tion animals, increased aggressiveness components midges (gnats) due to malnutrition larval stages, the disappearance of many species of nesting migratory birds, inadequate hydration floodplain soils, vegetation succession negative (depletion phytomass), reducing the flow of nutrients in the oceans.

Hydropower in Russia.

Hydropower is a good alternative for Russia, unnecessarily in our country there are many large and powerful rivers, as well as a large share of electricity generation refers to the TES, which is harmful to the country's ecology.

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Renewable sources of energy – the solution to climate change

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Climate change is arguably one of the greatest environmental threats the world is facing. The impacts of disruptive change leading to catastrophic events such as storms, droughts, sea level rise and floods are already being felt across the world.

While the Kyoto Protocol, which aims to reduce greenhouse gas emissions, is slowly impacting on energy markets, scientists are increasingly advising policymakers that carbon emission reductions of beyond 60% are needed over the next 40-50 years [1]. How will we achieve such a dramatic reduction in carbon emissions?.

At the heart of the issue is an energy system based on fossil fuels that is mainly responsible for greenhouse gas emissions. On the contrary, renewable energy provides one of the leading solutions to the climate change issue. By providing ‘carbon-neutral’ sources of power, heat, cooling and transport fuels, renewable energy options such as wind, solar, biomass, hydro, wave and tidal offer a safe transition to a low carbon economy.

This outlines the role that renewable energy can play in reducing greenhouse gas emissions such as carbon and methane. It highlights the success to date and the activity already happening across Europe and the rest of the world. It assesses its potential, and identifies how renewable energy is central to climate change policy and delivering large carbon dioxide reductions.

According to the vast majority of climate scientists, climate change is already underway. The past decade has seen the warmest 6 years since records began. A third of global habitats are at risk, and extreme events such as floods, storms and drought are becoming more frequent. The financial consequences of climate change are also becoming apparent – with insurance claims due to weather-related damage increasing dramatically over the past few decades.

The following effects of an increase in global average temperature have been identified:

- Steady rise of the sea level.
- Flooding of coastal areas.
- Frequent extreme weather conditions.
- Frequent poor harvest.
- Water shortage.
- Devastations.
- Loss of biodiversity.
- Increase of infections.

The climate change problem is essentially a fossil fuel energy problem. While agriculture, land-use changes, cement production and the use of chemicals all contribute to green-

house gas emissions, more than 70% of the problem is due to the unsustainable use of fossil fuels. The climate change challenge means shifting away from fossil fuels in the home, industry, at work and the way we travel. Furthermore, global energy demand is predicted to rise as countries industrialize and population continues to grow.

Renewable energy offers safe, reliable and increasingly cost-effective alternatives for all our energy needs – predominantly heating, cooling, electricity and motive power for transport. It can provide everything that fossil fuels currently offer in terms of energy services and by that dramatically reduce climate change gas emissions:

- Heating – a range of renewable sources including solar water heating, passive solar heating in buildings, geothermal and the use of biomass such as forest residues and fast-growing energy crops.
- Cooling – from biomass-powered systems or also solar cooling systems.
- Electricity – from wind power, small-scale hydro, geothermal, biomass, PV cells, tidal and wave power.
- Transport fuels – from liquid ethanol and biodiesel produced from plants.
- Chemicals – biofuels can provide a wide range of products currently based on oil and gas.

The natural flows of energy on planet earth provide a huge potential for harnessing carbon-neutral energy for society. Powered by the sun, the flows of wind power, hydro power, biomass, wave, tidal and solar heat and power – which can be captured by modern technology – are more than enough to provide for all our needs. The sun powers planet earth and allows us to survive. With smart technology it can also provide heat and electricity. It is also the driver for wind power. Wind in turn creates waves, a huge potential power source being tested worldwide in prototype schemes. The sun also powers the evapotranspiration cycle, which allows water to generate power in hydro schemes – currently the biggest source of renewable electricity in use today. Plants photosynthesize in sunlight and create a wide range of so-called biomass crops ranging from wood fuel to rapeseed, which can be used for heat, liquid fuels and electricity. Interactions with the moon produce tidal flows which can be intercepted and produce electricity.

Though humans have been tapping into renewable energy such as wood, solar and water power for thousands of years, so far we have managed to capture only a fraction of the technical and economic potential of renewables. The recent development of smarter and more efficient technology has been impressive. In the past 20 years these technologies have improved and costs have fallen dramatically. For solar photovoltaic (PV) cells, stimulated initially by the space programme, unit costs have fallen by a factor of 10 in the past 15 years. Onshore wind power at good sites can compete with traditional fuels, and modern biomass heating is invariably cheaper than oil heating [2].

While renewable energy technologies are often on a smaller scale than big fossil fuel and nuclear projects, they can be brought on-line quickly and with lower risks. Renewables already have a significant share in many countries. Denmark now gets 18 % of its electricity from wind power, and created an industry that has more jobs than the electricity sector itself. Spain has leapt from virtually nothing to become the second biggest wind power country in Europe with over 6000 MW of capacity. Countries such as Finland, Sweden and Austria have supported the development of very successful modern biomass power and heating industries through fiscal policies, sustained R&D support and synergistic forestry and industrial policies. As well as saving significant CO2 emissions, equipment from all three countries is now exported worldwide [3].

Renewable energy technologies are already available, but not used enough.

If all countries would focus on renewables in the same way as the most successful countries in terms of renewable energy technologies growth rates, the results would be impressive.

Renewable energy technologies do have an impact on the environment, as do all energy technologies. However, the relative impacts of renewables are far less than those of fossil fuels and nuclear power. A major EU study concluded that when climate change and the possible impact of catastrophic accidents of nuclear plants are taken account of, renewables have a significantly lower environmental impact.

Thus, in conclusion it should be mentioned that renewable energy should no longer have the alternative tag – it is a mainstream set of energy options able to provide cost-effective and reliable low-carbon energy. After extensive R&D and commercialization over the past 20 years, wind power, biomass heating and power, solar heating and power and the other renewable energy options are important elements of the modern energy mix. Renewable energy has some different characteristics to fossil fuels and nuclear power. Some of the technologies offer more intermittent power, and are less concentrated than oil or uranium. Taken as a group however, and utilizing modern energy grids and networks, renewable can be integrated to provide predictable and reliable energy solutions.

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Environmental impact of the smart grid

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Few issues are getting more attention within the energy industry and among policymakers these days than the smart grid and climate change. Yet most do not see these two areas as being connected. More precisely, the smart grid – and smart grid practices like demand response – is not being viewed as having a role in the attainment of climate change goals [4].

The Green Smart Grid Initiative (GSGI) is an effort to demonstrate that the smart grid indeed can be a major positive force in addressing climate change. Among the issues it seeks to help parties gain an understanding of are the following:

1. **Smart Grid and Renewable Energy;**
2. **Smart Grid and Energy Efficiency**

1. Energy Efficiency.

Major building block in plans to address climate change is energy efficiency. Most energy efficiency efforts are focused on replacement of devices and equipment with more efficient items, or focused on energy efficient design and labeling of products and buildings. The smart grid introduces and fosters new types of energy efficiency by allowing the operation of the electricity system to be dynamically optimized at all times. Also, and importantly, the smart grid does not stop at the customer's meter. It provides customers with new pric-