THE CONSULTANT

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Insight vs. Prius ? – Carl E. Scwhab

This writer continues to follow the hybrid car developments and makes these observations.

1) Efforts to convince Congress to use some of the STIMULUS money to promote the use of HYBRID technologies are at best stalled and more probably dead. (See 3-point STIMULUS Plan below)
2) Some of the responses from Congressional types indicate that they might approve the purchase of a large number (900,000 was mentioned) of hybrid cars to replace presently owned US Government cars.

3-Point STIMULUS Plan

The size of the STIMULUS assistance should be sufficient to cover the"premium"cost to manufacture the car as a HYBRID, plus an incentive to purchase. Recommendation up to $10,000 per car.

1) First define a HYBRID as any vehicle wherein LOCAL mileage is better than TRIP and both better than 25 miles per gallon.
2) The HYBRID cars qualifying must be assembled and manufactured physically in the USA.
3) The program would only cover vehicles ordered and built within the next 20 months.

This STIMULUS assistance as is "infrastructure" STIMULUS, a RIGHT thing to do.

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So, so much for that, for now. Now to the "INSIGHT VS PRIUS?"

In the past year several of the car manufacturers have introduced new hybrid models and are promoting them for the most part as luxury cars, hence trying to avoid the "premium" recovery question. In any case the pricing is absurd, for example $106,000 for a luxury vehicle that is offered also at $55,000.

A more interesting and for sure more real item of interest, is the competition that Honda is attempting to give the Toyota Prius by re-introducing its INSIGHT name still as a hybrid albeit a "mild hybrid", trumpeting IMA technology. IMA is short for Integrated Motor Assist.

Continued on page 3

Meetings, Past, Present, Future

November 5, 2008
Topic: "Is LICN meeting the needs if its members?"
Open Discussion led by Peter Buitenkant

December 3, 2008
Topic: "Ultrasound Imaging in Medical Application:
Fundamantals and Current Technology"
Speaker: Howard Fidel, Senior Engineer, Schick Technologies

January 7, 2009
Topic: Some History of the Electronics Component Business
On Long Island
Speaker: Barry Yonenson, CEO, KRP Electronics

February 4, 2009
Topic: "I'm a Consultant!... NOT a Salesperson!"
Sales and Sales Management Process Improvement
Speaker: Richard Isaac, President, Legend Development Services, Inc.

March 4, 2009
Topics: "Microchip's Design Partner Program"
"Zigbee and Miwi Protocals"
Speakers: Grainne (Grawnya) Josaphat, Field Sales Engineer
Jerry Fogarty, Field Applications Engineer, Microchip Corp.

April 1, 2009
Topic: "Software Engineering for LabView Applications"
Speaker: Newton de Faria, PhD, National Instruments
Times: 6:45 PM refreshments available.
7:00 PM LICN business meeting begins.
7:30 PM Presentation begins.
Place: Briarcliffe College, Great Room
1055 Stewart Avenue, Bethpage, NY.
Guests are welcome. No charge. No preregistration, but email
jlbrown@essexsys.com so we can order refreshments.
Directions: See our website www.consult-li.com.

May 6, 2009 CEU Credits
Topic: "A soft-Switched, Bi-Directional Power Converter"
Speaker: Lee Sirio, P.E. and Electrical Engineering Design Manager
TDK-Lambda Americas, Inc.

Other Meetings
Consult the Events Calendars on the Section website:
www.ieee.li and the LICN site: www.consult-li.com
Remember to inform the members about seminars and other items

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"Insight vs.Prius ?"…….continued from page 1.

IMA Brief Description—

Honda engineers several years ago had the idea of combining a MG (Motor-Generator) with an ICE in such a way that the MG rotating mass served as the flywheel for the ICE thus saving some weight. Further this MG could serve as a starter for the ICE and as a generator to charge the battery source. The claim was that the MG could restart the ICE and reach 800 rpm in 0.25 seconds. The penalty is that the MG and ICE must rotate at the same rpm and operation on electric only is not practical. The overall IMA package includes a CVT with its output clutch. Add a battery and some computational capability and you have the package that Honda offered first in the 2-seat INSIGHT, then the ACCORD and the CIVIC. By 2006 Honda removed the INSIGHT and the ACCORD from the market and continued only with the CIVIC.

Recall (see above) the INSIGHT was introduced as a 2-seater that produced about 55mpg on so-called mixed driving. It was withdrawn in 2006 and the residual inventory sold. Honda continued experimenting with the IMA technology and, in fact uses it in its CIVIC Hybrid.

What Honda has now done for 2010 is reintroduce the INSIGHT name, BUT this time it is a 5-door (four doors + a hatchback) that in profile looks very much like a PRIUS. Honda appears to be positioning the new INSIGHT as direct competition to the PRIUS. The main point is that Honda is pricing the 2010 INSIGHT at $19,900.

The Matter Of Price—

The buying public does NOT like the idea of laying out a "premium" at time of purchase and have to drive the car for near its useful life to recover the investment. So at the present time most manufacturers are treating hybrids as luxury cars believing if people want the hybrid feature they'll buy despite the "premium".

But price is everything and as I have pointed out the Prius is by far the most popular hybrid, far outselling all other hybrid offerings by Toyota. It happens that in the Toyota line the Prius is the only hybrid NOT available in a gas only version. I think this fact has not gone unnoticed by Honda marketing, which is why they have decided to reuse the INSIGHT name being careful NOT to offer a gas only version.

In a somewhat similar vein a Chinese manufacturer BYD is introducing a hybrid, the F3DM, into the USA at the end of 2009 and is targeted at $21,000. It is a 4-door car with a 3-cyl, ICE. Its hybrid scheme uses 2 MG and can power on electric only for 50 miles.It will be marketed as a hybrid with PHEV plus roof-located solar recharging. A gasoline only version will NOT be offered.

A PS On Price---

In the March 23, 2009, WSJ, an article entitled "Industry's Big Hope for Small Cars Fades" carries the message that cheaper gas has killed the market that burst forth when gas was at $4.00/gal. Cited was Honda that has a 125 day supply for the "FIT". But also mentioned was that Honda has reduced the premium on its CIVIC Hybrid first to $130.--and more recently to $0.--. The CIVIC Hybrid (mild hybrid) now sells for the SAME price as a gas only, CIVIC. No doubt Toyota and Honda will compete aggressively for this hybrid market which is good news for the customer, BUT for GM it means it will have to do something drastic to sell ANY VOLTS.

Now Something A Bit Different

All three of the vehicles i.e. Prius, Insight and BYD F3DM, are FWD (Front Wheel Drive). Toyota in some of its larger hybrid vehicles offers 4-wheel drive but in an unusual way. The rear wheels are electric drive only and have no mechanical drive connection to the ICE. The stated reason is that this arrangement provides more regenerative braking energy recovery and additional pulling torque for example if pulling a trailer.

Toyota has let slip (?) that the Prius will be offered with 4-wheel drive by 2011 or '12.
Using the technology already developed, this would be a simple change to add drive motors of each rear wheel and a dedicated VVVF drive package taking its control signals from the present VVVF.

The concept of electric-only power to the rear axle is NOT new and has been suggested by this writer as a less costly way to convert vehicles with FWD such as VANs

Where Is The VOLT? —

Notice the postulated 4-wheel versions have a strong resemblance to version of the VOLT3. Curiously the VOLT project is in some kind of limbo ostensively to finalize battery pack problems (?). GM is stressing the PHEV feature; meanwhile the initial offering price is $40,000+ for a FWD version. **INSANE!**

With all the STIMULUS problems besetting GM it looks like the VOLT is still a distance away. But noteworthy, except for outrageous price, the VOLT3 (4-wheel version) fits in with the PRIUS, INSIGHT and BYD F3DM.

Maybe sanity will strike GM and the UAW?

Conclusion—

Honda seems set to compete with the PRIUS with a new version of the INSIGHT. This new version is close in size and configuration to the PRIUS. The initial technologies are HSD for the PRIUS and IMA for the INSIGHT. But Toyota hints at a 4-wheel drive version for the PRIUS in 2011 or'12 and the same idea could be applied to the INSIGHT with even greater benefit. Sadly the VOLT is out of the running although the technology is excellent, because of an INSANE marketing/pricing decision on GM's part.

The sleeper could be the Chinese BYD F3DM.

Loop Current Demystified ***----- Dr. Richard LaRosa, sealevelcontrol.com***

Coriolis Force

The Loop Current (LC) enters the Gulf of Mexico (GoM) via the Yucatan Channel, intrudes into the GoM, often as far as New Orleans, then makes a right-hand U-turn, and exits the GoM via the Florida Straits. The LC water is stratified, with warmest (and therefore the lightest) water on top. Because of shear friction, the water nearest the surface moves fastest, and the water below about 800 m depth has little motion. The Coriolis force deflects the water to the right of the current. The Coriolis force is proportional to velocity, so mostly warm water is deflected toward the interior of the loop, where it forms a deep pool that can supply latent heat energy to a hurricane that might pass through it.

Equatorial Current Source

The LC water comes from the Caribbean Current, whose source is the North and South Equatorial Currents that are driven across the Atlantic Ocean by the Trade Winds. The South Equatorial Current splits at the protruding coast of Brazil into a northward and southward branch. The northward branch eventually flows into the Caribbean Sea via the Antilles Island passages that are closest to the South American Coast. The water flowing into the Caribbean via all the other Antilles Island passages comes from the North Equatorial Current.

Energy and Power Guesses

The Caribbean current is driven by wind through the Caribbean Sea and arrives at the GoM with a surface velocity near 1 m/s and a sea surface level elevated about 35 cm above the sea level in the Atlantic Ocean. The 35 cm rise is inferred from statements about a leveling survey across the Florida Peninsula that determined the sea level in the GoM was 19 cm higher than the sea level on the Atlantic side of the peninsula. The 19 cm is mentioned by Henry Stommel in his book on the Gulf Stream. It is also mentioned in at least one other book. I have not been able to track down this survey, but I assume it averages the position of the water over the range of tide and wind-driven sea levels on both sides of the Florida Peninsula. Just where, along each coast, I do not know. But Henry Stommel thought that a 19 cm hydraulic head would account for the friction loss in the Florida Straits and Florida Current. Acceptance of this estimate allows us to explain many features of the LC and figure out how to get rid of it and thereby reduce the hurricane threat to the Gulf Coast.

I arrive at the 35 cm sea level elevation by multiplying the 19 cm by the ratio of total maximum path length (of the LC plus Florida Straits and Florida Current) to the length of the Florida Straits and Florida Current path. For this calculation, I assumed that the Florida Current extended to Cape Hatteras. If we multiply a transport of 25 million cubic meters per second by the density of water times the gravitational acceleration times the 19 cm head, we get a power dissipation in the Florida Straits and Florida Current of 49 GW. The 16 cm hydraulic head of the LC tells us that 40 GW is dissipated in the LC. The 25 million value was arbitrarily picked from a published range of volume flow rates, so the calculated powers will vary.

Flow Volume Limitation

In January of 2009 I was using a simple open channel calculation to relate hydraulic head to volume transport rate. At that time I thought that the full 35 cm head might have the effect of increasing the volume transport. However, I now see that the flow is limited to its observed range of values because of the length of the global circulation paths involved. The South Equatorial Current contribution represents the return to the Northern Hemisphere of water that sinks in the Arctic, runs at great depth down to the Antarctic, upwells in the Antarctic Circumpolar Current, flows up the west coast of Africa and into the South Equatorial Current. Similarly, the North Equatorial Current contribution to the LC involves a long surface circulation path around the North Atlantic Ocean. Power in excess of the 49 GW required to drive the Florida Straits and Florida Current will not result in increased flow. This extra power is instead dissipated by the LC.

Power Dissipation in GoM

When the LC intrudes as far as New Orleans about 40 GW is dissipated in the GoM. This includes the power dissipated in the counter-clockwise (CCW) vortices adjacent to the main loop. Eventually, the loop short circuits somewhere along its path, and a clockwise (CW) ring is detached. The ring, with its stored kinetic energy, drifts slowly westward. The active loop is now shorter, but the velocity remains the same, so it should dissipate less power than when it was longer. The detached ring might decay initially, but it might intensify later on because of power fed into it from CCW vortices which are in contact with the intact portion of the LC. The LC intruded almost to New Orleans in January and February of 2009. On March 1, a CW ring started to detach and was still trying to break away on March 24. It is difficult to determine whether the vortex activity increased during this time, but for what it's worth, on March 24 two CW vortices appeared in the western GoM where there were none earlier.

It is likely that a CW ring detaches from the tip of the loop when there is less excess power to be dissipated. The driven part of the loop shortens by a large increment, but the transition is softened by a series of reattachments and detachments until the ring finally breaks free and drifts westward. During this hesitation period, CCW and CW vortices can adjust the power dissipation in the GoM to match the excess input power.

Electric Power to the Grid

Assume that the 40 GW of ocean current power can be converted at 50% efficiency to 20 GW of electric power into the grids on shore. The mooring cables and other structures will create eddies, and the turbines will have mechanical and electrical losses. There will be losses in the subsea and overland cables required to transmit the power from the turbine sites to the mainland load centers. There will also be losses in the power conversion equipment if high voltage DC transmission is used.

Wind turbines have reached the 5 MW output level. Two turbines rotating in opposite directions must be incorporated in each floating unit in order to balance the torque on the stators. If each floating unit produces 10 MW, 2000 units will be required in order to supply 20 GW. Suitable turbine locations are the inlet to the GoM, the Florida Straits, and locations along the Florida Current. The GoM inlet flow is over the Yucatan continental shelf, which would minimize the length of mooring cables. This location would have the advantage of lowering sea level in the GoM and would require short undersea cable runs to the Yucatan mainland and Cuba. The transmission cable could run across Cuba and also across the Florida Straits to Florida. This, of course, requires

friendlier relations between US and Cuba, which may be more of a challenge than the technical difficulties.

Florida Atlantic University favors turbine locations on the US side of the Florida Straits. This has the advantages of short undersea cable length to the US mainland and autonomy over our own territorial waters. The GoM lies upstream of these turbines so the GoM sea level will be raised. It is already too high, resulting in coastal flooding and damage to wetlands.

We need to study the design and performance of large arrays of closely packed turbines. It is interesting to note that the kinetic energy (KE) transport rate of the stream drives the turbine blades. The theoretical turbine output is the power coefficient (which might be as much as 0.5) times 0.5 times the water density times the cube of the velocity times the swept area of the blades. But if the stream cross section remains constant throughout the turbine array, and the quantity of water flowing in is equal to the quantity flowing out, the kinetic energy transport rate at the input is the same as that at the output. The kinetic energy consumed by the turbines is restored by the hydrostatic pressure gradient that pushes the water downstream. There is some minimum distance required to remove the flow disturbance in the wake of a turbine before the water encounters the next turbine. This sets a limit on how many turbines we can crowd into a section of the stream. Also keeping them from colliding will pose a challenge to the mooring system, especially when storm conditions are encountered. This crowding problem suggests that the largest possible turbines be used, and several pairs should be incorporated in each floating unit.

Because of the variation of flow rate and excess power, economic considerations suggest that the size of the turbine array should be chosen to reduce the LC length to zero for the minimum expected excess power. Greater power input to the GoM will cause some LC intrusion into the GoM, but it should be much reduced from the present situation. There is still the possibility of diverting the flow from the Caribbean Sea by the installation of turbines in the Antilles Islands passages.

Summary

There are many unknowns and challenges, but we have here a means to eliminate the mischief caused by the Loop Current, and gain a considerable supply of electric power. This would replace a significant number of large nuclear or coal-powered plants.