rie nimmt weniger Platz und hat einen Wirkungsgrad von mehr als gewöhnlich. Produktion von Solarzellen wird schnell entwickelt, deren Qualität verbessert wird, und die Preise sind niedriger. Daher sind Sonnenkollektoren immer mehr und mehr beliebt bei den Verbrauchern.

Jüngst startete eine dänische Firma «Mekoprint A / S» die erste Linie, die Polymer-Solarzellen produziert wird. Das Unternehmen ist über 10 Jahre in der Design-Arbeit und nun bereit für die Massenproduktion solcher Batterien.

Die Herstellung stellt ein Druckverfahren dar, bei dem das Solarelement auf eine flexible Oberfläche gedruckt wird, die gedreht und geschnitten wird. Aus dem Film können Batterien in beliebiger Größe gemacht werden.

Jetzt beginnt eine neue, bedeutende Phase der Energieerzeugung. Die Energie erscheint "ökologisch" und "rein". Allerdings gibt es noch viel Arbeit in der Entwicklung der erneuerbaren Energien, insbesondere der Solarenergie, sowie verbesserte Methoden für die Produktion von Solarenergie.

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Wind energy

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Introduction

Wind is the most attractive renewable energy sources: wind energy is cheap, available, almost inexhaustible and does not result in environmental pollution. However, there is a problem of using wind energy – its variability.

The technical potential of wind energy Russia is estimated over 50,000 billion kWh · h / year. The economic potential is about 260 billion kWh · h / year, or about 30 percent of all electricity production in Russia [1].

Wind energy zones in Russia are located mainly on the coast and islands of the Arctic Ocean from the Kola Peninsula to Kamchatka, in the areas of Lower and Middle Volga and the Don, the Caspian, Okhotsk, Barents, Baltic, Black and Azov Seas. Individual wind zones are located in Karelia, Altai, Tuva, Lake Baikal.

Maximum wind speed in these areas is in the autumn-winter period – the period of the greatest demand for electricity and heat. About 30% of the economic potential of wind power is concentrated in the Far East, 14% – in the Northern economic region, about 16% – in Western and Eastern Siberia.

The total installed capacity of wind power plants in the country for 2009 is 17-18 MW.

Power wind turbine depends on the area swept by blades of a generator, and height above a surface.

Air flows at ground / sea are laminar – lower layers inhibit layers located above. This effect is visible to height of 1 km, but sharply reduced even at altitudes more than 100 meters. Height of a generator above this boundary layer at the same time allows you to increase a diameter of blades and frees space on the ground for other activities. Modern generators have reached this abroad and their number is rapidly growing in the world. Output wind generator power is proportional to the third degree of the wind speeds: if the wind increases twice from 5 m / s to 10 m / s, the power is increased by eight times.

Coastal areas are the most perspective places for wind energy production. But the cost of investment compared with a land above 1,5 – 2 times. On the sea, at a distance of 10-12 km

from the coast (and sometimes more), offshore wind farms are built. Tower of wind turbines are mounted on foundations of piles, hammered to a depth of 30 meters.

Other types of subsea foundation and floating base may be used. The first prototype of floating wind turbine was built by H Technologies BV in December 2007. 80 kW wind turbine was mounted on a floating platform in the 10,6 nautical miles off the coast of southern Italy on the part of the sea depth of 108 meters.

June 5, 2009 the company Siemens AG and Norway's Statoil announced the installation of the world's first commercial floating wind power turbines of 2.3 MW produced by Siemens Renewable Energy.[2].

Statistics on using wind energy

On June 2012 the total installed capacity of all world wind turbines were 254 GW. The mean increase in the amount of wind power capacity in the world, since 2009, is 38-40 gigawatts per year and is due to the rapid development of wind power in the United States, India, China and Germany. According to the World Wind Energy Assosiation, Predictive power of wind energy by the end of 2012 closer to the value of 273 GW, in fact, it even surpassed the rate and reached 282.4 GW.[3].

According to IEA breakthrough will be happen on the market of renewable energy in 2018. Amount of electricity, produced by renewable sources will be increased to 25% of the total electricity generation in the world. its share was only 20% In 2011, 19% – in 2006 . By 2016, the share of electricity from renewable sources will be more than from nuclear energy and gas. They will become the second largest energy source after coal.

Europe had 44% of installed wind power, Asia – 31%, North America – 22% in 2010.

It is believed that using of wind turbines in home to provide electricity is not effective in Russia because of:

- High cost of inverter about 50% of cost of entire installation.
- High cost of batteries – about 25% of the cost of installation.
- Diesel generator is sometimes added to such an installation to ensure reliable power supply, and it comparable in cost with all equipment.

Currently, despite rising energy prices, the cost of electricity is not any significant value in the majority of production, compared with other expenses; the key for consumers remain reliability and stability of power supply.

The main factors leading to the rise of energy generated from wind turbines, are:

- Need to generate electricity industrial quality ~ 220V 50 Hz (requires of inverter).
- Need to autonomy for some time (requires of batteries).
- Need to long trouble-free operation of consumers (requires of diesel generator).

Atmospheric emissions

1 MW wind turbine reduces annual emissions of 1,800 tons of CO2, 9 tons of SO2, 4 tons of nitrogen oxides .[4].

Estimated Global Wind Energy Council by 2050, the global wind energy will reduce annual CO2 emissions by 1.5 billion tons.[5].

Impact on climate

Wind turbines remove some of the kinetic energy of moving air masses, which leads to reduction of speed of their movement. This reduction could theoretically have a significant impact on the local (and even global) climatic conditions in an area, if wind generators are used massively. In particular, reduction of average wind speed is able to make the climate of the region slightly more continental due to the fact that the slow-moving air masses become warmer in summers and cooler in winters. The extraction of energy from a wind can con-

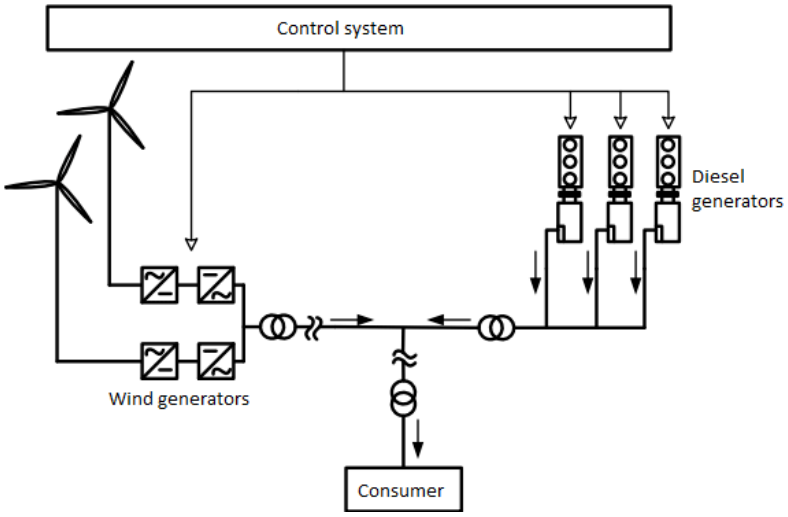
tribute to changes in humidity of the adjacent territory. However, scientists are only beginning research in this area, studies that analyze these aspects do not provide a quantitative assessment of the impact of large-scale wind power on the climate, but allow us to conclude that it may not be as negligible as previously thought.[6].

Wind diesel complex

Wind diesel complex – is a complex including wind turbine and diesel generator. Also a WDC may include inverters, batteries, and ballast load. These units are designed to reduce fuel consumption by diesel power plants in remote areas, where power network is not connected to the grid. This should reduce the expenses for the purchase and delivery of fuel.

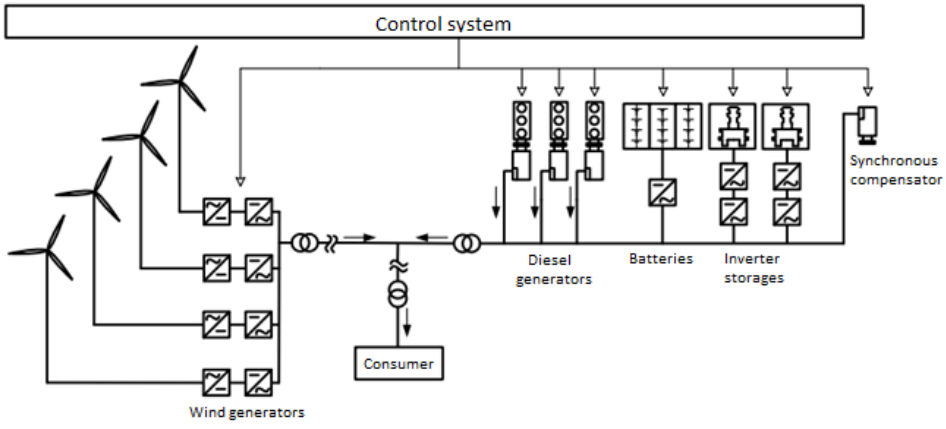
There are two types WDC.

1. Inefficient WDC. To the existing diesel generators connected from 30 to 50% of the design capacity of wind turbines. The diesel generators are complemented by panels of automatically start. However, to preserve the stability of the system, the capacity of wind turbines should not be more than 35% of power of diesel generators. Wind turbines and diesel generators operate in parallel. This solution can theoretically save up to 20 % of fuel consumption of diesel generators.



Picture 1. Inefficient WDC.

2. Highly efficient wind diesel complex. In the work are all designed wind turbines. Thus it is expedient construction of “wind component," generating 100-150% of the required power of electricity. The complex was supplemented with batteries and inertial drives, resulting in (when power and wind speed are sufficient) diesel engine-generators can be derived from work.



Picture 2 (right). Highly efficient WDC.

In the world practice wind diesel complexes are built and operated through a special Federal programs of development of renewable energy, and their task is only to reduce fuel consumption and accumulation of knowledge in the process of operation of such systems. The payback period of the plants are of secondary importance.

With all the advantages, WDC have several disadvantages: application of complex control systems; the lack of commercially available controllers; ob-

ligatory presence of qualified staff; the high cost of construction (up to 6800 euros per 1 kW power); the massive energy accumulators; very long payback period (25 years), often exceeding the lifetime of the individual components of wind diesel system.[7].

Conclusion

The work of the WG is accompanied by noise, vibrations, dangerous for birds that die, getting under rotor blades. And attractive sides of wind power is its inexhaustibility, waste reduction, rapid deployment of wind power almost anywhere, even in remote and inaccessible places, this all forces designers to fight over improving a design of wind turbines.

References:

1. www.smenergo.ru.
2. http://news.bbc.co.uk/.
3. http://www.wwindea.org/.
4. http://www.awea.org/.
5. http://www.renewableenergyworld.com/.
6. http://www.pnas.org/.
7. http://www.energybalance.ru/.

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Kohlegasifizierungsverfahren

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Russland spielt eine weltweit wichtige Rolle in Reserven und Kohlegewinnung, aber der Anteil der Kohleproduktion liegt nur bei 25 Prozent. In dieser Hinsicht bleiben wir hinter den Ländern wie China, den USA, Indien und anderen, wo die Kohlestromerzeugung 50 bis 75 Prozent beträgt. Der Hauptgrund des Zurückbleibens sind große Mengen billigen Gases. Die großen Reserven und gleiche Verteilung werden die Kohle in zuverlässige Energiequelle verwandeln. Viele Anforderungen, die Emission in der Umwelt reduzieren sollen, machen das Problem der Schaffung der Kohleenergietechnologie aus. Die Anwendung der Vergasungsprozesse begann mit dem XIX. Jahrhundert in Verbindung mit der Entwicklung von Gasstraßenbeleuchtung. Bis zur Mitte des XIX. Jahrhunderts versorgte man Haushalte mit Leuchtgas aus Holz und Kohle, nutzte für die Heizung industrielle Öfen.

Die Kohlevergasung verringert die Emission in die Umwelt aus einem Wärmekraftwerk und nutzt die Kohle in wirkungsvolleren Dampf- und Gasanlagen. Die Vergasung ist ein Hochtemperaturverfahren der Zusammenwirkung des Kohlestoffs mit dem Sauerstoffträger, das Ziel dieses Prozesses ist die Beschaffung der Gase (Methan, Wasserstoff und Kohlenmonoxid). Alle Prozesse der Vergasung unterteilen sich in autothermische, wenn die nötige Wärme aus der Kraftstoffverbrennung hergestellt wird, und allothermische, wenn nötige Wärme von außen zugeführt wird. Prozesse der Kohlevergasung werden nach Partikelgröße klassifiziert: Prozesse, wenn die Partikeln weniger als 1 mm groß sind; Prozesse, wenn die Partikeln bis zu 3 mm groß sind und Prozesse beim stabilen Zustand, wenn die Partikeln mehr als 3 mm groß sind.

Betrachten wir den Vergasungsprozess z. B. am Lurgi-Vergaser. Im Jahr 1932 erfindet der Betrieb Lurgi den Vergaser, der im stabilen Zustand und unter Druck arbeitet. Die Lurgi-Vergaser wurden für grobe Dampf-Sauerstoff-Kohlevergasung (5-30 mm) in der dichten