Technology Fact Sheet

Technology Name	Stand-alone wind systems[i]
Subsector GHG emission	2005 year: Category 1A1-Energy Industry (Stationary fuel burning for electricity and heat production). CO2 emission: 2986,6·10^3 t [*Comunicarea Naţională Doi a Republicii Moldova elaborată în cadrul Convenţiei-cadru a Organizaţiei Naţiunilor Unite privind schimbarea climei.*/ Ministerul Ecologiei şi Resurselor Naturale / Programul Naţiunilor Unite pentru Mediu; Coord.: Violeta Ivanov, Georgr Manful; Grupul de sinteză: V. Scorpan, M. Ţăranu,, P. Todos, I. Boian.-Ch.: „Bons Offices” SRL, 2009-323 p. ISBN 978-9975-80-313-7, tab. 2.11, pag. 105]
Background/Notes, Short description of the technology option	**Stand-alone wind systems** are equipped with small wind turbines (up to 20 kW) and are designed for electric power production are mainly used to supply remote, off-grid loads, such as homes and other remote small consumers. Often they are used in combination with batteries and/ or small diesel generation systems. The most difference between large and small wind turbines is the design of the transmission – generation system. Most small wind turbines are direct-driven, variable-speed systems with permanent magnet generators, hence a power converter is required to get a constant frequency if needed. Such a wind turbine design requires no gearbox. This approach is suitable for small wind turbines, as they operate with a much higher rotor speed than large wind turbines. This approach is also regarded as more reliable and less costly for maintenance. Also the power and speed regulation of small wind turbines vary significantly, e.g. mechanically controlled pitch systems or yaw systems instead of electronically controlled systems. Vertical and horizontal furling are also used for power control of small systems. In high winds, a vertical furling wind turbine will tilt the rotor skywards, giving the wind turbine the appearance of a helicopter. A horizontal furling turbine swings the rotor towards the tail during high wind speeds. Most of the small wind turbines that are currently deployed around the world have three blades, but there are also models with two, four or more at the micro-scale. Rotor diameter is below 20 m and most of the commercial small wind turbines have a rotor diameter below 10 m. These turbines are mounted typically on 12 to 24 m towers. For the rotor, technology trends are towardsadvanced blade manufacturing methods based mainly on alternative manufacturing techniques such as injection moulding, compression moulding and reaction injection moulding. The advantages are shorter fabrication time, lower parts cost, and increased repeatability and uniformity, but tooling costs are higher. Sources: 1. *The IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation Wind Energy.* June 2011. *2. Wind Energy: the facts,* EWEA, - 2009
Implementation assumptions, How the technology will be implemented and diffused across the subsector? Explain if the technology could have some improvements in the country environment.	The market for wind energy systems with electric output in stand-alone configuration is currently growing. Often a combination with other regenerative sources such as photovoltaic systems is intended. The range of ratings considered is from below 1 kW up to around 20 kW. Low investment cost is a criterion especially in this area. Small turbines are normally equipped with fixed blades. Effort and cost for maintenance should be low, in view of suitability for rural or less developed areas. Safe operation properties are indispensable, considering operation by unskilled persons in residential areas. Most stand-alone systems are for low-voltage ac output. They are mostly equipped with an energy storage device, generally a lead-acid battery of suitable capacity. The 2030 technology implementation capacity was estimated as following: According to the preliminary general agricultural census from 2011 there are over 900 000 agricultural soil owners, from which 2600 are distinguished by a area more than 10 he. As a rule, the appropriate areas of soil do not have access to the electricity network. 1 km of the grid costs around 18-20 th. USD. In order to cover

	the demand the owners prefer to ensure the electricity demand by installing small generators, 1-5 kW. An alternative solution would be the use of wind farms. In the concept that the soil owner with the area more than 10 he would use wind farms at a capacity of 10kW each, the total capacity would be 26MW.
Implementation barriers	Lack of investments. The legal framework is ambiguous and is not completed
Reduction in GHG emissions	Assuming that the next 20 years will be installed 26 MW wind power, by 2030 CO2 emissions will be reduced by $56{,}8 \cdot 10^3$ t annually.
Impact Statements - How this option impacts the country development priorities	
Country social development priorities	Increase number of employees
Country economic development priorities – economic benefits	**Increased energy security.** Lack of own natural fossil fuel reserves is obliging the country to import 95 % of energy resources needed. 70 % of electricity demand is covered by import. All natural gas is coming from GAZPROM
Country environmental development priorities	Reduced soil degradation
Other considerations and priorities such as market potential	Less air pollution. Work conditions improvement, less costs for transportation and stock of liquefied fuel.
Costs	
Capital costs	Average costs for current stand-alone wind turbines (rated power 1-10 kW)vary from $2800 to $5600 per installed kW. However, the price for the first 10 farms at the capacity of 10kW each didn't exceed $3000 per kW in 2010, inclusive taxes and the cost of accumulators at the capacity of 48 kWh. For this reasons it was accepted the specific cost of 3000 $/kW.
Operational and Maintenance costs	O&M cost for large farms was estimated at the level of 1.7 c$/kWh. For the wind farms at a smaller capacity O&M costs are less and are equal to 1,4 c$/kWh (multiplier is lack, cooling system is absent, etc.).
Cost of GHG reduction	Cost of GHG reduction is 68,7 USD/tCO2
Lifetime	20 years
Other	-

[i] This fact sheet has been extracted from TNA Report - Technology Needs Assessment for climate change mitigation - Republic of Moldova. You can access the complete report from the TNA project website **http://tech-action.org/**