WIND ENERGETICS

New approach to utilization of energy of wind

An Industry-Wide Proposal

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THIS PROPOSAL IS AIMED AT EXPANSION OF THE NATIONAL ELECTRIC POWER GENERATING CAPACITY, ACTIVIZATION OF THE LOCAL ECONOMY AND CREATION OF NEW JOBS

THIS PROPOSAL IS AIMED AT DECREASING OF USAGE OF THE FOSSIL FUEL FOR PRODUCTION OF ELECTRICITY AND MAKING THE ENVIRONMENT SIGNIFICANTLY CLEANER

THIS PROPOSAL IS AIMED AT ENCREASING OF THE NATIONAL ENERGY INDEPENDENCE AND IMPROVING THE NATIONAL SECURITY

About Qualitics, Inc.

The Qualitics, Inc. provides consulting services to small businesses in economics, engineering, and scientific aspects.

Qualitics, Inc. was founded in Cleveland, Ohio in 2005. The purpose of Qualitics, Inc. was to provide assistance to small business owners in establishing and developing of their businesses.

The Research Division of the Qualitics, Inc. is intensely involved in scientific research in areas of physical economics, natural, and environmental science.

The Research Division of the Qualitics, Inc. has published several monographs and journals.

The office of Qualitics, Inc. is in Euclid, Ohio. Detailed information about Qualitics, Inc. is available at www.thequalitics.com

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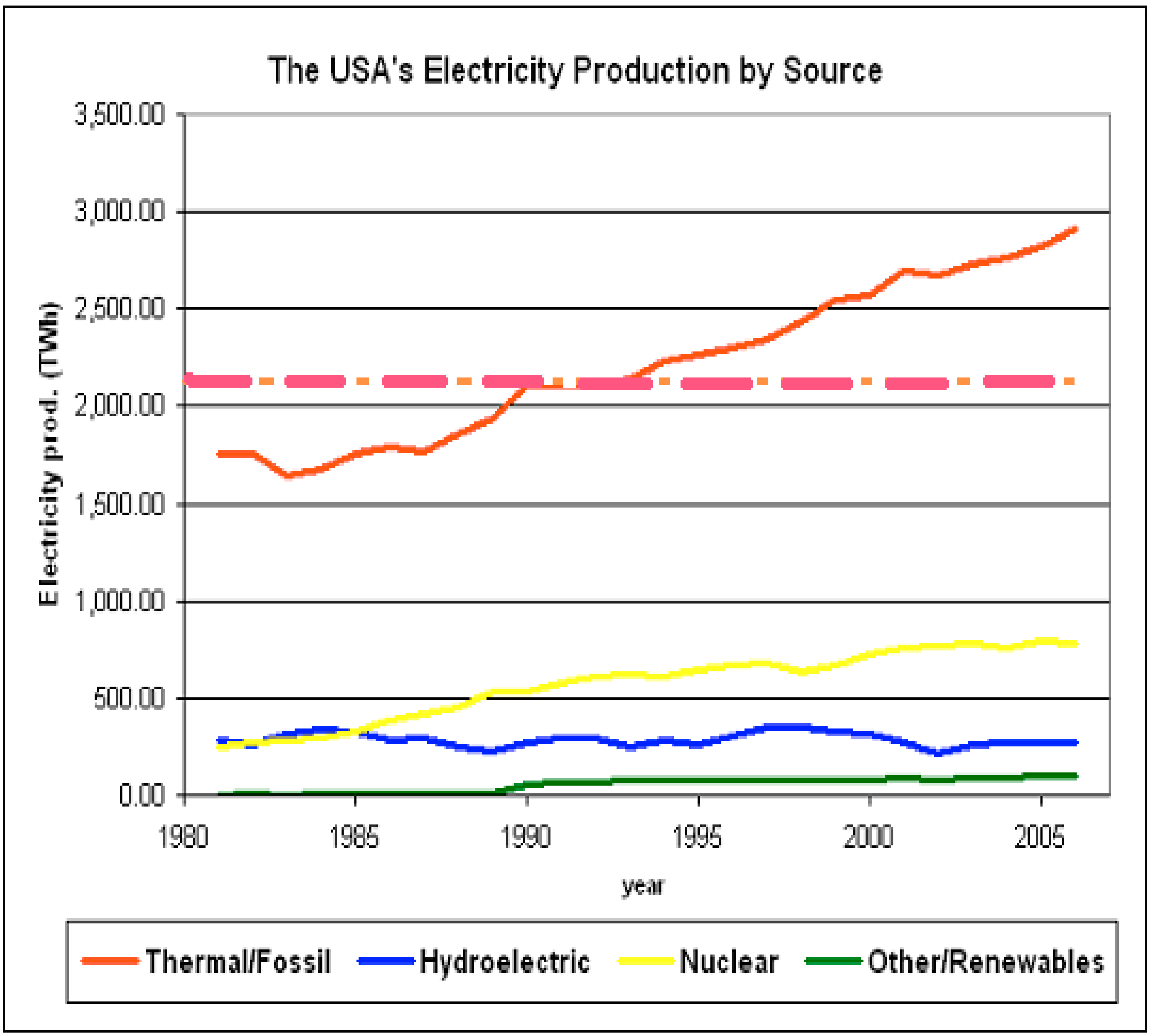
Chapter 1. Introduction and Purpose

Demand of Electricity in USA

The picture below shows the production of electricity in USA generated by different sources, representing the current annually produced power of **330 GW**.

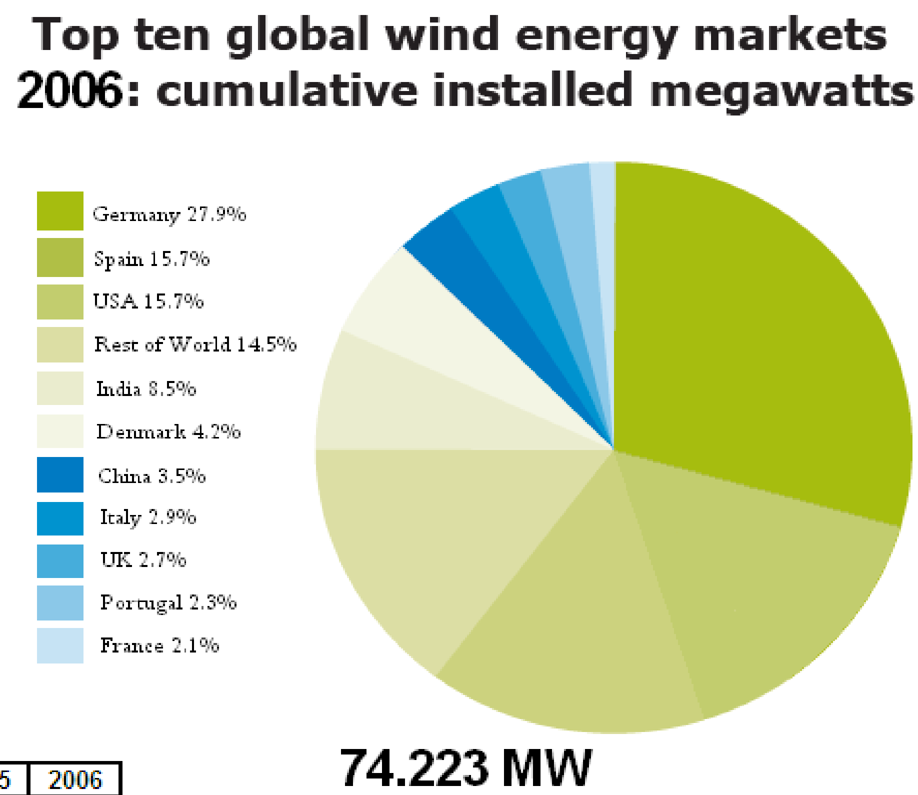
Dot-dashed straight line on this picture represents electric energy that can be provided by wind according to the presented Proposal.



Wind Power Usage

Currently, World is consuming about 75 GW (gigawatt) power of wind.

The picture on the right illustrates top ten national markets of wind-generated electricity.



Worldwide wind power consumption

Rank	Country	2005	2006
1	Germany	18,415	20,622
2	Spain	10,028	11,615
3	United States	9,149	11,603
4	India	4,430	6,270
5	Denmark (& Færoe Islands)	3,136	3,140
6	China	1,260	2,604
7	Italy	1,718	2,123
8	United Kingdom	1,332	1,963
9	Portugal	1,022	1,716
10	Canada	683	1,459
11	France	757	1,567
12	Netherlands	1,219	1,560
13	Japan	1,061	1,394
14	Austria	819	965
15	Australia	708	817
16	Greece	573	746
17	Ireland	496	745
18	Sweden	510	572
19	Norway	267	314
21	Egypt	145	230
25	New Zealand	169	171
	Total:	57,897	72,196

***Installed wind power capacity in* MW.**

The table on the left shows numbers for installed megawatts of wind power systems in 25 countries worldwide during 2005 and 2006.

As one can see, USA is not a leader of the mastering of wind energy.

Currently, wind delivers about 3% of USA's electricity production.

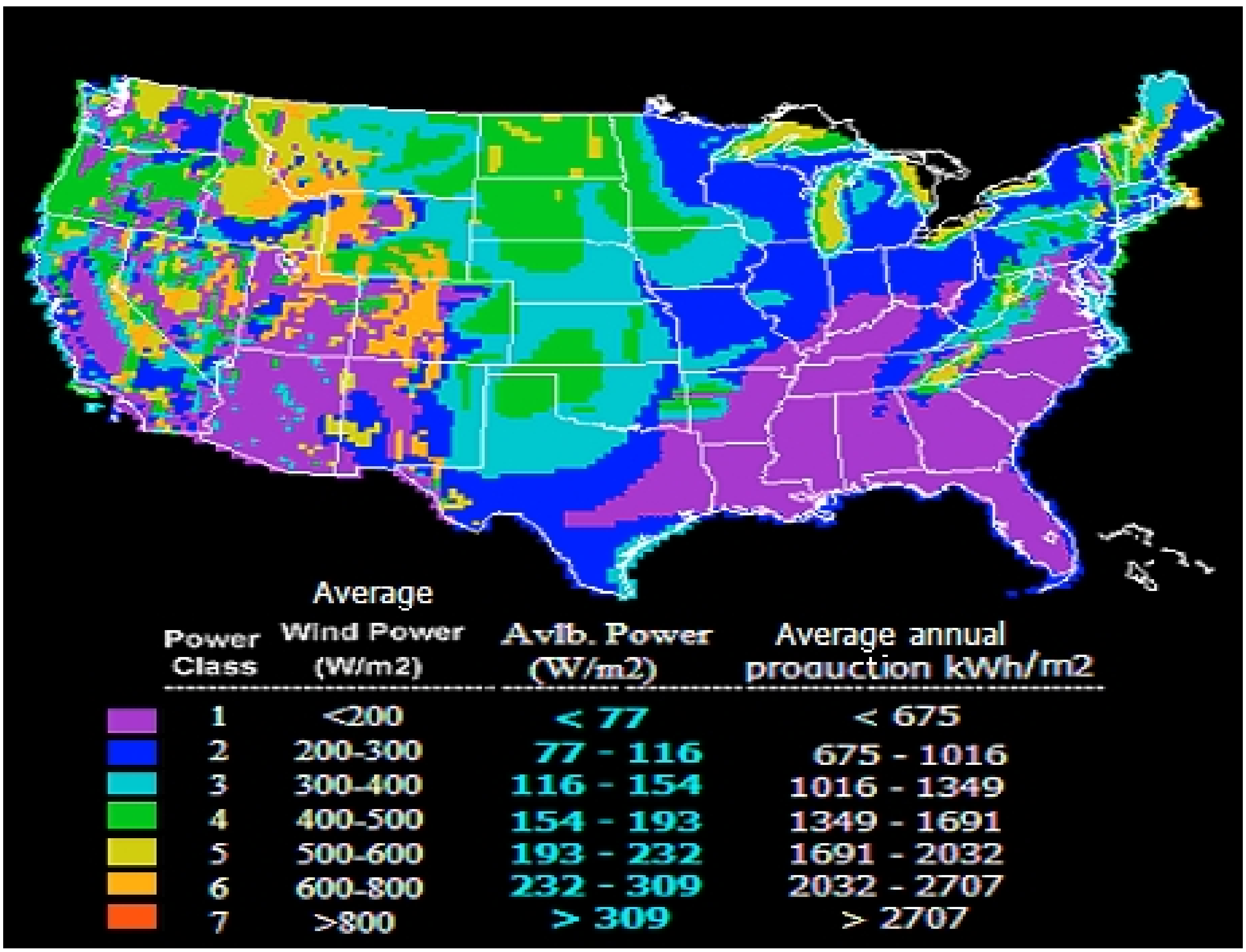
Chapter 1. Introduction and Purpose

Wind Map of USA

The territory is characterized by ***class***. Each **class** includes territories where average annual wind power per each square of the wind's normal cross-section has a value inside certain limits, as it is shown in image. (All measures are given for the height of h=50m).

Average annual production is a product of Available (on image -*Avlb*.) Wind Power and the number of hours in 1 year (8,760 hrs.)

To estimate available power per m^2 at wind's speed v one should divide v^3 on 4.



Chapter 1. Introduction and Purpose

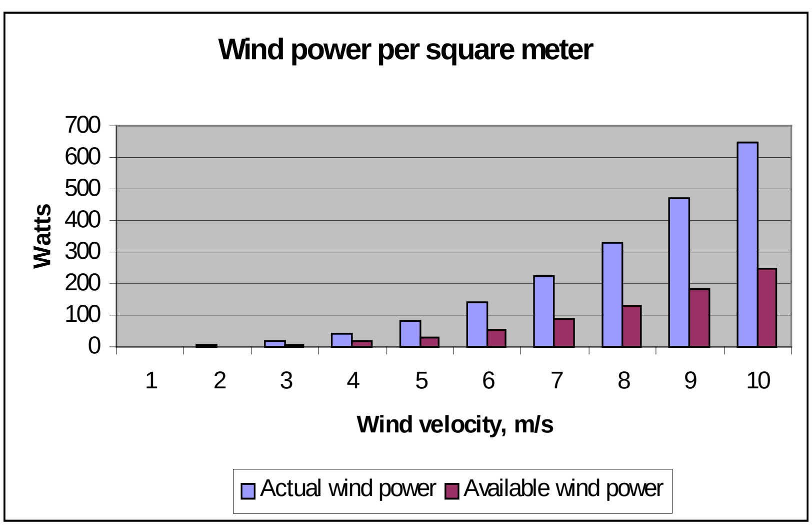
Available wind power

The wind power depends on its velocity v as v^3, and at constant velocity of v = 1m/s wind carries around **0.645W** of power through any normal cross-section of **$1m^2$**.

However, the same Physics teaches us that only 0.386 part of it, i.e. **$n_{useful} \cong 0.250W$**, can be consumed for a useful work. This part of actual wind power is exactly what we call an "***available wind power***".

The difference between *actual power* and *available power* of wind is based on the fact that there is no way to transform the whole energy of wind into a useful work without … stopping the wind itself. Doing a useful work, wind has to save certain kinetic energy for itself to be able to leave streamlined working bodies in order to give a place for a new portion of moving air to perform its useful work.

In other words, the continuous stream process is impossible without leaving some portion of the kinetic energy in the working fluid. Calculation of this part of energy accurately gives exactly the mentioned above result: only 0.386 part of the wind power can be used as a power for performing a useful work: generating of electricity.



The graph on the left shows a dependence of the wind's power per square meter of its normal cross-section versus the speed of wind.

Both – the actual power and the available power – are shown in comparison with each other.

Available wind power (cont.)

Discussing available wind power, we should first recognize the following fundamental fact:

USA, in principle, can fulfill all its needs for electricity through available wind power for many centuries ahead.

Indeed, if we would cover 2/5 of USA territory by Wind Power Stations (further – WPS) of 250W capacity each in a chess desk pattern of ***25 WPS per each square km***, we will harvest at least 2,100 TW-h (terra-watt-hours) of electric energy each year.

(That is exactly the level that was shown by the dot-dashed straight line in picture on page 4 of the present Proposal).

CONCLUSION:

At given climate conditions, even old-fashioned Wind Power Stations are capable to provide USA with all needed electricity.

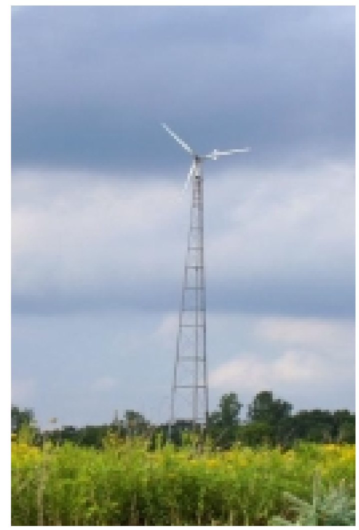
Chapter 1. Introduction and Purpose

Existing Solutions

Single wind tower approach.

Historically, the exploration of wind energy inherited separately standing towers with usually four-blade wind rotors on the top. We will call approach based upon building of separately standing wind power stations the "*single wind tower*" approach, or SWTA.

There are numerous types of WPS invented, some are shown here.



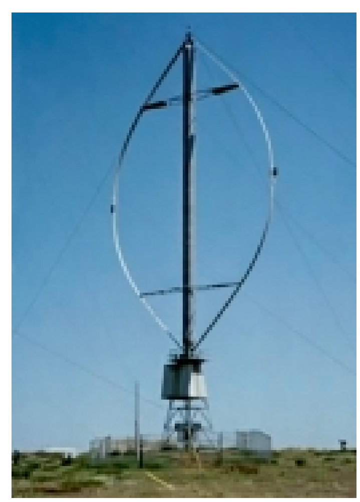
SWTA always presumes building of a tower (post, hub, tower, etc.), which should support a chosen rotary system (blade-wheel, sails, turbine, and others).

SWTA always presumes building of WPS in place where two major conditions are coinciding:

- A local need of power, and
- A presence of a strong enough wind during long enough part of the year.

SWTA always presumes careful choosing of lot for building of WRS because there are many natural requirements for safety, environment, and maintenance of WPS.

Sometimes even noise, which working WPS makes, can create a problem for a residential neighborhood.



Existing Solutions *(cont.)*

Wind Farms approach.

In the last quarter of XX century the new approach to WPS was developed and implemented – the building of a huge ensemble comprising many (several dozens and even hundreds) of big (usually tri-blade) WPSs with very dense placement in one remote location where strong enough winds are present during long enough part of the year. Thus the Wind Farms approach was born.

The most profound Wind Farms are using huge (several dozen meters) long tri-blade rotors and are able to provide up to 7-10 MW of power each.

Collected together in a farm, they are able to provide up to 1GW of power.

Of course, territory of each Wind Farm has to be strongly restricted for any activity and presence

Currently, the most developed project of a gigantic Wind Farm is the London Array Project. According to it, 341 wind stations should be built on the outer Thames Estuary in the UK that should provide 1 GW (gigawatt) electric power at the rated wind velocity v = 13 m/s, as it is shown on the picture below.

Chapter 1. Introduction and Purpose

Existing Solutions *(cont.)*

The London Array's lessons

It is expected that the London Array turbines will range between **3MW** and **7MW** in the electrical capacity, which will provide an average power output of **350 MW** at the proposed turbine size.

The exact size of the turbines is uncertain at this stage, but project presumes that turbines will be mounted on the poles about 100m above sea level with massive blades sweeping down to 25m and then up to 175m high; getting on for twice the height of Big Ben's mighty clock tower.

Therefore, it is expected that each blade will be 75m long! It means that "rotary disk" square will be $S = 17662.5m^2$! At such an area of wind and at velocity of wind v = 13m/s the ideal turbine should provide **N = 9,511,000 W (9.511 MW)** of the electric power!
Therefore, from the very beginning, this project -"***The London Array***"- is relying on efficiency of use of available wind power that is no more than between **32%** and **73%**!

Today, the budget for construction of this system is $5 Billion. Therefore, even this advanced project requires **capital investment** of **$5.00 per 1W** of provided capability!

At current cost of electricity, which is $0.10 for 1 kW-h, the London Array would produce commodity that is worse about $300 Millions per year. It shows that:

The London Array could **pay off** the invested capital no sooner than in **17 years**!

Chapter 1. Introduction and Purpose

Purpose of this Proposal

The purpose of this Proposal is to convince any reader that our unavoidable future – the usage of wind power to generate electricity in an environmentally clean manner – has the other solution than pursuing the Wind Farm approach.

This new solution is based on natural features of wind, on reality of existing climate, on reality of residential habitats, on existing system of the transportation of electricity and its delivery to consumers.

This new solution is much more flexible in respect to capital investments; it does not require immediate concentration of a huge capital investment neither for manufacturing, nor for installation of wind stations, nor for transportation and delivery of electricity from wind stations to consumers.

This solution significantly reduces, or even eliminates, "*pick-load*" effect and is very easy to develop and expend where and when such need occurs.

This solution is cheap, reliable, and simple. Once being implemented, it will work permanently for decades while requiring very little maintenance.

Chapter 2. Why a new approach is needed?

What kept us from usage of wind power?

Comparing the two following facts:

Fact #1

USA, in principle, can fulfill all of its needs for electricity through available wind power for many centuries ahead

and

Fact #2

Today USA is using miserably small part of all available energy of wind,

one might ask:

Why are we neglecting such a good source of energy?

The right answer is:

Because it was and still is too costly to obtain essential electric power through wind stations.

The two reasons are causing a high cost of the development of high-capacity energy industry based on the Wind Power Stations (WPS):

1. ***a poor efficiency of production of electric current by contemporary wind machines***

and

2. ***a wrong strategy of placement of wind machines for production of electricity.***

Let us examine both of the stated reasons.

Chapter 2. Why a new approach is needed?

Efficiency of Wind Power Stations

To evaluate the efficiency of the contemporary Wind Power Stations that are available on the market today, let us compare some of them in the large range of capabilities.

Model	Source	N in W	R in m	V in m/s	No in W	N/No	N/No in %
ARE 110	AbundantRE.com	2500	1.8	11	3329	0.751	75.1%
ARE 442	AbundantRE.com	10000	3.6	11	13317	0.751	75.1%
Bergey XL.1	bergey.com	1000	1.25	11	1606	0.623	62.3%
Bergey 1500	bergey.com	1500	1.6	12	3415	0.439	43.9%
Bergey Excel	bergey.com	10000	3.5	13	20777	0.481	48.1%
1.5s	gewindenergy.com	1500000	35.25	13	2107490	0.712	71.2%
1.5se	gewindenergy.com	1500000	35.25	13	2107490	0.712	71.2%
1.5sl	gewindenergy.com	1500000	38.5	14	3139951	0.478	47.8%
1.5sle	gewindenergy.com	1500000	38.5	14	3139951	0.478	47.8%
1.5xle	gewindenergy.com	1500000	41.25	12.5	2565637	0.585	58.5%
Air Breeze	windenergy.com	200	0.57	12.5	490	0.408	40.8%
Proven 0.6	solarwindwork.com	600	1.275	12	2169	0.277	27.7%
Proven 2.5	solarwindwork.com	2500	1.750	12	4085	0.612	61.2%
Proven 6	solarwindwork.com	6000	2.750	12	10088	0.595	59.5%
Proven 15	solarwindwork.com	15000	4.500	12	27014	0.555	55.5%
Enercon E-126	Wikipedia	6000000	63	14	8407803	0.714	71.4%
Repower 5M	Wikipedia	5000000	63	14	8407803	0.595	59.5%

"***No***" in this table is a theoretical value of the Available Wind Power recalculated for actual value of wind machine's blade radius, R, and rated velocity of wind, v.

One can see (the last column of table) **how insufficient the functional quality of built wind stations is...**

In reality, the value of efficiency at exploitation of these wind machines is even less than the ones in the table…

The reason of the poor efficiency of the considered models of wind power stations is obvious: all of them have two- or three-blade rotors, and consequently allow significant portion of wind to penetrate the rotary disk without interaction with blades. Furthermore, the multi-blade wind machines create too big of aero-resistance for wind, therefore wind simply escapes such rotary disk instead of going through it.

Chapter 2. Why a new approach is needed?

Huge capital investment

As we already have seen, even such an advanced project, as the London Array is, requires **capital investment** of **$5.00 per 1W** of provided capability!

To explore the problem of replacement only one big coal power station, let us use the best-known coal electric power station – the Drax Power Station near Selby in UK. It is one of the largest, cleanest, and most efficient coal-fired power stations in the world.

The output capacity of all its six generators is **4 GW** (gigawatts), and it provides enough power to meet **7%** of the UK's electricity needs.

To produce such power, Drax Power Station consumes more than **8 million tons of coal annually, produces around 1.5 million tons of ash, and 22.8 million tons of carbon dioxide each year.**

To replace this coal electric power station by the wind power farms like the London Array, it would be necessary to make a capital investment of **$20 Billions!**

For residential Market, the following citation shows current cost of having WPS on private back yard:

How much do they cost? A small 1kW wind turbine system that produces about 300kWHrs per month in a 12 mph average wind, can cost as little as $5000 to $7000. 1 A 10 kW wind turbine costs approximately $28,000-35,000 to install. The equipment cost is about $25,000 and the rest is shipping and installation. Even smaller and more basic wind turbine systems, such as those based upon Southwest Wind Power's Air-X can be purchased for $1000 to $2000. These systems are frequently a good fit for powering a small weekend cabin.

Chapter 2. Why a new approach is needed?

We simply cannot afford contemporary approach

As we already discussed, there is a need of **350 GW**-power of generators to meet the current needs of USA in electricity, which is almost **3,066 TW-h** of energy.

As it has been shown, the natural conditions in USA allow generation of such a huge amount of electricity if Wind Power Stations, or WPS, approach is implemented. There is no principal restriction to achieve this goal.

To obtain this amount of power, we need **350** Wind Farms like the London Array. At cost of the London Array, it will require **$1,750 Billions** to pay for construction of so many wind power stations. Can any private consortium or even Federal Budget afford it even in some significant part?

CONCLUSION:

We simply cannot afford the replacement of contemporary fossil fuel electric power stations by WPS.

To be able to make this replacement we have to design a more efficient and less costly wind turbines and reconsider our approach for a placement of such turbines.

Chapter 3. The new type of Wind Machines

The nature of poor efficiency of wind machines

As the table on page 14 shows, there has not been built a single station with efficiency better than 75%! An actual average efficiency of such stations is less than 50%... Such low efficiency can be easily explained: too much wind escapes rotating blades … by simply going between them!

Practice and theory indeed show that an efficient station has to consist of multi-blade propeller, just as it was in windmills of our ancestors. However, such propeller becomes a significant air-resistant and wind ‘prefers’ to streamline it from outside rather to go through it!

> The three-blade propeller is exactly an experimentally found compromise between “*escaping through*” and “*streamlined externally*” effects!

The real solution of this dilemma would be in studying of origins of air-resistance of multi-blade propellers and eliminating the source of such resistance in the “Next-Generation” of wind stations.

More than 30 years of studying of the nature of efficiency of processes and apparata of the stream techniques are showing that the main reason of poor efficiency is the turbulization of flow inside wind machine. This parasitic turbulence occurs not because our engineers are designing poor apparata and devices, but because **they simply do not known what type of stream machines do not create such parasitic turbulence.**

Qualitics, Inc. has accumulated results of numerous researches in this area and has published two monographs on that matter: “***The Dynamics of Quantum Vortices***” and “***The Qualitics, Volume 1: The theory of a quality of stream processes and apparata***”.

> Both monographs are available on the Company’s web site – ***www.thequalitics.com***

It has been proven that **there is only one way to avoid creation of the parasitic turbulence by any stream machine** – ***to provide a laminar outflow!***

Chapter 3. The new type of Wind Machines

The nature of poor efficiency of wind machines *(cont.)*

The term "***laminar***" is a synonym of the term "***without turbulence***", and it makes last statement on previous page a tautology. However, in Science easy things often appear as very complex: term "***laminar***" is also synonym of term "***being an exact solution of the equation of Hydrodynamics***". Therefore, all we need is to build a stream machine that is providing outflow of a stream which is described as an exact solution of the Navier-Stokes equations – the main equations of Hydrodynamics of a real fluids. A clear and well-stated problem for engineers, is it not?

The paradox is that engineers never were following this simple and clear directive because … there was no, even one exact solution of the Navier-Stokes equations for a rotating discharge flow! Engineers newer knew any example to follow!

In 1986 scientists of the Khurchatov Institute of Atomic Energy, Russia, have found the first exact solution of the Navier-Stokes equations for a rotating discharge flow, and this solution appears to be the one that explains and describes … tornadoes.

Tornado-like flow of a normal (*Newtonian*) fluid medium were discovered and published by G. I. Kiknadze and Yu. K. Krasnov [***Evolution of Tornado Like Flows of Viscous Liquids*****, Reports of Academy of Sciences of the USSR**, 1986, vol. **290,** № 6, p. 1315.] The particular case of a ***stationary*** tornado-like flow is described by the following solution:

$$v_\rho(\rho) = -\Omega\rho,$$
$$v_\varphi(\rho) = (\gamma/2\pi\rho)[1 - \exp(-\Omega\rho^2/2\nu)], \quad (*)$$
$$v_z(z) = 2\Omega z$$

where (ρ, φ, z) is the cylindrical coordinate system, axis **z** is the symmetry axis of flow, v_ρ, v_φ, and v_z are components of the local velocity of fluid, ν is the kinematic viscosity of fluid (for water $\nu = 10^{-6}$ m^2/sec at temperature T = 20^{o}C), Ω [in 1/sec] and γ [in m^2/sec] are some corresponding constants that are defined by kinematics of the stream on some control surface.

Chapter 3. The new type of Wind Machines

The tornado wind power stations (TWPS)

Discovery of solution (*) has opened a door for a new type of stream technique – **the tornado stream technique**.

The tornado stream machines of this type allow fluid (particularly – wind) to pass rotary disk without experiencing **any additional turbulence**. Because outflow from such machines represents the exact solution of the equations of viscous fluids (the Navier-Stokes equations), there could be no doubt about their **ultimate efficiency**. The question is not "*if*", but "*when*" our Energy industry starts manufacturing of machines of this type….

The Qualitics, Inc. has developed a lot of materials for popularization of the tornado-like wind power stations and any interested party can find them on the Company's official web site: ***thequalitics.com***

All accumulated experience allows us to state that we are capable of building wind power stations with efficiency of 90-95% today!

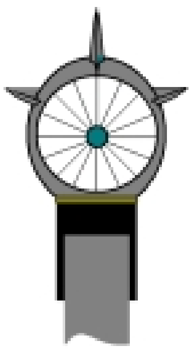
The picture on the left shows the model of a tornado chamber that was built in collaboration with G. I. Kiknadze in the Wind tunnel of the Hamburg University, Germany. This is an example of a practical realization of the flow that is described by the equations (*).

There is a huge variety of practical applications where flow (*) could be used to improve efficiency and to obtain new features of implemented stream processes.

In the present Proposal we concentrate on possibility of creation of a new generation of the wind power stations – Tornado Wind Power Stations, or TWPS.

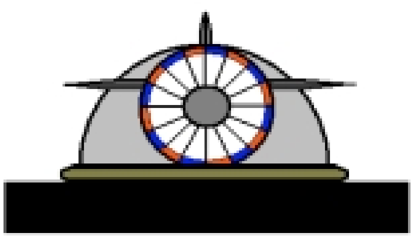
Chapter 3. The new type of Wind Machines

The tornado wind power stations (TWPS) *(cont.)*

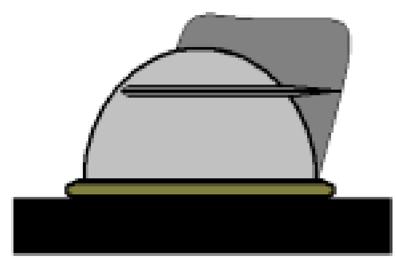


Qualitics, Inc. proposes several designs of TWPS in a wide range of capabilities and standing bases. All of them demonstrate the following unique features:

- ***The most advanced aerodynamic shapes;***
- ***The most advanced stability in respect of wind blows that are causing turn dawn torque;***
- ***The anti-noise and anti-turbulization patterns all over "working" surfaces.***

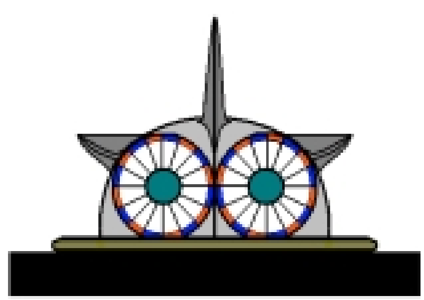


These features allow providing additional stability to the pole that supports TWPS-machine, because they provide absence or minimize the turning torque in respect to the base of the supporting pole.



The "*night-owl*" configuration of TWPS-machine, which also was designed by Qualitics, Inc., eliminates the total torque that is caused by the rotating blade-wheel.

All these features provide such important quality of TWPS-machines as the ability to significantly improve stability of TWPS's supporting base in respect of wind's attempt to turn off and destroy this base.



Paradoxically, ***the constructions with TWPS-stations on top will be more stable in respect to wind's blows, than those without TWPS-stations!***

Chapter 4. A new strategy to acquire the Wind energy

The alternative to Wind Farms

Why are we looking for special places to build the wind power stations?

Wind is not a river - wind blows everywhere, we can acquire its energy in any place.

One of stereotypical answers is based on the belief that bigger wind power station provides electric energy from wind more efficiently than the smaller one.

It is a pure illusion: **Efficiency of transformation of the wind energy into an electric power does not depend on size of power station.**

4 million small wind power stations with electric power capability of 250 watt each, will provide the same 1GW (Gigawatt) electric power as entire London Array, with at least the same efficiency!

Another stereotypical answer is based on the belief that a bigger wind power station costs cheaper than the numerous smaller ones that provide cumulatively the same power.

It is yet another illusion: **Even today, installation of 250W capacity tri-blade wind turbine will cost less than $1,250. It means that a net of 4 million such small wind stations will cost less than $5 Billion, i.e. less than the cost of London Array.**

Hence, the clear alternative to stereotypical 'gigantomaniacal' approach to wind power stations is:

Disperse but dense distribution of small wind power stations!

The development of Wind Power Stations Industry, or WPSI, based upon such paradigm is called *DDD-approach*.

Chapter 4. A new strategy to acquire the Wind energy

Disperse but dense distribution of WPS

The most obvious advantages of disperse but dense distribution of small wind power stations (DDD-approach) are the following:

• Permanent and constant development of Wind Power Station Industry (WPSI), which is aimed at utilization of natural reservoir of wind energy that is capable to fulfill entire existing need of electricity in USA (around 3,000 TW-h).

• Avoiding huge expenses for construction of special electricity transportation grids due to usage of existing grids for delivery of produced electricity to consumers.

• Avoiding huge expenses for construction of special gigantic hubs to support monstrous rotors.

• Smoothing out "pick-loads" and wind's "dead calm" periods.

• Obtaining required means and finances for development of WPSI, i.e. avoiding instant huge capital investments.

• Creation of a vast manufacturing property that will generate multi-billion value (electricity) during many decades at insignificant operational expenses.

The DDD-approach can be and should be developed in all three following directions:

- **Pole-based Project**
- **Residential Housing-based Project**
- **Commercial and State Building-based Project**

Chapter 5. The pole-based Project

The technical background

Our entire country is literally covered with web of hung-in-air electric and telecommunication grids. This net is supported by the many millions of poles. Each of them can be used to support also a small Wind Power Station, which would be generating electricity day and night…

Generated by such Wind Stations, electric current can be immediately passed to the electric wires, which are supported by the very same poles!

The pole-based Project naturally comprising several specific features, making it very preferable solution of the entire problem, and those are the following:

- ***The produced electricity will be genuinely coincided with electricity transportation system and there will be no need for additional transportation lines to deliver produced electricity to the common electric net;***

- ***Small power of each Wind Station allows to use of Electronic (not Electro-mechanical) conductor to incorporate the produced variable frequency current from Wind Power Station in the general grid of the practically constant frequency current;***

- ***It would be much easier to vary the density of small Wind Power Stations to satisfy the local needs for electricity all over the Country;***

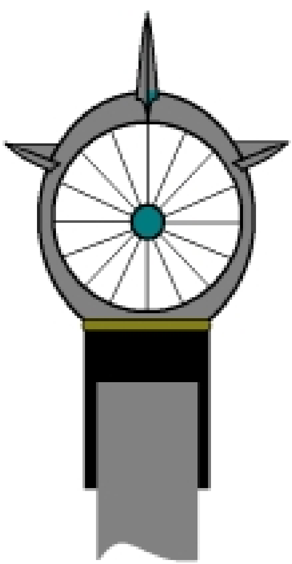
- ***It would be much easier to vary the density of small Wind Power Station to gain the maximal effect of local specifics of wind distribution all over the Country;***

- ***It would be much easier to plan development of WPSI in accordance with any given region's capability and build WPSI without straitening region's finances and resources.***

Chapter 5. The pole-based Project

The technical background *(cont.)*

As already mentioned, ideal Tornado-type wind power station, or TWPS, being placed into a current of wind with rated velocity v = 10m/s at rotary square $S=1m^2$ (i. e. with blades R = 0.56m long) provides electric capability of around 250W.



The schematics of appropriate wind power station that could be attached to a pole is developed by Qualitics, Inc. and is shown schematically in Figure on the left.

Built-in electric generator is connected with the local electric net, wires of which are supported by the same pole, so that produced electricity becomes immediately accommodated by and involved in common local electric grid.

Power station can be made of material like fiberplastic, designed to be assembled at attachment to the pole and will be easily replaceable. This type of device should not require any maintenance and should work non-stop for many years. If in mass production, self-cost of such device should not exceed self-cost of a cheap dishwasher machine.

Design of these TWPS-machines is done with accommodation of the genuine features of tornado exhausted tail of air that is passing through the rotary blade-wheel, so as the natural aero-dynamical nature of the external streamlining of apparatus. Exactly this approach has allowed designers to provide the following features of TWPS-machines:

- ***The very low aero-resistance to falling wind;***
- ***The direction of force of straight falling wind right down to the ground, not up or straightforward;***
- ***The direction of forces, which are caused by the side-blows of wind, right by vertical, not straightforward along the wind's blow;***
- ***The very low aerodynamic noise.***

Chapter 5. The pole-based Project

The technical background *(cont.)*

The features of TWPS provide additional stability to the pole that supports it, because TWPS minimizes the turning torque in respect to the base of the supporting pole.

"Though wires are often buried underground in new developments, there are approximately **150 million** wood poles in service throughout the United States with an additional six million new poles added annually. Approximately three percent of treated wood poles are retired from service each year" (North Pacific Group, 2005).

CONCLUSION:

If even only each third pole would carry TWPS, we would be able to have 50 million Wind Power Stations with at least, 200W-power capacity each, or 10GW-power capacity combined.

It would be equal to 10 London Arrays!

If even we would attach the said WPS only to ¾ of new poles that are replacing old ones each year, we will add more than 1GW.

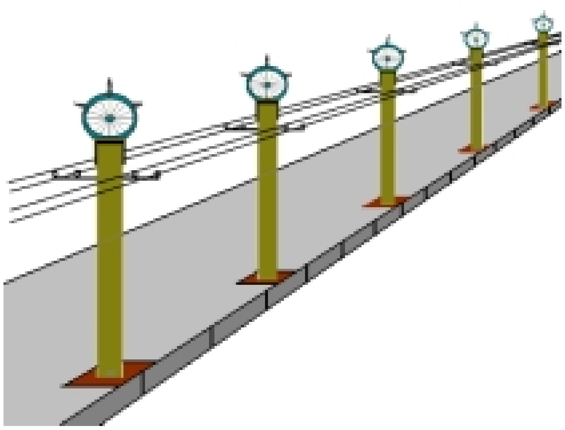
In other words, we will build 1 London Array per year!

Chapter 5. The pole-based Project

The economical background

At current market price of $0.1 for 1kW-h of electricity, the pole-based WPS with only 200W capacity per pole will produce commodity of $175 per WPS annually.

If even the price of each WPS attached to a pole will be $1,250.00, this WPS will pay-off within 8 years. It makes Pole-based WPS Industry more profitable than even Home Mortgage Industry!



CONCLUSION:

Suggested Pole-based Project is cheaper to implement and faster paying-off than the London Array (gigantic Wind Farm) approach!

Chapter 6. The Residential housing-based Project

The technical background

Another independent implementation of WPSI is based upon installation of Wind Power Stations on the roofs of residential buildings.

The idea of such implementation of wind power stations in not new: the displayed picture shows aggregated 8 tri-blades rotary machines of the small (up to 1kW) capacity that are attached to the roof of a building (product of AeroVironment, Inc.).

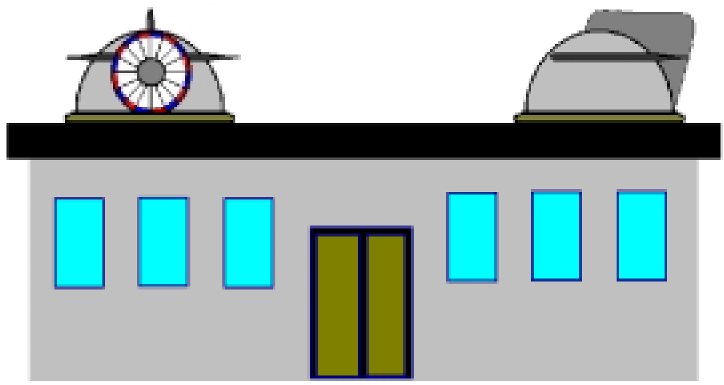
There are at least 60 Million residential houses in USA. If each second house is carrying TWPS with minimal power of 2.5 kW, working only one third of year at locally available average wind, **the residential houses-based WPS will be capable to provide 50 GW**, which is an equivalent of the more than **12** such stations as Drax Power Station, or **50** London Arrays!

Therefore, implementation of WPS only in the residential aspect will provide at least **50 GW** of power of electricity, which is equal to the prevention of burning of at least **100 million tons of coal annually** **and** **producing of around 19 million tons of ash and 285 million tons of carbon dioxide each year.**

Chapter 6. The Residential housing-based Project

The technical background *(cont.)*

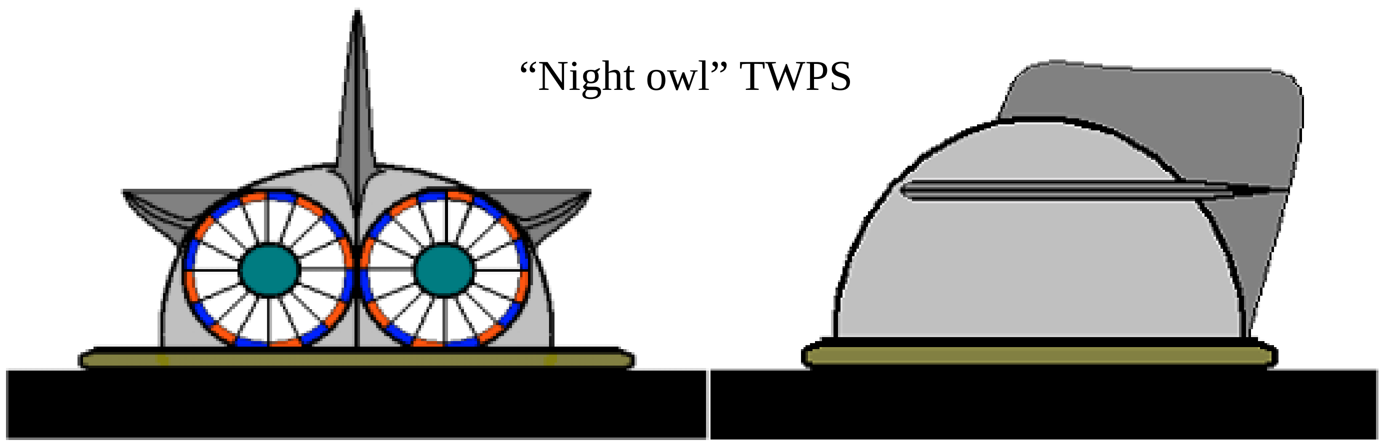
Tornado Wind Station with at least 2.0 - 3.0 kW electric power capacity can be installed on the roof of our homes, as it is schematically shown in following Figure.



At small own weight, such devices due to their aerodynamic features will only improve resistance of a building in respect to a destructive power of the blowing wind. Moreover, especially for residential houses implementation, Qualitics, Inc. has designed so called "night owl" configuration – two TWPS rotating in opposite directions installed close to each other, as it is shown in Figure below.

The aero-dynamics of this shape of TWPS provides such important quality as the ability to significantly improve stability of TWPS's supporting base in respect of wind's attempt to turn off and destroy this base. Paradoxically, ***the constructions with "night owl" TWPS-stations on top will be more stable in respect to wind's blow, than those without TWPS-stations!***

"Night owl" TWPS

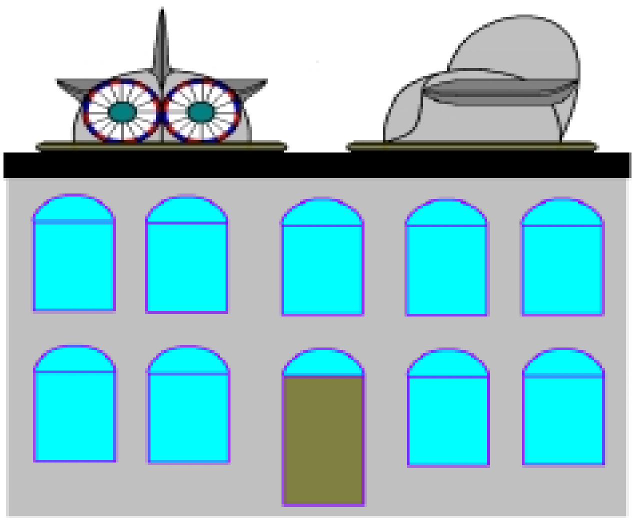


Face *Side*

Chapter 6. The Residential housing-based Project

The technical background *(cont.)*

Using "*night owl*" configuration that is shown in Figure below, it becomes possible to install twice more powerful wind stations that will provide at least 3.0 - 5.0 kW of the electric power each on the roofs of residential buildings.



300,000 houses, being equipped with such wind stations, will generate the same amount of electricity as entire London Array!

And all this electricity will be obtained just where it is needed!

No costly transportation of electricity, no "pick-load" effects and other drawbacks.

Produced electricity will supplement household usage when there is a need, and at absence of such need it will go directly in the general electric grid as a commodity which is sold to others consumers. Especially it concerns the "night hours", when household is using a lot less electricity, but installed WPS continues generation of electricity. House owners will become the sellers of electricity!

Households that are equipped with accumulator – the set of batteries – can save some portion of produced electricity for usage during "pick-load" hours. WPS will recharge accumulator during day-night work…

With development of the Residential housing-based Project, the architecture of houses, and especially the roofs, will be more and more accommodative to the ability to support "night owl" type of TWRS because of the advantages and benefits such WPS provide…

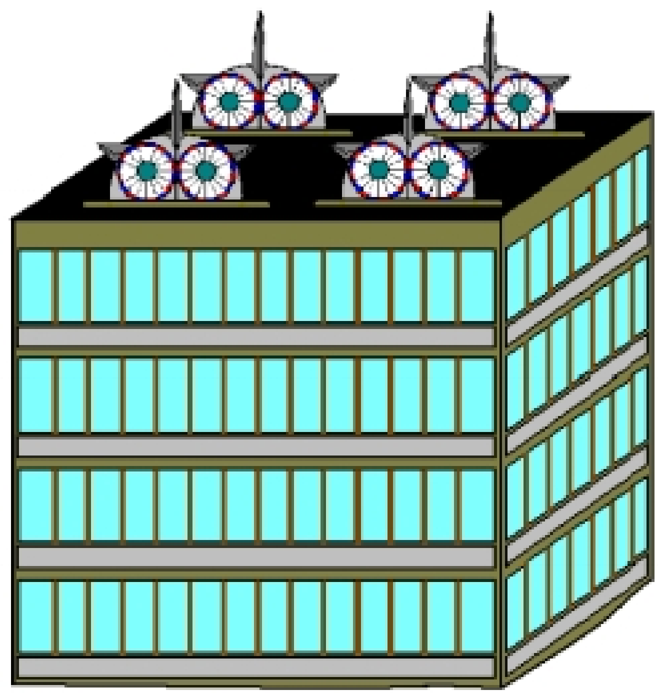
Chapter 6. The Residential housing-based Project

The economical background

At current market price of $0.1 for 1kW-h of electricity, each Residential House-based "night owl" TWPS with only 1.5kW capacity will produce annually a commodity – the electric energy - of $1,310.

Even if the price of each such WPS attached to the roof of the house will be $6,500.00, this WPS will self-repay within 6 years. It makes Pole-based WPS Project much more profitable than even Home Mortgage Business!

It is important to mention that there is a huge base for of the implementation of large enough "night owl"-TWPS – the roofs of apartment buildings…



There are more than 100,000 large apartment buildings with flat roofs in USA right now.

Each of them could carry at least 4 "night owl"-configuration TWPS with 10-20kW each, i. e. 40-80kW…

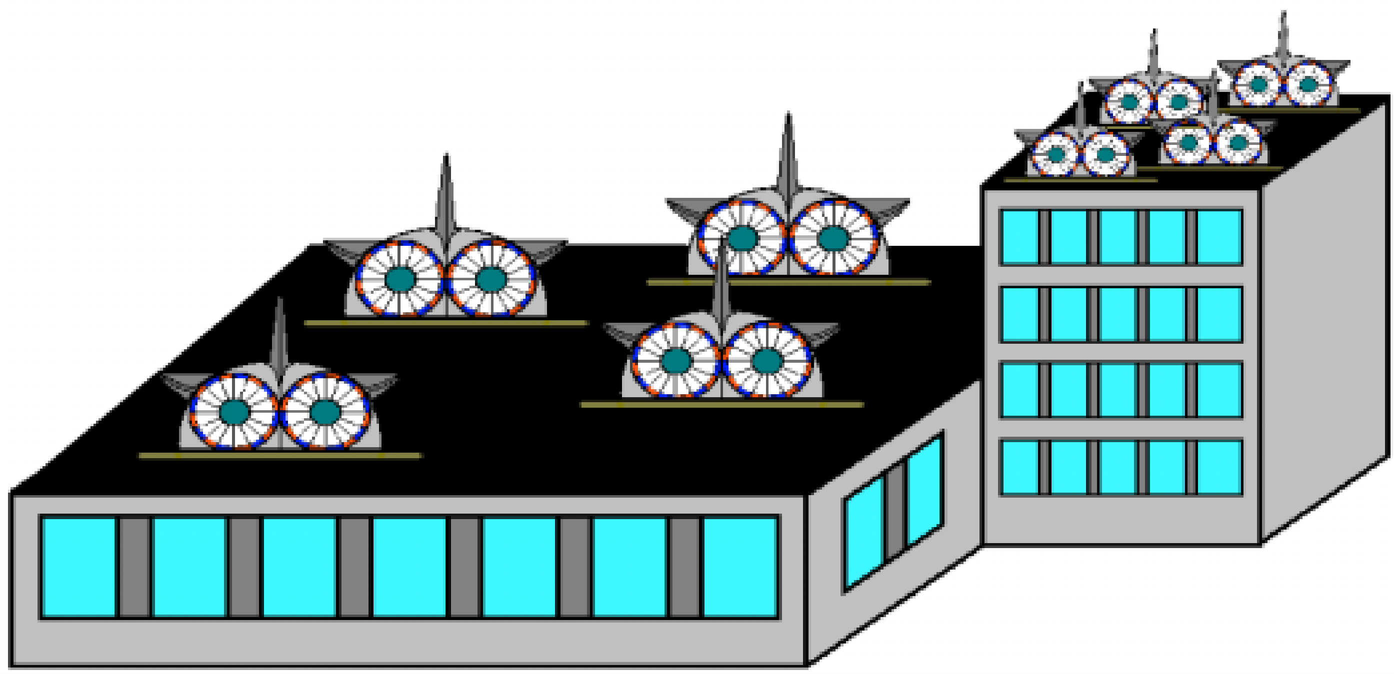
CONCLUSION:

Suggested Residential housing-based Project is cheaper to implement and self-repaying faster than the London Array (gigantic Wind Farm) approach!

Chapter 7. The Commercial and State Buildings-based Project

The technical background

Another ground of the implementation of WPSI is based upon installation of Wind Power Stations on the roofs of the Commercial and State buildings as it is schematically shown in following Figure.



Each of commercial "night-owl"-TWPS can easily be of **30-40 kW** capacity, and will be capable to produce **300 MW-h** electrical energy in the amount of **$30,000 annually**.

Considering the fact that today there are at least **1 Million** commercial and State buildings in USA, which could carry at least **4** said TWPS each, one should expect a potential possibility of generation of at least **120-160 GW** of electricity!

Therefore, **the question is not "*if*", but "*when*" our Energy Industry starts exploration of this huge natural reservoir of wind energy...**

Chapter 8. Summary of Proposal

Starting Point

The presented Proposal is based on the recognition that:

- The nature of winds all over the United States of America allows satisfaction of all current and near future needs of our country in electricity trough transformation of this energy into electricity

- The transformation of the wind energy into electricity is the most clean and environmentally friendly way of the production of electricity

- The current low level of the usage of the energy of wind as a source of electricity is explained by two major obstacles:
  - A high cost of the contemporary models of the Wind Power Stations at a low efficiency of transformation of the wind energy into an electricity
  - The wrong stereotype of a huge Wind Farms as a most preferable way of the producing of electricity from the wind

- Both of those obstacles can be and have to be prevailed over due to two following alternatives:
  - Developing and manufacturing highly efficient Tornado-type Wind Power Stations
  - Implementation of the Disperse but Dense Distribution of the small and medium Tornado-type Wind Power Stations all over the USA

Chapter 8. Summary of Proposal

Wind Power Stations Industry.

The logical action that should follow the formulated Starting Point is creation of the Wind Power Stations Industry, or WPSI.

Said means that there should be established a new Industry in the entire meaning of this social-economical phenomenon, which:

- Employs hundreds of thousands of scientists, engineers, administrators, technicians, workers, etc
- Operates hundreds manufacturing and storage units with invested capital of tens billions of dollars
- Manufactures millions units of Wind Power Stations annually, installs and maintains them
- Produces dozen hundreds TW-h of electric energy
- Consumes of the production of other Industries for several billions of dollars

In contrast with hydro- and coal electric power stations Industry, WPSI has to comprise ability of permanent manufacturing of Wind Power Stations, because the demand for many hundreds of millions of such stations is expected.

In contrast with hydro- and coal electric power stations Industry, WPSI has no need for an electricity distribution grid for Implementation of the Disperse but Dense Distribution of the small and medium Tornado-type Wind Power Stations all over the USA. Because already existing electric grid is totally capable of distribution and delivery to consumers of all electric energy that will be produced by WPSI for several decades ahead.

Usage of the existing electric grid creates a good natural motivation for very tight collaboration of WPSI with owners of this grid to modernize and develop it.

Chapter 8. Summary of Proposal

Three Ways of Implementation

Implementation of the Disperse but Dense Distribution of the small and medium Tornado-type Wind Power Stations all over the USA, or DDD-approach, can be and should be developed in all three following directions:

- **Pole-based Project**
- **Residential Housing-based Project**
- **Commercial and State Building-based Project**

because poles, residential houses, commercial and State buildings can be and should be used as a natural, already existing, and reliable base for installation of hundred millions of small and medium Wind Power Stations.

Pole-based Project is capable to accumulate 150,000,000 small Tornado Wind Power Stations of 250 W capacity each, or up to 37.5 GW combined, and produce up to 328.5 TW-h of electric energy annually (around 11% of current total usage of electricity in the USA), which is worth of $32,85 Billion per year (Based on current rate $0.10 per kW-h).

Residential Housing-based Project is capable to accumulate at least 60,000,000 small Tornado Wind Power Stations of 1.5 kW capacity each, or up to 90 GW combined, and produce up to 778.4 TW-h of electric energy annually (around 24% of current total usage of electricity in the USA), which is worth of $77,84 Billion per year.

Commercial and State Building-based Project is capable to accumulate 4,000,000 medium Tornado Wind Power Stations of 30.0 kW capacity each, or up to 120 GW combined, and produce up to 1,051.2 TW-h of electric energy annually (around 32% of current total usage of electricity in the USA), which is worth of $105.12 Billion per year.

The common benefit of all three Projects is that all produced electricity goes immediately into a general electric grid exactly in the location where it was produced.

Chapter 8. Summary of Proposal

Tornado-type Wind Power Station

Proposed DDD-approach (the disperse but dense distribution of the small and medium wind power stations all over the USA) will be more effective, cheaper and reliable than Wind Farm approach no matter what model of wind machine is employed. However, the ultimate efficiency, reliability, and profitability will come with the use of Tornado-type Wind Power Stations, or TWPS that were designed by Qualitics, Inc.

TWPS have a unique air-dynamical design, which allows laminar streamlining by nuclei of wind of the external surface of device, as well as its rotary disk.

TWPS feature surfaces that are covered with triangular pattern of smooth dimples which provides minimal turbulization of the boundary layer of the streamlining air.

The blades of the rotary wheel of TWPS have shapes that provide formation of a laminar rotating discharge flow of air, which is passing through rotary disk. Together with laminar streamlining by the nuclei of wind and minimal turbulization of the boundary layer, it provides extremely low total aero-resistance of TWPS

TWRS have special wings that provide pressing of device down to its base as stronger as velocity of wind increases.

The rotary wheel of TWPS can freely rotate around vertical axis of device.

TWRS have special tail-wing that provides fast and stable orientation of device right by normal to wind's direction.

These and other unique features of TWPS provide an ultimate efficiency of the transformation of the available wind power into electricity – **up to 95%.**

Chapter 8. Summary of Proposal

Tornado-type Wind Power Station (*cont.*)

Small and medium (up to 50 kW) TWPS are provided together with an original Electro-generator that is producing AC current, which is electronically kept within range of frequencies that are acceptable by the general electric grid.

TWPS practically have no “start-up” limitation for the wind’s velocity – they work at any, even the slowest wind.

TWPS are light devices (the only metallic parts they contain are wires, permanent magnets, and bearings, all other parts are made of plastic, mostly - fiberplastic).

These and other features of TWPS provide additional stability to the base that supports TWPS, because they eliminate or minimize the turning torque (in respect to the supporting base), which is created by the wind. The construction with TWPS on the top will be more stabilized in respect to wind’s blows, than those without TWPS.

When in mass production, totally automatic manufacturing will keep self-cost of TWPS much lower than of any other model of wind station that is available on the today’s market.

This brake-through design of TWPS allows providing a long lifetime of these devices (30-40 years) without the need for any significant maintenance.

Chapter 8. Summary of Proposal

How to begin?

Building of WPSI contains different specifics depending on which proposed three directions – either Pole-based Project, or Residential Housing-based Project, or Commercial and State Building-based Project – is implemented.

The most straight forward direction is Commercial and State Building-based Project: there is well-defined consumer, there is already base for installation of TWPS – flat roofs of the commercial and governmental buildings – with well-defined ownership, there are well-known mechanisms of establishing either “buyer-seller”, or rental, or financing relations.

Hence, implementation of Commercial and State Building-based Project is the most preferable start for WPSI.

Residential Housing-based Project is the second in the raw for implementation, but in cases when and where the residential homes with flat roofs are present in significant proportion.

Of course, installation of TWPS on the roof of home will increase the value of home, so that Mortgage Loans Companies would be directly interested in financing such improvement of property.

Due to advantages and benefits that TWPS provide, the architecture of houses, and especially of their roofs, will be more and more accommodative to the ability to support TWRS and the next generation residential houses will be TWRS-friendly.

It is important to note that owners of homes with installed TWPS could not only be suppliers of their own cheap electricity for the current household needs, but also producers of supplemental income, by way of selling of excess electricity to the nationwide grid.

Hence, implementation of Residential Housing-based Project in regard of houses with flat roofs can be considered as an immediately available market of TWPS.

How to begin? *(cont.)*

The Pole-based Project seems most atypical and indeed comprises several rare features.

The national electric distribution system – *the common grid* – is very complex and complicated phenomenon. It plays very important role in life of Society and in running of Economics. Thus, any intervention in it has to be very carefully analyzed and examined.

That is the main reasoning for the proposition that can be recommended as a beginning of implementation of the Pole-based Project.

The entity, which will be responsible for the implementation of the Pole-based Project, has to have the right to install appropriate TWPS on the top of each new installed pole and each pole that replaces the old one. This right should be accompanied with a liability to compensate any and all damage that should be caused by the specifics of installed poles with TWPS.

In this case, said entity will have an opportunity to design a new, wood saving poles, that will be much more aesthetic, strong, ecologically clean, functional and longer living than contemporary ugly, fulfilled with a creosote, wood poles.

Within couple of decades (and may be even in several years) all current wood poles could be substituted with the new fiberplastic poles that will carry wires of common grid in much more reliable manner (no insulators, no solid attachment of wires to the pole, much less air-resistance to wind, elastic response on wind's blows, etc.) and will support a small or even medium TWPS on top.

The new fiberplastic poles are not exposed to erosion, or corrosion; and there is not any problem for the environmentally friendly recycling of them. The lifetime of such poles easily can be a century and more…

Chapter 8. Summary of Proposal

New ways of financing

The implementation on TWPS simultaneously with invention of new fiberplastic poles creates a great opportunity to solve two independent problems: how to boost overdue necessity of invention of new type of the fiberplastic poles and save hundreds of millions of the best trees, and where take the money for this huge project from?

The long-living TWPS and fiberplastic poles, and interminable need of electricity are creating unique opportunity for a new source of money for Pole-based Project – the establishing of a new Nationwide Retirement Plan.

According to this approach, peoples of USA will obtain a possibility to buy any number of TWPS-s that are implemented in the frame of Pole-based Project (without any Sales Tax!) and become owners of these TWPS-s. All profit from sales of the production of electricity due to said TWPS-s would go directly on the personal Retirement accounts of owners of said TWPS-s.

When the retirement time comes, each of those people will have not only the cost of the owned TWPS-s (which, most probably, will significantly increase!), i. e. initially invested capital, but entire balance on their personal Retirement account together with all interest from Bank that was handled this account during all long years before retirement.