AuzGnosis Pty. Ltd.
ABN 99087569391 ACN 087569391

W. Shawn Gray
12 Grahame Street,
Blaxland NSW 2774 Australia
Chief Conceptualist,
AuzGnosis
Phone +61 2 4739-2370
Email: shawn@auzgnosis.com
http://www.auzgnosis.com

Open Questions Arising from Post-Carbon Australian Options for Railway Locomotives:

Introductory Contextualization & Clarification

Consistent with recommended; teaching practices, as well project management strategies, it was not my original intention to craft such a list of questions as follows. I had initially hoped that once having read the some eighty pages of my research documentation {on the web at}

http://www.auzgnosis.com/pgs/auzloco.htm university students and staff would have seen points or issues in that documentation where they saw interesting challenges that they would like to formally pursue as research topics. The theoretical advantages in that approach is the reader by spotting an issue themselves takes some personal motivational ownership thence reward in discovering a solution to their point of concern. Additionally that approach engenders an unconstrained examination by fresh eyes of my documented analysis. Whereas a list of questions (such as follows) inherits the danger of being viewed as "the" authoritative, complete and prescribed listing of the limited potential research offering flowing from my quest to conceive future Carbon Neutral Railway Locomotive options suitable for Australia.

Warning ~ Caveat

The following questions assume that the enquirer has previously read on the web at

http://www.auzgnosis.com/pgs/auzloco.htm both ;-

Germinal Material, Folio:g	The discussion of the environmental, sociological and technical context of my work, along with a little about aims and processes.
Technical Material, Folio:t	All the railway history along with most of the other technical material from before.

Further more while the following questions are group together under various topic-areas (like;- Solar-energy Technology, Fluid-mechanic, Thermodynamics, Material Science) that is not meant to imply only people from such backgrounds may have insight to plausible answers to same.

Please see over for List of Questions

Proposed Core Answers:

After examining all those variables I was able to identify impacting on the quest for Sustainable Carbon Neutral Land-transport Options, I disparagingly settled upon variations to the Nitrogen Economy vision. The transport vision for a nitrogen economy is dogged by two well documented shortcomings that I believe I may have circumvented.

1st hitch. Low energy density + long refill times servilely limit convenient travel range.

1st solution. Automated swapping of refilled fuelling containers.

2nd hitch. Traditional solution to the problems of frost with cryogenic fuels and the Leidenfrost effect necessitated the use of heavy, bulky heat-exchanges.

2nd solution. Semi-closed nitrogen gas circuit deployed in a reciprocating engine. Whereby rather than attempting to heat cryogenic liquids by contact with some hard surface, the warming is obtain by the reintroduction of warm (normally waste-heated) gas back into a boiler is a manner analogous to the injectors found on the traditional steam-locomotive.

Questions about General Concept.

1. Any obvious deficiencies or erroneous assumptions in my analysis or research documentation?
2. Has the university (or anybody else know to you) examined the social risk to Australia, thence Australia's sustainability in/of not addressing the issues raised in my research from the cross-feedbacks of Climate Change and the Peak Oil challenges?
3. After reading all the documentation, are there any other concerns not covered by the following questions?
4. From the readers perspective of their professional experience in such matters are the time-lines in the mud-maps **[Part 4: Proposed Investigation. Folio:g** Germinal Material**]** realistic? too optimistic? too pessimistic?

Solar-energy Technology Questions.

5. The relative cost (in terms of both dollar, or energy consumed) of solar-thermal energy (or other applicable renewable energy sources) as a source of liquid nitrogen and/ or hot-salt container-batteries. When used as inputs for the proposed railway locomotives contrasted against other solutions foreshadowed in the market-place (and so explored in the **Post-Carbon Australian Options for Railway Locomotives** research documentation) such as Hydrogen used in diesel motors?
6. Unit costs, flexibility, along with features of the various competing heat-storage technologies currently under-investigation for on-line power storage at solar-thermal electric-power stations?
7. Any relevant research into the solar energy capture potential along with utility of various translucent or transparent materials?
8. Is any research know of into the effectiveness of various stacking orders for multi-layer capture of solar energy at sequentially from different wavelengths?

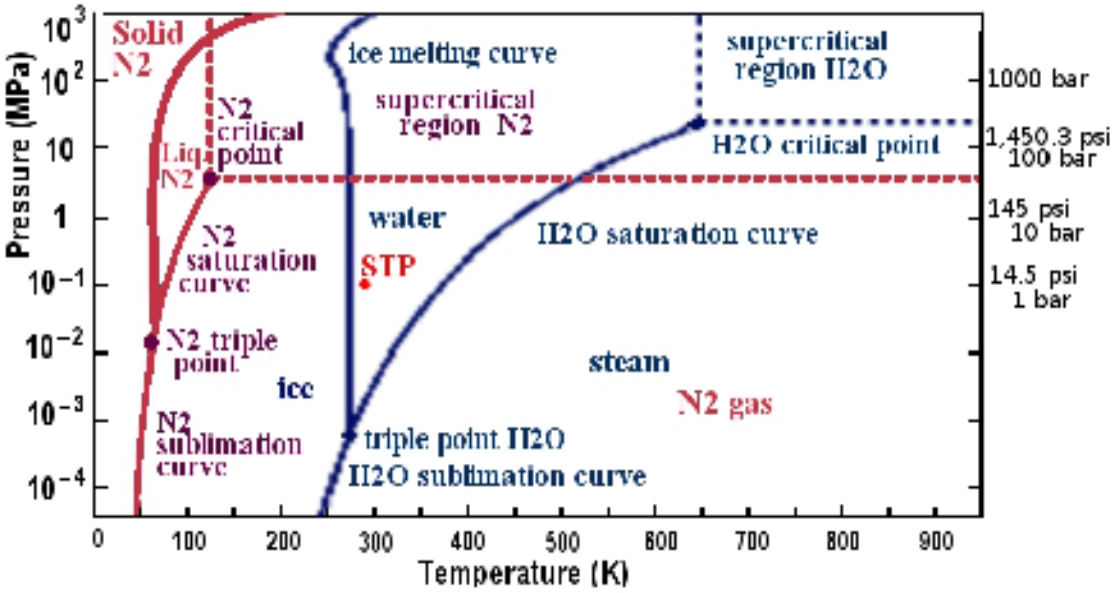
Fluid-mechanic Questions.

9. The ambient temperature of air moving past the locomotive represent one potential significant source of energy for raising the cryogenic liquids or gases into any target

operating temperature zone. Thus while increasing the surface area of the locomotive will "theoretically" facilitate greater energy capture, that logically (at some point; speed, area wind-flow characteristics) will-be associated with increased air-resistance or drag. Where is the optimal points in such progressions?

10. How does the drag issues outlined in the previous question relate to the drag performance of various roiling stock configurations that conceivably may be seen following behind any envisage locomotive in regular operations? In other words what is the potential air-drag of the following train as a floor for consideration of the effectiveness a locomotive's streamlining?
11. With the reintroduction of pre-warmed gases back into the gas-cooker what is best staging of such injectors? heat zone stratification ~ containment? vortex dynamics for effective mixing and optimal heat transfer betwixt the contributing gas streams?

Thermodynamic Questions.



12. Harking back to the Fluid-mechanic Question above about heating the working fluid from passing ambient air temperature. What are the energy cost or advantages from such an approach that need further consideration?
13. The thermodynamic efficiency of a heat engine is theoretically predicted by the absolute difference between the hottest and coldest points encountered via the operating cycle of that engine. But as flagged with the research analysis **[Working-fluid Trade-offs: Optimal Efficacy Point. Folio:t** Technical Material**]**
"... *a question for early resolution is if there maybe some point warmer than -195.79°C (77.36 K, -320.3342°F, the Boiling Point of Liquid Nitrogen @ 1 atm.) where the reduced material complexity (flowing from not having to be engineered for such extreme cold) will justify some loss of potential theoretical thermal efficiency in deploying Nitrogen as the working fluid.***"** So what is the ideal operational temperature zone for these locomotives?
14. What pros and cons should be weighed up if risking, or deliberate entry into Nitrogen's supercritical region is a possibility of any considered design option?
15. With reciprocating steam engines there historically was the operational practice of

"compounding" where a series of falling pressure steps where matched with every greater piston volumes. With nitrogen as a working fluid does there exist any parallel for deploying steps of falling density as the temperature rise through use?

Material Science Questions.

16. NASA in their designing of expandable living modules for moon deployment have been investigating products like Kevlar to provide strong flexible membranes in freezing temperatures of the moon airless surface. F1 racing cars also use a composite of rubberised (Kevlar like) fabric to create flexible puncture-proof fuel tanks for the racing cars. With such advances would flexible boiler or extension thereof be plausible for storing and heating working fluid gasses in?
17. Would the stepped layering or compartmentalisation of cryogenic storage containers (like say capillaries in a plant's stem) be so configured as to allow the use of transparent materials for encapsulating liquid gasses at much higher temperatures &/or pressures than those associated with current safety guidelines. Such that the redundancy of inveighing fabric or rigid surfaces would negate any risk of a BLEVE (boiling liquid expanding vapour explosion)?
18. What are the possibility that with Nitrogen as a working fluid that materials could be found to guarantee a long-lasting, gas-tight moving surfaces with minimal friction, without need to resort to one or other messy lubricants?
19. Are there any special metallurgical risks associated with using very cold nitrogen gas as the locomotives working-fluid? Could any such risk be managed or negated by the addition of traces (0.000%) of other gases (Argon?) to working-fluid mix?

Hydrogen specific Questions.

20. What would be the safe operating parameters for using hydrogen as the working fluid instead of nitrogen? Per concept described as ***Reciprocating, Compressing Cryo-Hydrogen,*** option. **[Part 6: Exploring Solution Spaces: Candidate Engine Configurations. Folio:t** Technical Material**]**

Other Questions.

These twenty off-the-cuff question are not exhaustive of issues arising from my Post-Carbon Australian Options for Railway Locomotives work on the web at http://www.auzgnosis.com/pgs/auzloco.htm . With further consideration I have no doubt more such question should be forthcoming, along with any further questions arising from any answers to these first twenty questions.