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Dr. Tom  
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## Household Wind Turbines

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**Abstract:** Wind power is used all over the world to power businesses, homes, and schools. Wind energy is the energy available in a moving mass of air. As the wind increases, the power available increases cubically. Wind turbines are often used in a large scale on wind farms containing over a hundred turbines. However, in the proper location, and with the proper equipment, wind turbines can yield successful energy on a household level. A homeowner needs to first determine whether or not a wind resource in their area makes a small wind system economical. If the wind speed is below 7mph there will be no energy output and thus make the household wind turbine obsolete. Homeowners would also need to know whether or not local zoning ordinances allow wind turbines to be installed in their area. If all these pieces fit together, homeowners could have 80-90 percent of their energy bill paid for by a household wind turbine.



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## **I. INTRODUCTION**

Wind power has been used for over 2,000 years. Since the first sails were set to the wind, powerful machines have provided electricity all over the world. The first windmill used for electricity was made in Scotland in July of 1887 by Professor James Blyth to provide electricity for his holiday cottage.<sup>1</sup> Since then wind farms have grown all over the world with large wind farms in major countries such as India, China and the USA. A wind farm is a group of wind turbines located in the same area to maximize the amount of electricity produced. Large wind farms can contain upwards of a couple hundred turbines with agricultural areas covering the land around the turbines.<sup>2</sup>

Energy choices have an immense impact on our environment. More than 50 percent of the United States energy is produced through burning coal which has a negative effect on the neighboring land, water and air.<sup>3</sup> Electricity from wind turbines helps to reduce the detrimental use of coal worldwide. While most of the wind energy utilized comes from large scale wind farms, some residents have chosen to take the next step of installing a household wind turbine or windmill. Installing a household wind turbine is a big step for any household family and comes with a list of pros and cons. Household wind energy yields cost effective benefits along with relief on the environment; however, they are an expensive investment that will only be successful in proper conditions.

## **II. WHY WE SHOULD USE WIND ENERGY**

Renewable energy resources such as wind energy are a way to slow down climate

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<sup>1</sup> Culp, Vince. "Wind Power Basics." *Wind Energy Foundation*.2

<sup>2</sup> Gumula. Environmental and Economic Benefits Of Using Kinetic Wind Energy To Generate Electricity." *Polish Journal Of Environmental Studies*.2322

<sup>3</sup> Culp, Vince. "Wind Power Basics." *Wind Energy Foundation*.4

change and global warming. Carbon dioxide concentration levels have increased by about 11.03 ppm in recent years.<sup>4</sup> The global land and ocean temperature is also increasing. Sea levels are rising as ice in the Arctic melts away.<sup>5</sup> World energy production and consumption are both growing rapidly while nonrenewable fossil fuels such as coal and oil begin to diminish. The two major culprits of abusing fossil fuels are the US and China. According to Figure 1.1, China consumes the largest amount of fossil fuels with the US not far behind. However, in Figure 1.2 it is shown that the United States by far has the largest usage per capita with China barely making the top ten.

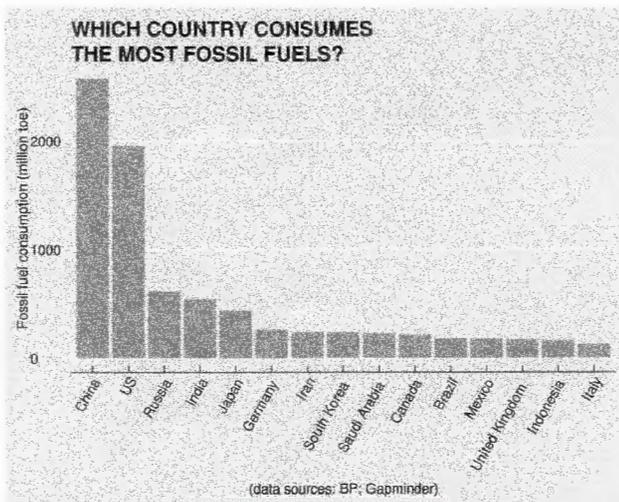


Figure 1.1

*Caption?*

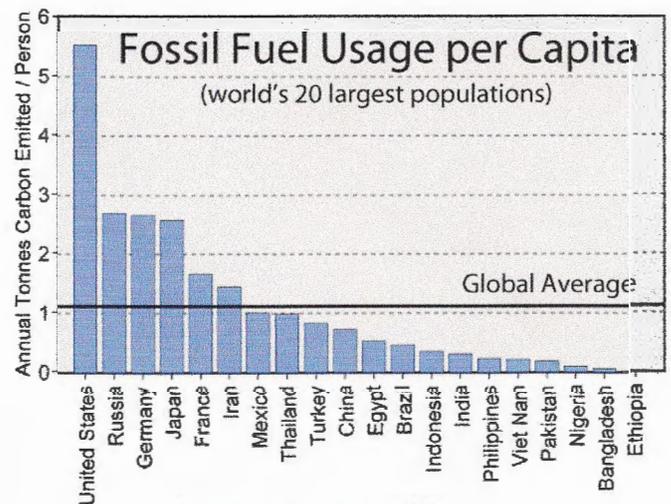


Figure 1.2

*Caption?*

The need for change is now. Countries all over the world are exploring new ways of powering major cities with wind, water, and the sun. Wind energy is now a significant energy resource whose exploitation, unlike that of coal, creates a positive impact on the environment. It relieves the pressure of fossil fuels and emits no toxins into the environment. There are not many economical drawbacks for the land wind turbines are

<sup>4</sup> Gumula, Stanislaw." 2317

<sup>5</sup> Gumula.2319

built on considering that one turbine has an average base diameter of 15 meters.<sup>6</sup> Wind farms can also be used for agriculture and farming because of their utilization of height rather than width. Pushing in the direction of wind energy will not deplete land use but will help stop environmental turmoil.

### III. PREPARING FOR HOUSEHOLD WIND ENERGY

When Professor Blyth installed his wind turbine next to his cottage, it became the first house in the world to have its electricity supplied by wind power. His household turbine was such a success he offered the extra electricity to light up Main Street.<sup>7</sup> The first thing to do when preparing to install a small wind turbine is to determine whether or not the surrounding area produces enough wind to make the project economically feasible.<sup>8</sup> The next step is to determine your household electricity usage and find out whether local zoning ordinances allow for the installation of a small wind turbine. A common household turbine is between a 5kw-10kw generating turbine with a diameter of 5-10 meters and a height of 24-40 meters.<sup>9</sup> This is significantly smaller than the industrialized turbines most people think of which stand as tall as 100 meters. Figure 1.3 shows the different sizes of commonly used turbines, the smallest being much bigger than the common household turbine.

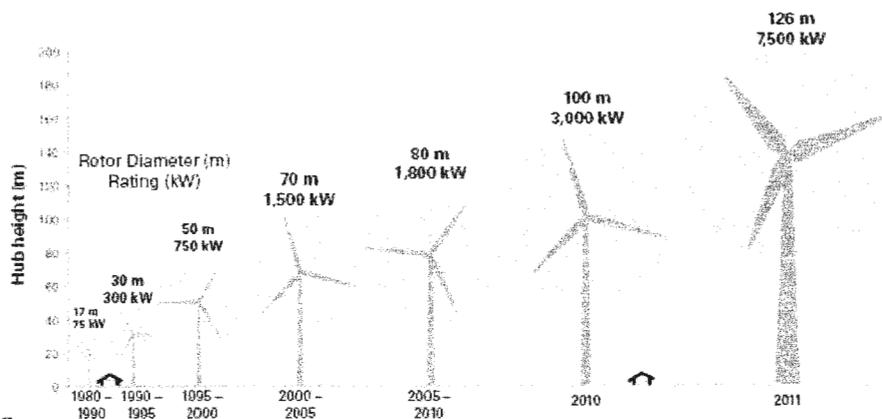


Figure 1.3

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<sup>6</sup> Culp, Vince. "Wind Power Basics." *Wind Energy Foundation*. 10

<sup>7</sup> Gumula. 2316

<sup>8</sup> "Power Your Home." *Wind Energy Foundation*. 2

<sup>9</sup> "Power Your Home." *Wind Energy Foundation*. 5

Household wind turbines are not practical in urban areas where space is limited and wind is scarce. It is recommended to have a lot size of at least an acre or more when installing a wind turbine for household purposes.<sup>10</sup> In order to have a functioning wind turbine, there needs to be 7 mile per hour winds otherwise no energy will be produced.<sup>11</sup> Many people overestimate their wind resource and professionals encourage mapping weather data and local experience to determine the best place for a wind generator on your property.

Household wind turbines are best utilized in places that have higher utility rates in order to maximize savings on electricity bills. Installing a small household wind turbine requires planning and knowing the correct legal steps, but if done properly can produce worthy results.

#### **IV. BENEFITS OF HOUSEHOLD WIND ENERGY**

Installing a household wind turbine has many economic and environmental benefits. The main benefit of installing a household wind turbine is that it can greatly lower the cost of an electricity bill, and overtime, the turbine will have paid for itself. Hypothetically, if your local rate for a kilowatt hour is \$0.10 and the turbine works at half-capacity and generates 650 kilowatt hours a month, then the turbine saves the homeowner \$65 per month on their energy bill. This is only if the turbine is working at half-capacity, imagine what it would be when working more. At this rate of savings the homeowner will pay for the turbine with their energy savings in 132 months, or about eleven years.<sup>12</sup> If a household generates more wind energy than they use in their own home, they can sell the excess product to local energy companies.

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<sup>10</sup> "Small Wind Turbines for Homes & Businesses." *Bergey WindPower*.3-4

<sup>11</sup> Culp, Vince. "Wind Power Basics." *Wind Energy Foundation*.13

<sup>12</sup> Hamm, Trenton. "The Costs and Benefits of Installing a Windmill." *The Simple Dollar*. 2-4

There are also tax benefits to installing a household wind turbine. Depending on the area of installation, residents can buy the equipment with no sales tax and can earn \$0.01 in credit for each kilowatt hour of energy sold back to the electric company. In addition to this, homeowners can receive tax credit up to 30 percent on small residential turbines.<sup>13</sup>

In addition to the economic gain yielded by installing wind turbines, the environment also benefits. As stated earlier, more than 50 percent of the United States energy is produced through burning coal.<sup>14</sup> Fossil fuels such as coal cause a great amount of air and water pollution all over the world. Wind energy creates no such pollution and by using wind energy, less coal is being burned to fuel our homes. Wind turbines are also built to utilize the space above ground, not the ground itself. Because wind turbines are not very wide, the land is minimally disturbed and residents, such as farmers, can continue to use the land surrounding the turbine.

## **V. DRAWBACKS OF HOUSEHOLD WIND ENERGY**

While the benefits of household wind turbines are commendable, there are some drawbacks that a homeowner should be aware of before investing in wind energy. First and foremost, not all areas have enough wind to power wind turbines. As stated before, there needs to be at least 7mph of wind in order for wind turbine blades to rotate and create power.<sup>15</sup> Any less wind and you are looking at a motionless investment. Wind turbines are not practical unless you have at least one acre of land to build it on. This is because the more buildings and houses around the wind turbine, the more wind is going to get blocked

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<sup>13</sup> Erik, Hyrkas. "Could Your Home Benefit from a Small Wind Electric System?" *Energy.gov*.2-3

<sup>14</sup> Culp, Vince. "Wind Power Basics." Wind Energy Foundation 8

<sup>15</sup> Culp, Vince. "Wind Power Basics." Wind Energy Foundation 11

and once again not create sufficient energy.<sup>16</sup>

The biggest concern some residents have about building a wind turbine on their property is the noise pollution. The bigger the turbine, the more noise it will create. The constant turning of the blades creates a sound like an airplane flying overhead. Many homeowners who live with a loud wind turbine say they experienced headaches, dizziness and insomnia after the turbine was installed.<sup>17</sup> Some homeowners left their homes where there were wind turbines running that were owned by the cities because they could not sleep and were experiencing health problems. It is important to understand both the pros and cons of having a household wind turbine and whether or not they are worth it.

## **VI. CONCLUSION**

Wind energy creates monetary and environmental gains all over the world. As large scale wind farms continue to increase, so does the interest in household wind turbines. Understand that a household wind turbine is not the towering wind turbine you think of when driving down the open road. They are much smaller but can still have enough power to provide electricity for a house with energy to spare. With the proper planning and consideration, a homeowner can reap the benefits of installing a small wind turbine on their property.

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<sup>16</sup> "Small Wind Turbines for Homes & Businesses." *Bergey WindPower*.7

<sup>17</sup> Seltnerich, Nathan. "Wind Turbines: A Different Breed of Noise?" *Environmental Health Perspectives*.2

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