Technologies

All need R&D and Demo investment

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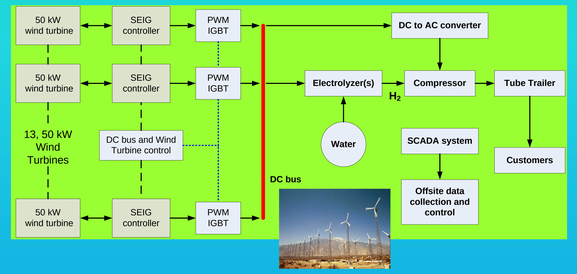


Wind to Hydrogen or Ammonia Fuels: CO_2 –free, without grid connection ~ TRL-4

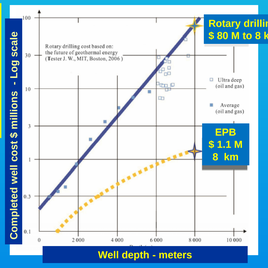
- Self Excited Induction Generator (SEIG) plus close-coupling windplant DC bus to electrolysis stacks, for lower-cost H_2 and NH_3 fuels
- Simplify wind-to-hydrogen system: low-cost, simple, rugged induction motor as generator, simple power electronics, integrated controls
- No electricity grid needed: autonomous Hydrogen and Ammonia fuel production anywhere with good wind resource
- Opens large land areas and remote sites without electricity transmission to wind generation: export via underground fuel pipelines
- Palm Springs, CA windplant R&D & Demo test bed: DOE funding applied for via ARPA-E, Small Business Voucher

High Voltage Electrode array Borehead

50 cm diam

Low-cost rock break boring

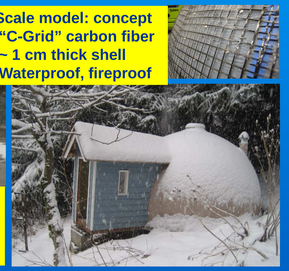
No rotary abrasive drilling



Electro Pulse Boring (EPB) for low-cost Geothermal, anywhere on Earth ~ TRL-3

- Electricity and byproduct DHS heat from a single ultra-deep borehole, anywhere; branched for more energy harvest
- Fast, lower-cost, rock-breaking technology: goal $ 150 / meter to 5 -10 km depth, 1 meter per minute ROP
- Proof-of-concept: 50 cm diam hole, to 200 m in granite. Cuttings (rock chips) to surface via hose return and mud
- No drill rig required; no fracking required. EPB components are small, transportable
- Consortium applied for $ 100 M MacArthur “100&Change” grant, Oct 2016

Strong enough to Earth-shelter
Seismic tested to 2.7g horizontal
Low-cost, rapid on-site build
Reusable forms set



Scale model: concept
“C-Grid” carbon fiber
~ 1 cm thick shell
Waterproof, fireproof

Thin-shell concrete structures: Low-cost, low-energy, for remote sites ~ TRL-5

- Permanent housing, clinic, classroom, storage, granary. Remote bases, disaster relief. Tsunami and earthquake resistant.
- Rapid on-site construction with minimum imported materials, tooling, tools, expert labor. Reusable forms set. Bagged premix.
- Proof-of-concept scale model in Alaska. Now needs scaleup to 6-7 m diam, morph to more useful quasi-spherical thin-shell shape.
- Concrete shell 2 - 3 cm thick. Strong enough for Earth burial: protection from weather, shrapnel, small arms fire.
- Need market. Need engineering analysis for design codes, to maintain strength and durability with flexible door, window, vent placement.