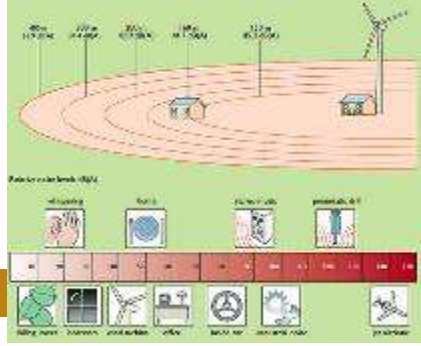
- **Weather conditions**

Gregory et al. point out that 3 out of 48 bird mortalities happen when the weather is not a factor. Migrating birds tend to fly at lower altitudes during bad weather such as storms, low clouds, and rain. This increases birds' collision potential with wind turbines.

- **Tower design**

Old wind turbines have a small capacity, low hub heights, and shorter blades. Old wind farms usually have a large number of small turbines. The low height of the turbines attracts birds' nesting and the blades' high rotation speed increase the bird mortalities. Josimovic shows that high wind generators' (145m) do not present a risk for the migrating birds since they fly at much higher altitude.

Noise impact



- Noise pollution is considered a critical environmental impact of wind farms. The wind turbine noise can be a major annoyance to people. The value of properties nearby the wind farms may be negatively impacted by the noise greeted by wind turbines.

- There are two types of noise emitted by wind turbines; mechanical and aerodynamic noise;

The mechanical noise can be lowered by using proper acoustic insulation of the turbine house and by the use of anti-vibration support footings.

The second type of noise is the aerodynamic noise which is caused by the dynamics of how the airflow and passes the blades of the turbine. The interaction of blades with turbulent wind causes the "whooshing" sound.

In general, the aerodynamic noise increases by the increase of the blade tip speed. The reduction of the aerodynamic noise can be achieved by proper blades design. The noise of the blade is less with slow blade tip speeds and with large wind turbines.

Noise causes anxiety, sleep disorders and hearing problems.

Visual impact

Visual impact is affected by several factors, the proximity of the observer to the wind farm, size, type, color or contrast, number of wind turbines, wholly or partially seen, the number and rotational speed of blades, the arrangement of the turbines across the site, the local lighting conditions (shadow flickering) operation time and local turbine history .

Visual impact surveys conducted in the UK have shown that the majority (70%) of people doesn't oppose wind turbines. While some surveys point out that people from the tourism industry believe that wind farms may negatively impact local tourism.

Carefully planned wind farms can fit well into and be part of the landscape. For example, Josimovic, argues that visual impact was not a major problem for Bavaniste wind farm in Serbia, and they argue that the farm will act as a catalyst in developing the local tourism, which contradicts the observation of Leung and Yang.

Local climate and Land Use impact

- **Local climate impact**

As the wind turbines become larger in size and number, there are some speculations that they could affect the local climate. In the latest studies of Chapman and Miller and Keith they argue that wind power can impact the local climate by changing the macro-climate at the local level, but its impact on the global average surface temperature would be insignificant.

- **Land-use impacts**

The land use of wind power depends on the turbines' spacing and their configuration. The land use includes land preparation, construction, access roads, and transmission lines. Usually, wind turbines use less than 10% of the wind farm areas. Compared to other energy systems, wind energy has a minimal land footprint. However, the visual impact on the landscape may affect the value and uses of neighboring lands.

THANK YOU

Tareq Abu Hamed **tareq@arava.org**