

# Research Report

# MUNISH '12



Please think about the environment and do not print this research report unless absolutely necessary.



**Forum:** Environment Commission

**Issue:** Research and Development of New and Efficient Renewable Energy Sources

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## Introduction

Taking a black-and-white definition, it could be generalized that the development of new technology generally leads to the increased use of the Earth's resources and energy as well as increased greenhouse gas emissions, making it directly proportional to accumulating pollution levels, rising sea levels and increasing climate change globally. Thus, with the unstoppable development of new, flashy technology seen in Western society today, the negative environmental impact of technology development has become increasingly clear. The solution to these environmental threats seems logically to lie in the reduced use of new energy-consuming technologies. However, fortunately, the world does not exist in concrete black-and-white definitions, so technical advances and a sustainable environment are not necessarily mutually exclusive. It is possible to maintain a balance with nature and the Earth's resources whilst still enjoying the luxuries new technology has to offer. The answer lies ultimately in renewable energy. Renewable energy technology aims to minimize the strain of our increasing energy demand on the environment by taking energy from limitless areas of the environment itself, such as the sun, wind and water. Despite the seemingly ideal solution renewable energy presents to a dire problem, in reality, many obstacles still stand in the way of it becoming the dominating energy source, all of which are reasons why research and development of renewable energy is so crucial for the future of our Earth, if we wish to continue consuming energy whilst living on this Earth.

## Definition of Key Terms

### Renewable Energy

Renewable energy refers to '*any naturally occurring, theoretically inexhaustible source of energy, [such] as biomass, solar, wind, tidal, wave, and hydroelectric power, that is not derived from fossil or nuclear fuel.*' (*Dictionary.com*) Renewable energy is named renewable because no matter how much energy is extracted from it, more can be obtained, thus the source is theoretically limitless. Renewable energy can be used over and over again, making it sustainable in comparison to fossil fuel energy, which requires the combustion of fuels that are of limited availability on our Earth. Renewable energy is thus also known as sustainable energy, alternative energy, and 'green' energy, because it is far less harmful

to the environment than its alternative.

## Non-Renewable Energy

When put in contrast with renewable energy, non-renewable energy speaks for itself. Non-renewable energy refers to energy that comes from an exhaustible source, usually fossil fuels (coal, oil, natural gases) or nuclear fuels. These fuels are limited and after use cannot easily be recreated, thus are not renewable. They are also not sustainable as they exploit the Earth's natural resources. For example, fossil fuels are created from the decay of animal and plant remains. It thus took millions of years to accumulate the large amounts of fossil fuels that have in recent decades been discovered and exploited by humans. However, at the rate of fossil fuel depletion occurring globally currently, it will take millions of years to reproduce the fossil fuels that have been depleted in the past few decades. These fuels are thus unsustainable, as there will be an inevitable point in the future when we will no longer be able to obtain fossil fuels, because they are of limited supply. Fossil fuels are also considered unsustainable as they produce harmful toxins that pollute the environment, causing many of the major environmental threats we see today.

## Climate Change (Global Warming/Greenhouse Effect)

Climate change refers to a phenomenon that accounts for the change in global temperatures of the atmosphere and oceans. Although there are a few that argue this change in temperature is negative, labeling it as global cooling, the majority would agree that global temperatures are increasing, arguing for global warming. Global warming in itself may not seem a deadly phenomenon, but what it triggers could be catastrophic. Global warming causes rising sea levels, droughts, increased risk of natural disasters, increased precipitation levels, accelerated spread of diseases, changing ecosystems, and ultimately, an unbalanced nature. This is very risky, not only to the environment, but also to human life. The theory behind global warming points to excess greenhouse gas emissions as its leading cause. Greenhouse gas emissions are mainly a result of fossil fuel combustion, whether in energy plants or transportation vehicles. These gases are produced as byproducts when the fuel is combusted and energy is obtained. Despite greenhouse gas emissions and fossil fuel combustion being the major cause of global warming, other contributing factors do exist, including deforestation and overpopulation.

## Energy Source

An energy source is something or somewhere where energy can be obtained. In non-renewable energy sources, this is an object or material to be consumed (combusted) for the generation of power. However, in renewable energy production, this refers to a natural element or aspect of nature whose movement or energy can be captured and used for the generation of power. Energy sources include fossil fuels, nuclear fuels, wind, sun and water. Often, especially with renewable energy sources, it is not the source that needs to be found, but the most effective and efficient way of exploiting the source to obtain energy from it.

## General Overview

### Brief History

The use of nature for energy is itself not a new concept to human civilization, dating back far in history. Wind energy was the earliest form of energy to be harnessed by humans, traces of which date back to 3200BC. Since then, versions of renewable energy have been seen to be used scattered throughout history, in forms ranging from windmills to watermills. However, despite this use of nature's energy for specific purposes, the actual harness of its energy for electricity was only discovered in the 1800s. By 1882, the first hydroelectric plant was already established. Since then, much development has occurred in the field of sustainable energy, with wind, sun, hydroelectric, geothermal and biomass energy becoming powerful sources of energy, successfully able to obtain energy from nature at a relatively efficient rate. However, for renewable energy to beat fossil fuel energy as the leading energy source is still but a dream. The only medium to make this reality is human ingenuity, in the form of research and development to minimize and overcome limitations of renewable energy, maximizing the benefits.

### Types of Existing Renewable Energy

Existing renewable energy is most commonly found in the form of wind, sun, hydroelectric, tidal, biomass and geothermal energy. All these sources are from common, powerful, natural processes on Earth, however, are not readily available in all areas of our Earth. Renewable energy is thus incredibly dependent on geographic location, nature and climate.

**Wind energy** is usually obtained from wind turbines that turn with the wind. Wind, the movement of air from high pressure to low pressure, is a powerful source of energy, as 1% - 3% of the Sun's energy hitting Earth becomes wind energy. The energy of this movement is then captured when the blades of wind turbines move with the wind, spinning a rotor connected to a generator that turns the kinetic energy from the wind into electric energy to be stored and transported.

Sun energy, also known as **solar energy**, is captured using solar panels placed in areas with direct exposure to the Sun. These solar panels obtain energy when photons from the Sun shine on it. This energy is then transformed into electrical energy. Because of the necessity for direct sun exposure, many solar panels are placed on the roofs of homes or buildings, making it hard for obstacles to stand in the way of the sunlight hitting the panels.

**Hydroelectric energy** comes from the movement of water, often powered by gravity. This type of energy can come in many forms, but it is commonly found in (man-made) dam-like structures where water is left to cascade from higher ground to lower ground, turning turbines as it falls, generating electricity from this kinetic energy similar to how electricity is generated in the wind turbine. Often, because electricity is not always in high demand, stored energy is used at night, when energy demand is low, to pump water back up from low ground to high ground, so that the energy can once again be

obtained the following day, making the system self-sufficient in producing energy. Hydroelectric energy can also include wave energy generated when the wind hits the seas. **Tidal energy** is similar to hydroelectric energy as it relies on the tide to move a buoy back and forth. This movement is captured and transformed into electricity.

**Biomass energy** operates similar to fossil fuel energy; however, instead of using coal, oil or natural gas as fuel, wood and plants are burnt to obtain energy to be transformed into electricity. This is thus classified as renewable energy, because plants and wood are relatively easy to reproduce and grow, especially in comparison to fossil fuels and nuclear fuels. However, regarding its impact on the environment, biomass energy is not necessarily more environmentally friendly than non-renewable energy, especially as it produces not only greenhouse gas emissions, but also contributes to the major environmental threat of deforestation as wood is cut down to be burnt for energy.

**Geothermal energy** refers to energy obtained from underground. This is usually heat energy that is collected from drilling underground. This energy is harnessed and then transformed into electrical energy for use. Geothermal energy is a less common form of renewable energy because of its underdeveloped and expensive state.

## Advantages of Renewable Energy

### Limitless Source (Sustainability)

The most obvious advantage and reason to pursue renewable energy is the allure of an endless supply of energy unlocked. Despite there being limitations to the capacity for energy production of these sustainable sources, these sources will be able to provide energy endlessly, no matter the amount, which is far more than what can be said about fossil fuel energy. There will always be wind, sun and water on Earth to manipulate to create energy, and even when energy is created, nothing is lost or destroyed in the process, thus more energy can always be obtained, unlike with non-renewable energy, where fuels are lost for the gain of energy.

### Energy Potential

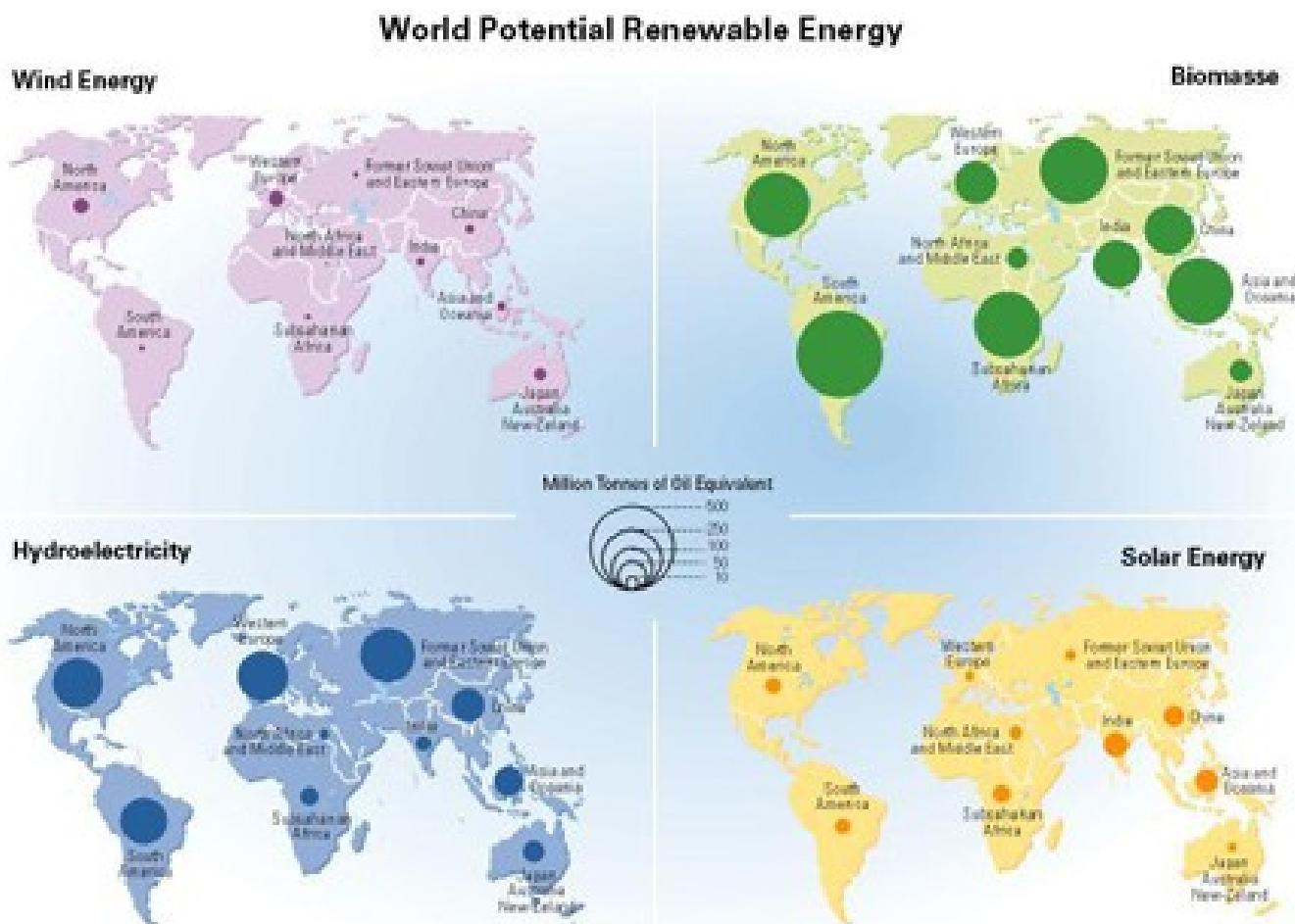
Renewable energy provides much potential for growth in energy production. In a society where technology is only developing further and faster, it is not only crucial to find a replacement for the depleted fossil fuel energy, but it is also incredibly important to find more energy, better energy and more efficient methods of collecting this energy, to stimulate development and improvement in energy production, not just sustain current levels of energy production. The potential of fossil fuels and non-renewable energy have long already been discovered and exploited, meaning there is no future left for these energy sources. However, there is still much to be discovered and improved in the area of renewable energy, because much of this energy is yet to be discovered and harnessed. Furthermore, there is much room for improvement in the

efficiency of this energy production. Thus, in order to have a chance to produce enough energy to meet future demands, renewable energy is the only area with still much potential to be explored. For example, the theoretical long-term potential of wind power is as high as 72TW, which are over 5 times the current global energy demand and 40 times the current global electricity use. This is partially because of the large quantities of wind energy constantly surrounding our Earth, but also because renewable energy has developed to maximize the energy to be obtained from the wind, so that when wind speed doubles, the energy obtained increases eightfold, thus a lot more energy can be obtained from a small increase in wind speed. Statistics also show that, theoretically, wind energy could possibly power the world for many generations to come. Yet, currently, wind power is not even considered a serious energy source.

Below is a map that displays the renewable energy potential distribution across the world:

### Environmental

Another large advantage renewable energy offers is how it is far more environmentally-



friendly than its alternative. Renewable energy does not require fuels to be burnt to obtain energy, and thus do not emit greenhouse gases that contribute to the current environmental concerns of global warming. The renewable energy sources themselves, despite causing minor interferences with the surrounding nature, do not release unnatural substances into the

atmosphere, and thus do not have lasting negative effects on the environment or nature.

## New Market

Similar to how there is much potential to be found in harnessing renewable energy, it opens a new market in our currently highly competitive economy. By developing and investing in renewable energy, nations and corporations get a head start at an opportunity to perhaps dominate future energy production, if renewable energy development succeeds. This opportunity could be crucial to securing a nation's influence and success in the future, as energy has almost become a necessity for human civilization, and its need is almost timelessly guaranteed. Currently, Europe dominates most of the renewable energy production, earning annual profits circulating around \$100 million from wind energy alone.

## Limitations of Renewable Energy

### Dependence on Nature

Renewable energy is hugely dependent on nature and natural processes to operate, as its energy comes entirely from natural surroundings that cannot be man-made or altered by human action (unless with the use of energy, which would then defeat the purpose of creating energy from it). For example, solar energy is dependent on the Sun, and thus is unable to produce (much) energy during the night or days with little sun exposure (e.g. foggy or rainy days). Wind energy production is completely dependent on levels of wind, and even when placed in open fields with lots of wind exposure, production of energy always varies, and it is never definite that energy can be produced. Hydroelectric energy is, in comparison, less risky, as it can, to an extent, be controlled and manipulated, and doesn't always depend on the natural flow of water. However, tidal and wave energy is the opposite, completely dependent on nature and wind levels for the little energy it is capable of producing. Geothermal energy is also quite stable, because the heat energy underground is relatively guaranteed, thus energy can always be obtained if machinery is drilled deep enough. Biomass energy is similar, as energy is certain to be obtained if biomass is burnt; however, it is not guaranteed that there will always be biomass to burn.

### Expenses

Renewable energy plants are expensive to establish and often expensive to maintain. This is a major drawback that prevents its dominating use, especially in less economically developed countries (LEDCs). Its major expenses are in the materials and technology needed for its creation. For example, generating electricity from coal costs approximately \$0.04KW/h, whilst generating energy from oil and gas costs c.a. \$0.08KW/h. However, generating energy from wind power costs currently c.a. \$0.12KW/h, whilst solar energy costs anything between \$0.18KW/h and 0.5KW/h. Hydroelectric energy is generally cheaper, often able to compete with energy

produced from coals, sometimes producing energy at an even cheaper rate. However, hydropower is limited in choice of location.

### Environmental

Despite the environmental advantage renewable energy offers in comparison to fossil fuel energy, renewable energy itself is not without harmful side-effects to the surrounding environment, despite these side-effects being better in the long-term than those of non-renewable energy production. For example, wind farms often intrude on the natural beauty of the environment, sometimes slightly disrupting local ecosystems with its constant noise. Birds are also known to have been killed flying into the rotating rotors (c.a. 70,000 per year), however, comparing it to the 50 million killed annually by cars and 97.5 million by flying into glass, this is rather insignificant. Finally, it is also important to recognize the materials needed for the production of renewable energy plants. These materials often include many metals that would need to be extracted and refined, a process that also hugely damages the environment, another disadvantage.

### Efficiency

Renewable energy is not often very efficient in obtaining energy, and thus is often unable to collect the maximum energy from its natural source. Its efficiency is lower than that of non-renewable sources, meaning it is usually not able to produce as much reliable energy as fossil fuel plants, partially because the natural source from which it obtains this energy doesn't hold as much energy as fossil fuels, but also partially due to its new and underdeveloped state. As with any new technology, there is much space of improvement and upgrades, although it would be difficult to ever obtain as much energy from renewable energy as quickly as can be done from fossil fuels.

### Location Inconvenience

Renewable energy can only be obtained in very specific locations complying with strict requirements, also often taking up much space. For example, wind energy-producing turbines must be placed in areas that are not only prone to high levels of wind, but also free of obstacles that could block the wind, thus usually resulting in open fields on high land, an environment that is becoming increasingly hard to find as cities are expanding and human influence on Earth drastically increases. Solar energy, on the other hand, requires direct exposure to as much sunshine as possible. This means that not all areas on Earth are suitable for sun panel usage, especially areas with little sun or lots of precipitation. Furthermore, nothing should be blocking the sunlight from reaching the solar panel, which is why most panels are installed on roofs and high land, making it hard for obstacles to obstruct the sunlight hitting the panel.

## Necessities for Research and Development

For research and development to be possible in renewable energy, there are a few necessities for its success. Firstly, **human ingenuity** is crucial. This would be in the form of innovative scientists genuinely interested and knowledgeable on the topic, willing to dedicate their career and time to development in this field. Secondly, and perhaps equally as important, is the **availability of resources**. Resources are not only in the form of money, but also in materials, facilities, and necessary equipment. This is crucial for proper, effective and efficient research to take place, as a scientist cannot produce proper, reliable technology without the proper tools, materials and conditions. Thirdly, **space and location** is important for proper research, but especially crucial to the development of renewable energy, as renewable energy can only be obtained, investigated and researched in specific areas suitable for obtaining a certain type of natural energy. Finally, **support and attention** from nations, the UN and the public helps fuel and speed up research and development.

## Controversy

It is no longer just a theory that nature is losing balance, as well as becoming more erratic and unpredictable. This is because of a variety of human influence that has messed with Earth's natural ecosystems and biodiversity, causing instability in the natural world. This thus brings up a point of controversy. Renewable energy requires complete dependence on nature. However, is this a good time to suddenly start depending so heavily on nature, especially for something so essential, such as energy? Nature is becoming harder and harder to depend on,

## Major Parties Involved and Their Views

### United Nations-Energy (UN-Energy)

UN-Energy is “*the United Nations’ inter-agency mechanism on energy*”. “*UN-Energy was initiated as a mechanism to promote coherence within the United Nations family of organizations in the energy field and to develop increased collective engagement between the United Nations and other key external stakeholders. Its envisaged role was to increase the sharing of information, encourage and facilitate joint programming and develop action-oriented approaches to coordination. It was hoped that it would develop into a system wide network open to all and a mechanism by which a range of organizational actors could work with the United Nations to ensure a more coherent approach to addressing energy issues.*” (UN-Energy, 2012) Regarding renewable energy, UN-Energy is also very much involved. UN-Energy and its members form a knowledge network that provides financial and technical assistance, expertise and knowledge. Its many programs are focused on capacity-building, enabling environments, knowledge sharing, research, technology, development and demonstration. UN-Energy is very much in support of renewable energy, offering knowledge and expertise to the UN regarding safe, successful use of renewable energy technology, whilst leading programs to further develop and spread renewable energy.

## United Nations Commission on Sustainable Development (CSD)

As its name suggests, the CSD is focused on sustainable development, set up to by the UN General Assembly in 1992 after the Earth Summit to ensure proper follow-up to the objectives set. “*The Commission is responsible for reviewing progress in the implementation of Agenda 21 and the Rio Declaration on Environment and Development; as well as providing policy guidance to follow up the Johannesburg Plan of Implementation (JPOI) at the local, national, regional and international levels. The JPOI reaffirmed that the CSD is the high-level forum for sustainable development within the United Nations system.*” (Division of Sustainable Development) Renewable energy development is a large part of the Earth Summit’s mission to reduce greenhouse gas emissions, being in the JPOI as follows:

- “*Improve access to reliable, affordable, economically viable, socially acceptable and environmentally sound energy services - [para. 9\(a\)](#)*
- *Recognize that energy services have positive impacts on poverty eradication and the improvement of standards of living - [para. 9\(g\)](#)*
- *Develop and disseminate alternative energy technologies with the aim of giving a greater share of the energy mix to renewable energy and, with a sense of urgency, substantially increase the global share of renewable energy sources - [para. 20\(c\)](#)*
- *Diversify energy supply by developing advanced, cleaner, more efficient and cost-effective energy technologies - [para. 20\(e\)](#)*
- *Combine a range of energy technologies, including advanced and cleaner fossil fuel technologies, to meet the growing need for energy services - [para. 20\(d\)](#)*
- *Accelerate the development, dissemination and deployment of affordable and cleaner energy efficiency and energy conservation technologies - [para. 20\(i\)](#)*
- *Take action, where appropriate, to phase out subsidies in this area that inhibit sustainable development - [para. 20\(p\)](#)*” (Division of Sustainable Development) (**See Appendix for a full version of the JPOI**)

## Intergovernmental Renewable Energy Organization (IREO)

“*The Intergovernmental Renewable Energy Organization (IREO) was established to promote the urgent transition to sustainable development and renewable energy sources. In support of the United Nations, IREO is building long-term partnerships with key public and private stakeholders on projects that improve peoples’ lives, protect the environment, and preserve our planet’s resources for future generations.*

- *Promoting clean energy and conservation*
- *Enabling developing countries to become leaders*

- *Fostering government and private sector collaboration*
- *Developing new models for project finance and implementations*
- *Promoting awareness through education and communication” (IREO, 2012)*

As an organization not officially affiliated with any government or the UN, the IREO may also be a useful, neutral body, since its dedicated specifically to the promotion of renewable energy.

### [The People's Republic of China](#)

As the world's largest energy consumer (recently surpassing USA), China is a major player in both energy production and consumption. Currently, despite using up the most energy, China is the world's leading renewable energy producer as well, with 17% of its energy consumption coming from renewable sources in 2007. Furthermore, China owns the largest amount of hydroelectric generators, as well as the largest hydroelectric plant. China was capable of producing 197 GW in hydropower in 2009. China's investment in renewable energy was second to Germany, equating \$12 billion USD, in 2007, and is expected to have surpassed Germany by 2009. China's is thus a leading producer and promoter of renewable energy. The reason behind its rigorous pursuit of renewable energy is to complete its 'economic transformation and achieve energy security'. Furthermore, China was not willing to reduce greenhouse gas emissions or limit energy consumption, thus, instead, they agreed to reduce emissions intensity, planning not to minimize energy consumption, but to increase energy (production) efficiency in regards to greenhouse gas emissions.

**Below is a map that shows the locations of the majority of renewable energy producers (companies):**



## Timeline of Events

Below is a short summary of the development and research in renewable energy until now, with a longer, more detailed and descriptive list to be found in the appendix:

Date	Description of event
3200 BC	First recorded use of wind energy - sails are invented by the Egyptians
200 BC	Invention of the windmill, in China.
BC	The Greeks use hydropower to turn water wheels that grind wheat into flour.
1839	Edmond Becquerel notices that sunlight absorbed in certain materials produces electricity – discovery of solar energy for electricity
1882	The first hydroelectric plant is completed in Appleton, Wisconsin
1920	Hydroelectric power provides 25 percent of all U.S. electrical generation.
1970s	The US experiences its first energy crisis. Interest in renewable energy escalates.
1992 (June)	United Nations Conference on Environment and Development (UNCED) (Rio Summit, Rio Conference, Earth Summit)
2002	World Summit on Sustainable Development was held in Johannesburg
2005	Launch of the Global Wind Energy Council, in Brussels
2005	China's Renewable Energy Law
2012 (June)	International Year of Sustainable Energy for All
2012	Rio+20 (Rio Earth Summit 2012)

## UN involvement, Relevant Resolutions, Treaties and Events

- Promotion of new and renewable sources of energy, including the implementation of the World Solar Programme 1996-2005, 15 February 2002 (A/RES/56/200) (**See Appendix for the entire document**)
- 2012 – International Year of Sustainable Energy for All (UN initiative)

## Evaluation of Previous Attempts to Resolve the Issue

### China's Renewable Energy Law (RE Law), & Renewable Energy Development Policies

*"Effective since February 2005, [the RE law] has set the world's most aggressive and legally*

*binding target. By 2020, 15 percent of all energy is to come from wind, biomass, solar and hydropower energy, compared to its present 7 percent. China is to have 137 gigawatts (GW) of renewable power generation by then, plus vehicle fuels with at least 15 percent renewable energy content.” (The China Sustainable Energy Program, 2012) Furthermore, “China has numerous policies in place to reach its renewable energy goals. For instance, all taxpayers are to share the incremental costs of renewables nationwide, and electric utilities have to pay a favorable ‘feed-in’ tariff for the output of renewable facilities. Other mandates encourage the development of a domestic renewable industry. Newly installed facilities such as wind turbines must contain 70 percent content that is manufactured in China.” (The China Sustainable Energy Program, 2012) As a result, the Chinese now produce about 40 percent of wind turbines sold in China and 3 percent of wind turbines sold globally. These initiatives and policies have been incredibly effective, as supported by statistics, because China is now the leading renewable energy producer, with 17% of its energy coming from renewable sources, which is already more than its set target for 2020.*

### Sustainable Energy for All (2012)

This initiative was founded by the UN Secretary-General, under the guidance of his High-Level Group, to make sustainable energy accessible, attainable and a reality for all nations by 2030. To reach this goal, there are many smaller objectives, including increasing energy efficiency (getting more energy from available sources), ensuring universal access to energy, and promoting renewable energy. This initiative sets a timeframe and gives proper attention to renewable and sustainable energy, providing a platform from which major players in the energy production and consumption industry can come together to negotiate and discuss the future of energy production. However, its effectiveness is yet to be determined, as the initiative has just begun.

### Possible Solutions

#### Research Grants

By offering research grants, scientists are provided with incentives to research and further develop renewable energy. Because funding is often the obstacle preventing innovative technology from taking place, by providing research grants specific to development in renewable energy technology, scientists receive the incentive as well as the resources to develop new technology in renewable energy. This fulfills two of the most important necessities for renewable energy development; human ingenuity and resources.

#### Transparency

There should be transparency between the research and development of renewable energy technology of different nations and corporations. Perhaps an international database could be established to record and collect development and research of renewable technology all over the world, making it

attainable for all nations and making renewable energy development a global, international effort, as opposed to national or private. Furthermore, this makes the technology obtained more reliable, accurate and successful, as it will have been verified, improved, adjusted and corrected by a variety of scientists with different approaches from all over the world, as opposed to just one in one nation with a limited set of resources available.

## Aid

In order for LEDCs to have a chance at developing their own renewable technology, they inevitably will need aid. However, aid is sometimes a dangerous form of help, especially in corrupt governments, typical of LEDCs. Therefore, the aid should not be in a general form, such as money, but should be more specific to the topic, such as knowledge, equipment or resources. These assets are specific only to renewable energy development, and thus it can be insured that this aid will go to the right place, to benefit all the population, not just corrupt officials.

## Regulation

Similar to the need for transparency, the need for regulation to ensure the research is proper and just is necessary. To ensure resources are used as effectively as possible, as well as used in a proper way, a regulatory body must keep an eye on research bodies, to make sure they are moving in the right direction. Whether this regulatory body should be the government, a separate organization or an UN organ, each has their benefits and limitations.

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## Appendix or Appendices

I <http://alternativeenergy.procon.org/view.resource.php?resourceID=002475>

Detailed history of both discovery and production of energy, including recently related

events. from 2000BC to 2012

- II <http://www.worldlii.org/int/other/UNGARsn/2001/284.pdf>

Resolution: Promotion of new and renewable sources of energy, including the implementation of the World Solar Programme 1996-2005, 15 February 2002  
(A/RES/56/200)

- III [http://www.un.org/esa/sustdev/documents/WSSD\\_POI\\_PD/English/POIToc.htm](http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POIToc.htm)

Complete document of the Johannesburg Plan of Implementation created at the Earth Summit