



Wind & Storage

New Technology Innovation...

“Turning Wind and Water into Clean Dependable Energy”

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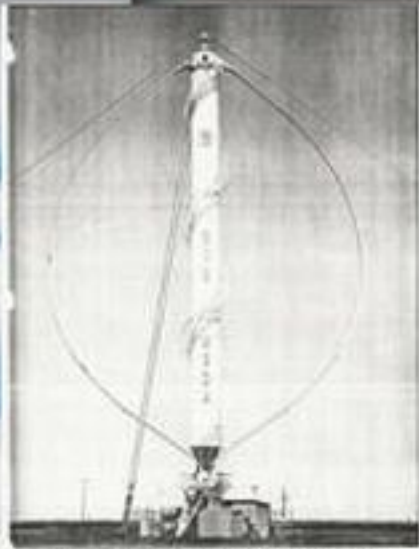
The Next Generation Wind Turbine

- **Significantly reduces COE ***
 - *~ 1/2 present state of the art*
 - **Less Intrusive to the Environment**
 - **Much Easier to Maintain**
-
- * *COE – Cost of Energy*

This is Accomplished Via:

- **Doubles Swept Area of Rotor**
- **Improved Aerodynamic Performance**
 - *Advanced Airfoils*
- **Eliminates Gear Box and Drive Train**
 - *Via use of Linear Induction Generator*
- **Utilizes a Self Erecting Tower**
 - *Can install and maintain without cranes*

This is Accomplished Via:



DOE/SANDIA 34-METER VAWT TEST BED
LINDA AGRI-CULTURAL RESEARCH SERVICE, SUBFLAND, TEXAS
DISPLAYED MAY 15, 1998

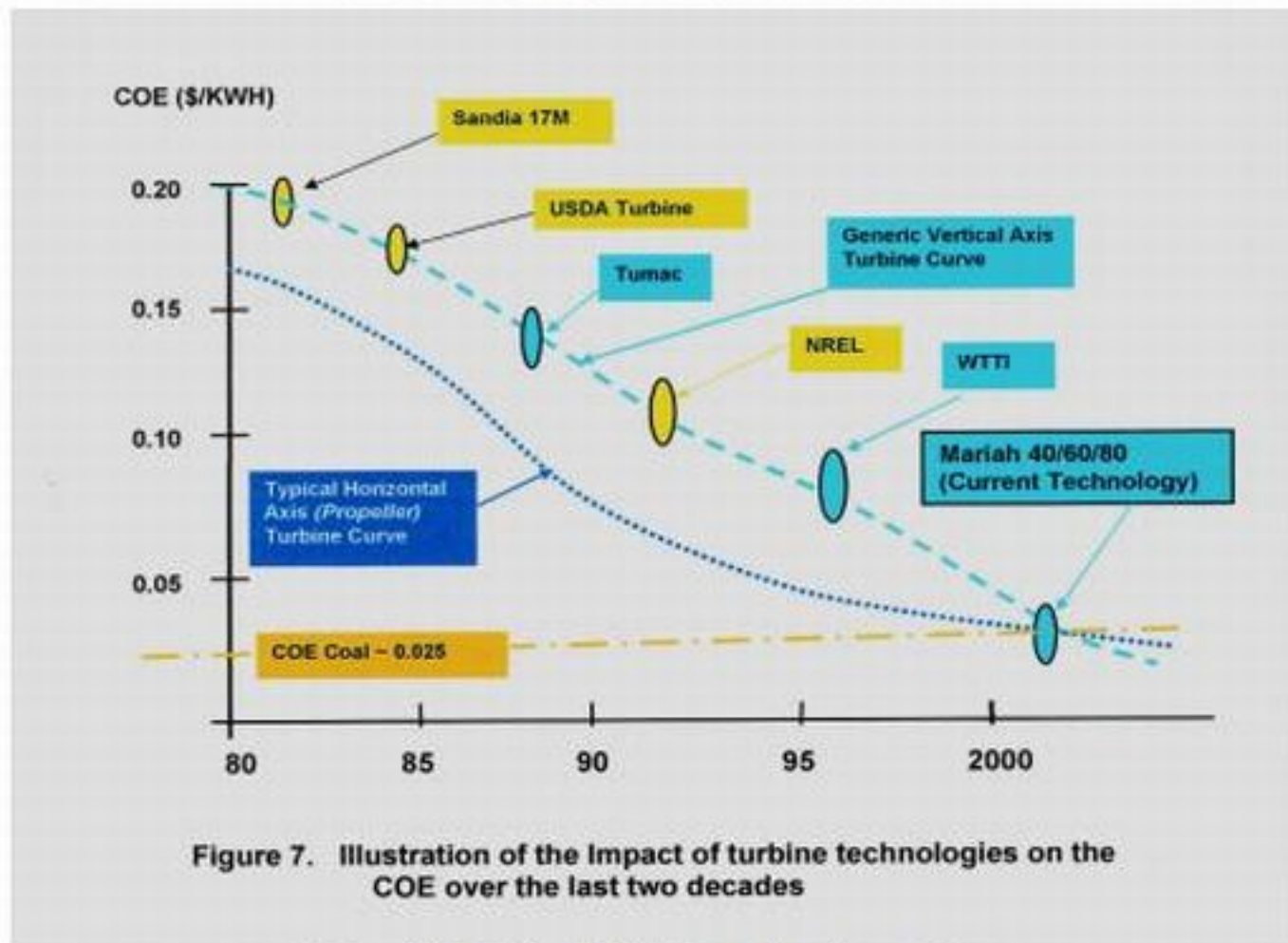


Mariah WindFoil VAWT (Turbine)



Turbine Production Cost of Energy:

- Evolution of Cost of Energy for HAWT and VAWT Turbines From Early 1980's - 2000



Turbine Production Cost of Energy:

- Evolution of Cost of Energy for HAWT and VAWT Turbines From Early 2000's - Today

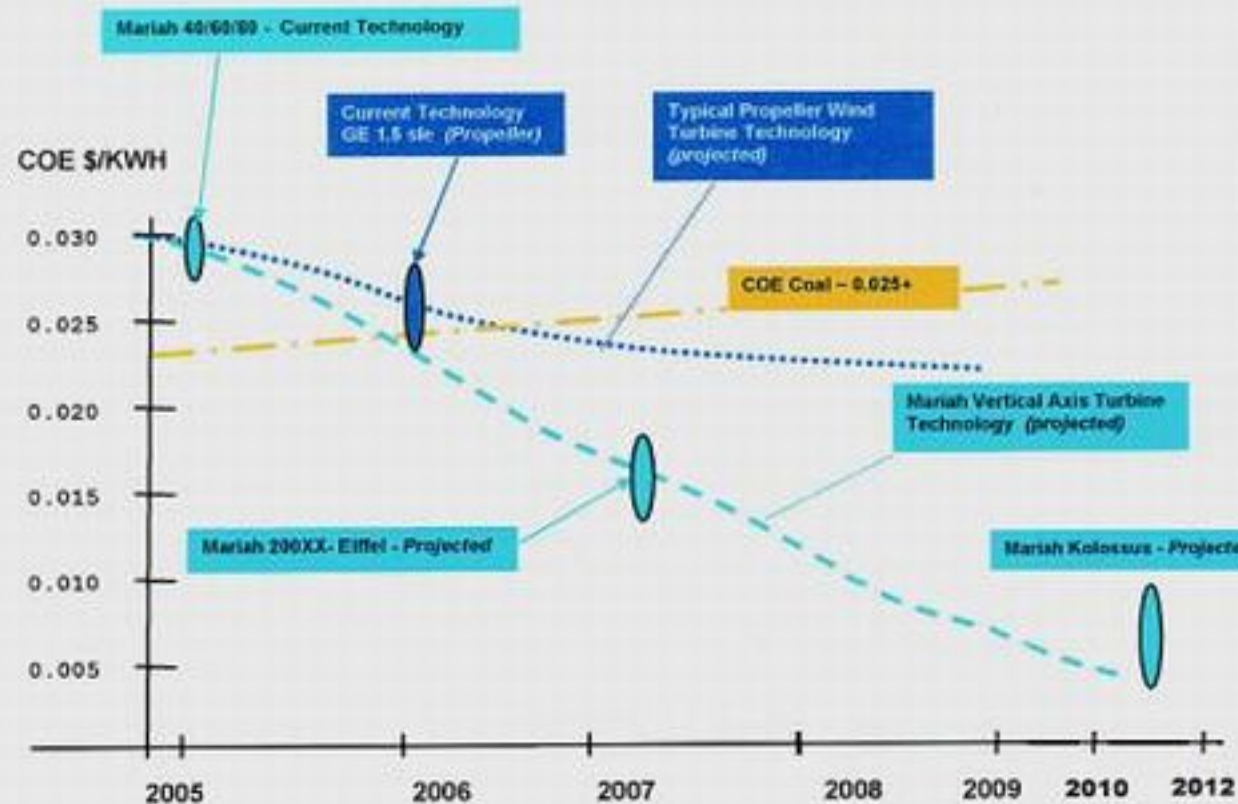


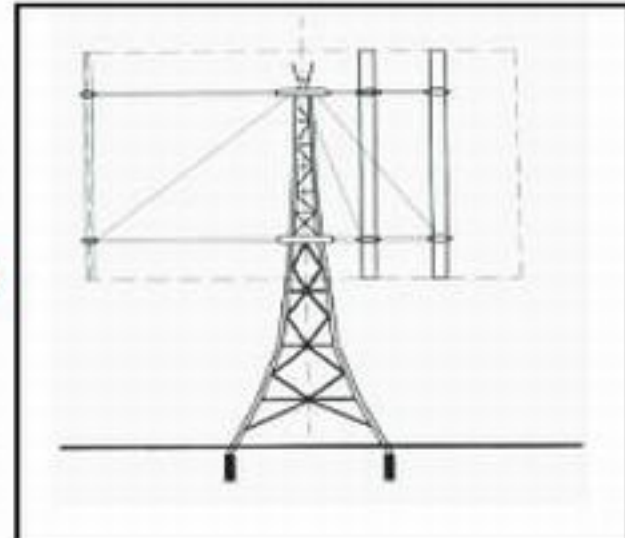
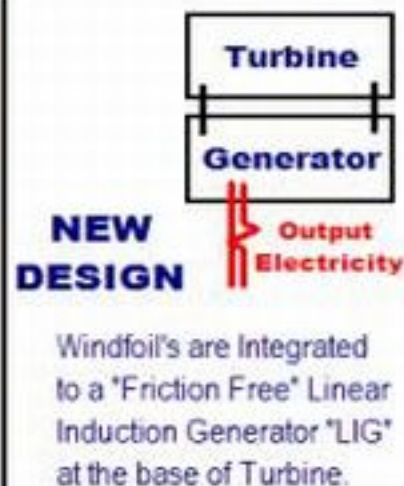
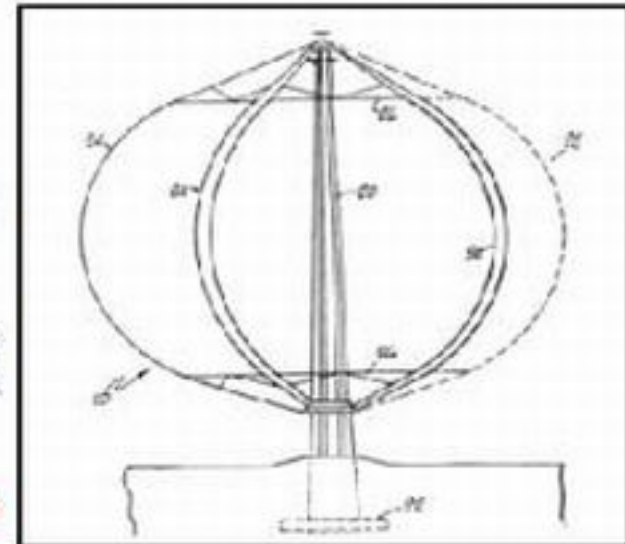
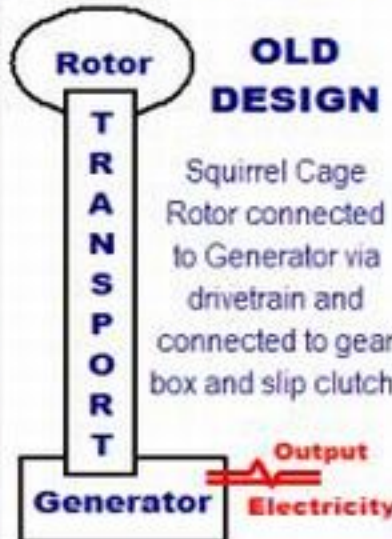
Figure 8. Illustration of the projected COE anticipated in the near future.

Wind Turbine Conclusions:

- The next generation of Vertical Axis Wind Turbines will be better performers and more cost effective than existing technology.
- Reducing the COE of turbine production by more than $\frac{1}{2}$ from currently deployed turbine solutions.

Wind Turbine Conclusions:

OLD "Squirrel Cage Rotor" Design vs NEW "WindFoil Turbine" Design



The Hydrogen Backup System:

- **Primary Goal:**

“Firm – On Demand Electrical Power”

- **Demonstrated by NREL since 2008 at the Wind Center.**

-- Initial 100kw Feasibility Pilot needs to be scaled up and commercialized to larger systems exceeding 10mw.

- **For Community and Utility Scale Distributed Generation Applications**

The Basic Process:

- **Use Electrical Energy Produced by the Wind Turbine to:**
 - *Produce hydrogen gas from water via electrolysis. Hydrogen is stored...*
 - *Remaining output is pure Oxygen !*
- **Store hydrogen as compressed gas in high pressure tanks, (10-15k psi).**
- **Then, combust the hydrogen producing electricity via a gas turbine.**
 - *Output is pure Water !*

Hydrogen Storage System:



Hydrogen Storage System:



Hydrogen Storage System:



Hydrogen Storage System:



Storage Conclusions:

- **The x20 Hydrogen Storage Scale Up Project:**
 - *Started in early 2009 – With a team of Independent Consultants working with NREL who are also working with Mariah on our Hydrogen Storage Program...*
- **Primary Goals:**
 - *“Firm – On Demand Electrical Power”*
 - *To Design, Build, and Operate a Commercially viable 2.5mw – 3.0mw Hydrogen Storage System*
- **Need to scale up Pilot x 20 Times**
- **Mariah is currently working on a proposed design to create a 2.5mw -3.0mw Hydrogen Back Up System.**
 - *The components and subsystems currently exist to do this scale up.*
 - *We already have these key components:*
 - *Electrolyzers, Compressors, Carbon Fiber Storage Tanks, 2.0 mw GenSet (In Development)*

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