DOCKETED

Docket Number:	17-HYD-01
Project Title:	Renewable Hydrogen Transportation Fuel Production
TN #:	215564
Document Title:	Bill Leighty Comments: Renewable H2: Windpower 2016 Poster B
Description:	N/A
Filer:	System
Organization:	Bill Leighty
Submitter Role:	Public
Submission Date:	1/25/2017 12:58:40 PM
Docketed Date:	1/25/2017

Comment Received From: Bill Leighty
Submitted On: 1/25/2017
Docket Number: 17-HYD-01

Renewable H2: Windpower 2016 Poster B

Third of 6 files

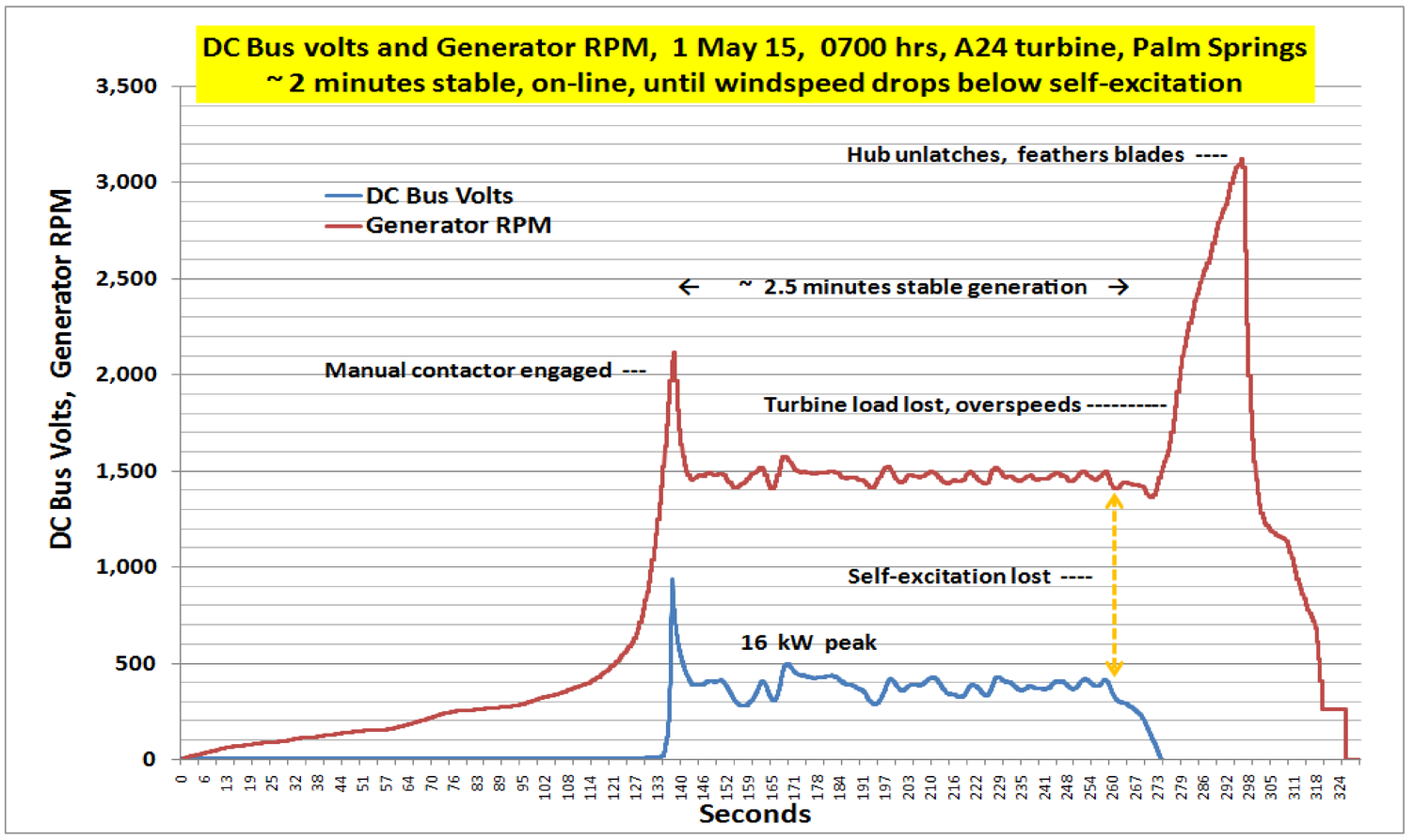
Additional submitted attachment is included below.

Converting a 13-turbine California Windplant to Hydrogen Fuel Production Without Electricity Grid Connection: R & D and Demonstration

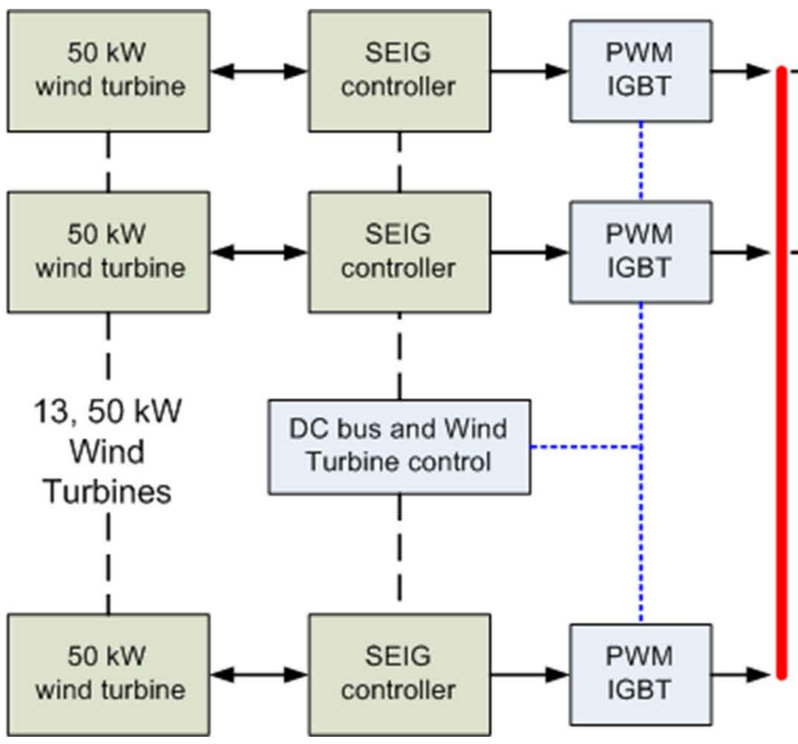
Bill Leighty, AASI, Juneau, AK wleighty@earthlink.net Poster download: http://leightyfoundation.org/w/wp-content/uploads/WP16-B.pdf

San Gorgonio Pass, Palm Springs, CA
13, 50 kW turbines = 650 kW windplant
Squirrel cage induction motors as generators
Alaska Applied Sciences, Inc. (AASI)

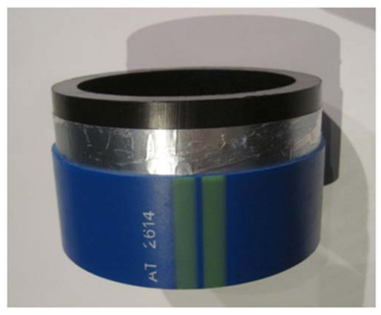
This windplant of vintage-1985 turbines has delivered electricity to the SCE grid since 1991. The PPA has expired. We will reconfigure it to deliver 100 % of its captured energy as Hydrogen transportation fuel, with no connection to the grid, for fuel cell cars, buses, trucks. Hydrogen delivery will be via tube trailer in short term, then via a new, dedicated, high-purity, underground Hydrogen pipeline system for gathering and transmission, firming storage, and distribution.
In year 2050, California will need more Carbon-emissions-free (CEF) energy for transportation fuel than CEF energy for the electricity grid. This will be a major new market for wind energy. Turbines and windplants may be simplified if they are dedicated to delivering only Hydrogen fuel, with no connection to the electricity grid, as below.



Self Excited Induction Generator (SEIG) power production on one 50 kW windplant turbine. Three-phase "Wild AC" from the induction motor is rectified to "wild DC" to a resistive load bank. Electrolysis cells will replace the load bank, eliminating the transformer-rectifier electrolyzer subsystem, integrating all controls. This novel technology close-couples SEIG-equipped turbines with electrolysis stacks for CapEx and O&M cost savings, higher energy conversion efficiency, and resulting lower plant-gate cost for Hydrogen fuel.



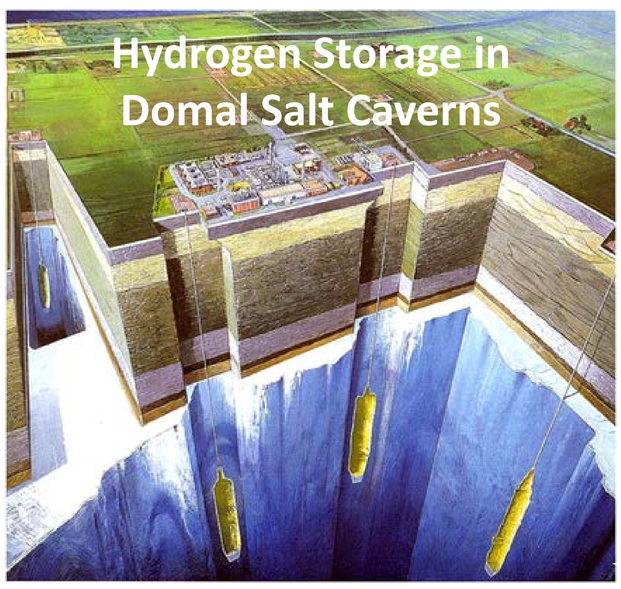
The electrolyzer(s) are a dumb DC load, fed "wild DC" from "wild AC" via simple power electronics and controls



Gaseous Hydrogen Transmission Pipelines made of polymer-metal tubing with Al or Cu foil as the H2 permeation barrier will be immune to Hydrogen Embrittlement. A 1-meter-diam Hydrogen pipeline has a Capacity of 8 GW. CapEx per GW-km of transmission service is lower than for electricity transmission lines. Gaseous pipelines may be "packed" like NatGas pipelines are, for "free energy storage".

Turbines with simple, low-cost induction motors are modified for Self Excited Induction Generator (SEIG) mode and closely coupled via simple, smart rectification on a DC bus to the electrolyzer stacks, via a SCADA system integrating the complete wind-to-Hydrogen plant, to reduce system complexity and capital and O&M costs.
This will reduce kWhe per kg Hydrogen and boost energy conversion efficiency, reducing plant gate Hydrogen fuel cost in several ways.

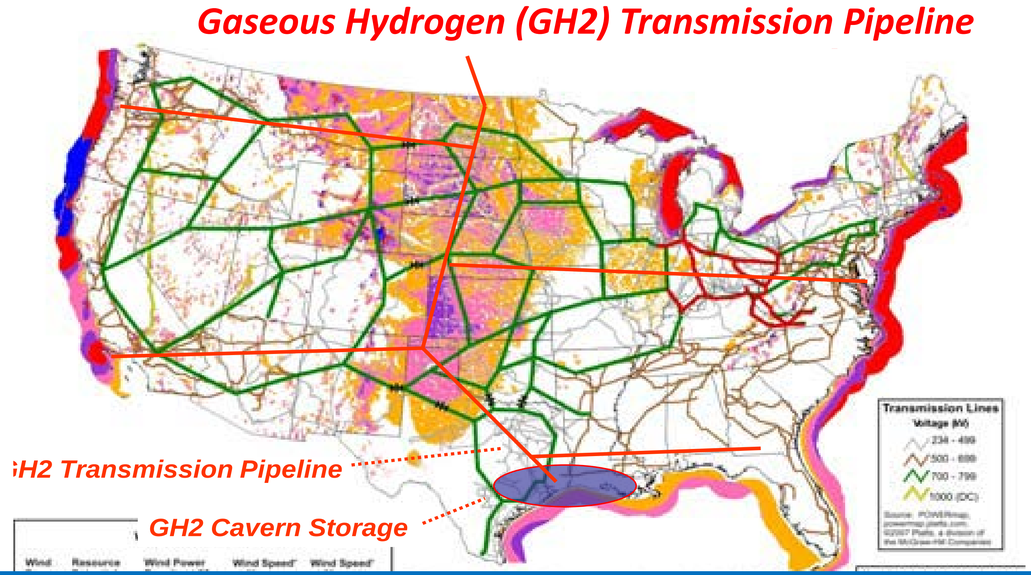
Windplants may be dedicated to Hydrogen fuel production, with no connection to the electricity grid, without costly generating systems and infrastructure to deliver grid-quality AC or DC.



Annual-scale firming storage for < $ 1.00 / kWh CapEx. Each Gaseous Hydrogen (GH2) salt cavern:

- Stores ~ 92,000 MWh as ~2,500 Mt "working" H2
- "Full" at 150 bar = 2,250 psi
- Cavern top ~ 700m below ground
- 860,000 cubic meters typical physical volume
- $ 15 M average CapEx per cavern
- CapEx = $160 / MWh = $0.16 / kWh

Gaseous Hydrogen (GH2) Transmission Pipeline



The wind potential of the 12 Great Plains states is ~ 10,000 GW, which may be exported as Hydrogen fuel for transportation and CHP over thousands of miles in underground pipelines at lower cost than by electricity transmission.
Hydrogen may be stored in Gulf Of Mexico salt caverns for < $ 1.00 / kWh CapEx.