

FREE COMPLEMENTARY ISSUE

EV WORLD

INSIDER ILLUSTRATED

EDITION 11.52

2011

IN RETROSPECT

Safe Nuclear Power?

V2H Then & Now

Two of the Best of Insider

EV EXPO: COME TO TAMPA IN 2012



The 'OTHER' EV World

If you think that EV World is just another web-site about electric cars, publishing just another email newsletter, you haven't seen EV World's MOBILE edition for tablet devices. Published weekly, which is itself a damned near impossible feat for any serious online publication, especially with a staff of one; it simply is without peer. Hyperbole? Perhaps, but here's an email we recently received from Bob O'Neill, a subscriber. In short, he writes..

"Spent 43 yrs. in business publishing, lastly as Editor of Progressive Grocer. Five-time winner of American Business Press editorial achievement awards. Winner of Points of Light award for an article back in the days of Bush... you have the best EV publication in the business. Also the most handsome."

For a mere \$49 annually, readers like Mr. O'Neill receive weekly an 18-20+ page PDF magazine that weaves the mere threads of information you might find on the EV World.com website into an amazing, full-color digital publication, exactly like the one you're viewing now. To receive the MOBILE edition each week, become a premium subscribers. It's easy. Just visit <http://evworld.com/subscribe.cfm>. You can pay online through Paypal or 2Checkout, as well as by check. Discover the 'other' EV World.

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About Illustrated

EV World Illustrated is an experiment of sorts. Its purpose is two-fold: (1) to get more information into your hands, despite our being out of the office much of the previous week, making it difficult to create a full edition of EV World Insider MOBILE; and (2) to elicit your response to a different format, one that is more visual, created in the wake of various conferences and electric vehicle relevant media events.

Share your impressions and comments with us at editor@evworld.com.

About the Cover

The sparking night skyline of downtown Tampa, Florida, which will be the site of the 2012 International EV Expo being organized by the CLE.VE.R. Institute and EV World. See page 14 to learn more about this first-of-its-kind event that reaches out to consumers, small business and community planners preparing for a EV world.



Rescuers search rubble along Japan's earthquake and tsunami ravage coastline. Destructive earthquakes also plagued New Zealand and Turkey.

2011 - The Year In Retrospect

“May you live in interesting times,” is a Chinese proverb and a curse. 2011 certainly meets the “interesting” criteria; especially if you live in the Iwate and Miyagi Prefectures in Japan where the triple disasters of a 9.0 earthquake, tsunami and nuclear power plant meltdown caused widespread death and destruction. Yet, the seemingly indomitable Japanese people appear to be taking it in their stride with stoic resolution.

Amazingly, Mitsubishi, Nissan and Toyota have been able to recover sufficiently to continue to deliver their electric-drive vehicles to the home market, as well as overseas, delighting those fortunate enough to own or lease the estimated nearly 40,000 vehicles produced so

far, a number that is 4 times higher than during California ZEV mandate period from 1998 to 2003, a number the right-wing American pundits and media have ignored in their premature criticism of the technology and the Obama Administration throughout the year.

Looking back on 2011, the industry achieved a number of important milestones beyond the sheer number of EVs hitting the streets: safety being one of the key ones. Despite the overshadowing events surrounding the post-crash test fires in several Chevrolet Volts, all three production vehicles: the LEAF, i-MiEV and Volt earned the highest safety rating from both government and insurance industry test

Continued page 4
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Year in Retrospect...

labs in North America and Europe. In the two private residence garage fires in which Volts were destroyed along with two other vehicles, fire investigators absolved the plug-in hybrid of blame. In reaction to the NHTSA fires, the agency, in collaboration with General Motors, is looking more closely for what caused those fire, which occurred days after the cars had been successfully crash tested. None of this has caused Volt owners -- with a couple of exceptions -- to abandon their vehicles, or the City of New York to park its fleet of 20 Volts. Expect a resolution to the problem in 2012.

Electric vehicles accumulated a number of records: both battery and fuel cell-power, completing around-the-world junkets and in the case of several fuel cell programs,

amassing record numbers of hours of operation and service miles completed.

Politically, the year was tumultuous, especially in the MENA region (Middle East and North Africa) with the coming of the "Arab Spring," as people rose up, often risking and some losing their lives, in the cause of equality and the end of political oppression and corruption. Tin pot dictators toppled from Egypt to Libya. The later, Muammar Gaddafi, we learned, had an interest in electric cars, one of which he owned, and wanted to build them in Libya. This awakening in the Middle East and North Africa will continue well into 2012, and likely beyond, the outcome of which remains uncertain.

What the occupiers of Tahrir Square accomplished, served to inspire the occupiers of Wall Street and their offspring from Boston to Oakland, shifting the dialogue from defi-







The first of what eventually is planned to be a fleet of 3,000 electric Bluecars will be available for short-term hire in and around the environs of Paris, France. 2011 also saw the debut of the Yo-Mobil (below), a unique Russian hybrid that uses ultracapacitors instead of batteries.





Starting January 1, 2012, neighborhood electric vehicles like the GEM, sitting here on dealer showroom floor in Omaha, will be legal to drive on public streets across the State of the Nebraska, and EV World had a small hand in helping bill pass.

cits to inequality, from which we learned, many of us to our surprise, that there is less wealth inequality across the MENA region than in America. Certainly, America's standard of living -- and energy consumption -- remains higher, but the gap between the super rich and the rest of America continues to widen, reaching feudal levels where 400 individuals own 50% of the nation's wealth. That disparity, and the financial conservatism it spawns, is part of the reason sales of Volts and LEAFs, and likely Focus EVs in the coming year, have lagged. We also learned that the narrower the gap between the rich and the rest of us, the more prosperous a nation is.

Another trend that emerged in 2011 was the growing recognition that personal car ownership, at least in the developed world, is on

the wane, highlighted by the launch this Fall of the Autolib carshare program in Paris, and the spread of the Car2Go network in Europe and America, both using electric cars. Members of each respective system can access, via smart cards, hundreds of EVs for short-term trips about town, eliminating the burden of car payments, depreciation, insurance, licenses and taxes. Along a similar vein, conventional and electric-assist bikeshare programs are growing, as well.

Beside the embryonic shift to ownership sharing models, 2011 also might be considered the year of the urban EV, characterized by the debut of short-range, often narrow-bodied, twin or triple seat vehicles specifically designed for congested city streets where parking is often



Now deceased dictator Muammar Gaddafi ordered an electric version of the Fiat 500 and expressed interest in building them in Libya. Before his brutal death, rebels make off with the vehicle he had built in Italy. Below is all electric Cri-Cri, the world's smallest and now fastest electric airplane. A nearly identical version, called the Cristaline, achieved a top speed of 175 mph this past summer.



Year in Retrospect...

non-existent. While most of the concepts appearing this year will probably remain so, a couple have actually gone into limited production. Depending on their success, others are bound to follow.

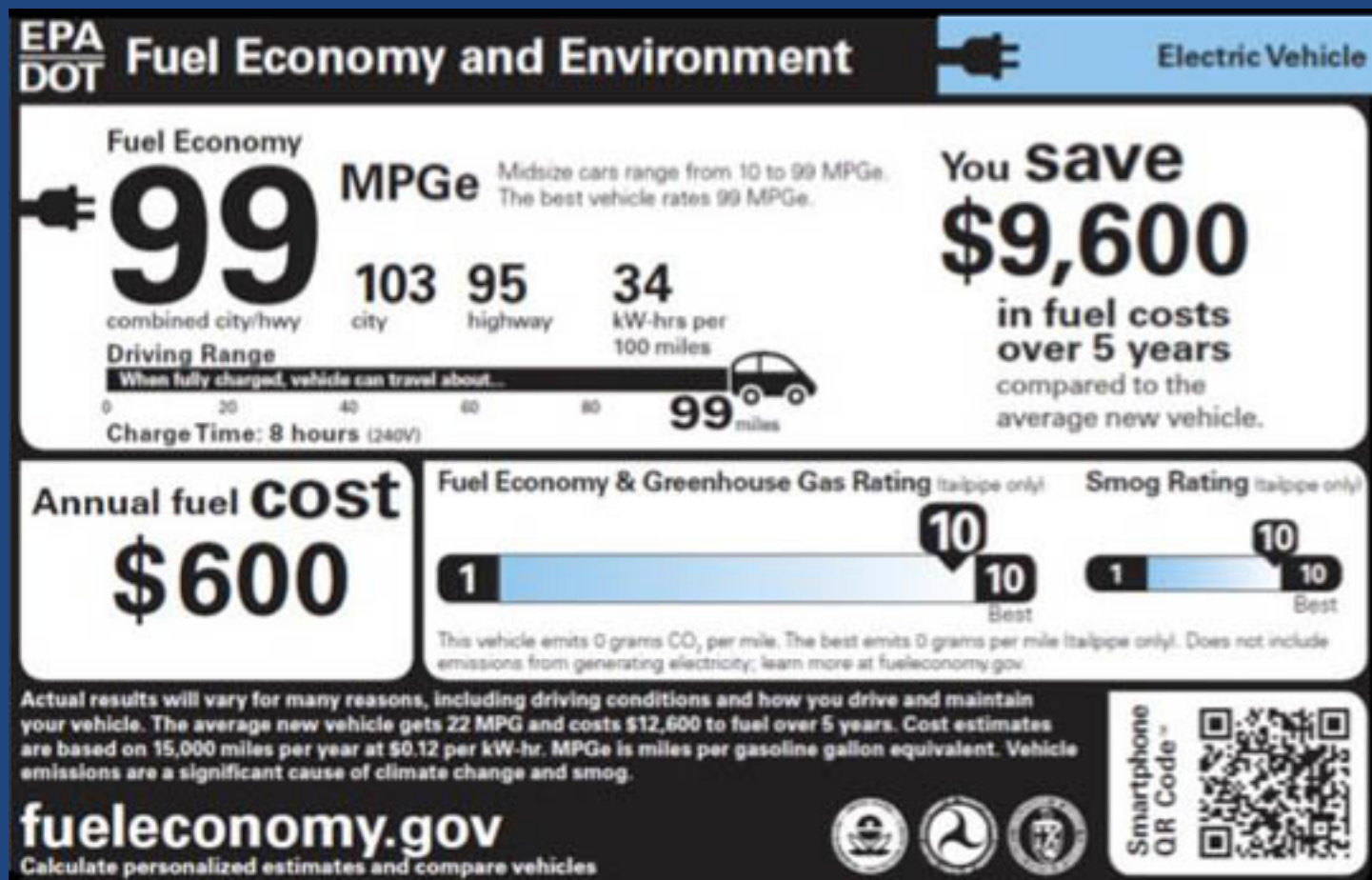
The other interesting development is the advent of electric flight from the giant solar-powered Solar Impulse, which flew from its nest in Switzerland for Brussels and then the Paris Air Show, to the Greenflight Challenge of flying 200 miles on batteries alone. Two European groups also developed vertical flight vehicles: a helicopter and a multicopter. Electric aircraft are appealing to flying clubs and flight instructors because of the often short duration of the flight and the low operating costs. Not only were distance and endurance records set, but so were

speed records.

There were, of course, disappointments. THINK sank into bankruptcy again, taking Ener1's chairman with it. Aptera shut its doors, but others have stepped into the ring, including GTA's MyCar, headed by former Democratic National Party chairman, Terry McAuliffe.

On a more upbeat note, the EPA introduced its highly informative new fuel economy sticker (below) that seeks to better educate car buyers on the costs of motoring, especially when doing so electrically.

Finally, we may be on the verge of an energy revolution if LENR proves successful, which it appears, for the moment, it may be, at least from the tightly controlled demonstration Andrea Rossi performed in late October. Time and the new year will tell.





Italian engineer Andrea Rossi demonstrated his low energy nuclear reactor made up of some 52 e-Cat units that appear to produce excess heat without dangerous radioactivity. The heat was used to produce low-grade steam. Below: Peugeot VELV concept illustrates trend towards small, two and three passenger, short-range, electric runabouts for cities.





Daimler drove several fuel cell cars around the world, while the Moto Mundo husband and wife team from Denmark drove their Nissan Qashqai (above) electric conversion 30,000 km through 14 countries, completing their 'round-the-world' adventure in 11 months. U.S. Vice President Joe Biden acknowledges Charles Gassenheimer in the waning days of his chairmanship at Ener1, the battery manufacturer that had heavily invested in the Norwegian EV-maker THINK.





2011 saw the number of public charging stations for electric cars surpass the number of alternative fueling stations in the United States. It also witnessed the introduction of several wireless/inductive charging technologies that don't require plugging in the EV; just parking over the top of it. Overleaf: Occupy Wall Street protestor was among those who helped shift political discourse in America from Tea Party talk of deficits to growing income inequality.





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Coming in 2012

2012 INTERNATIONAL **EV EXPO**

TAMPA, FLORIDA • FEBRUARY 21-23, 2012

There are boat shows, car shows, and home & garden shows. Now there is EV Expo 2012, the first broad-spectrum electric vehicle event tailored specifically for the general public; and Tampa, Florida will be the site of the first one.

A collaboration between EV World, Z Fever Racing, and the CLE.VE.R. Institute of Tampa, this three day consumer show incorporates activities designed specifically for public, business, and community planners. Besides technology exhibits and expert forums, EV Expo includes daily, hands-on workshops each morning, one of the nicest Ride & Drive routes in the city, a Shine & Show display of the best and brightest EV conversions, plus the introduction of the first NEDRA-EVexpo, Florida Nationals 2012 Electric Drag Racing. Learn more at <http://evexpo.info>.

LEARN MORE@ WWW.EVEXPO.INFO

Special pricing available for EVWorld subscribers

- Exposition Hall
- Expert Forums & Panels
- Hands-on EV Workshops
 - Ride & Drive
 - Social Events
- Shine & Show Vehicle Displays
- NEDRA-EVexpo, Florida Nationals
2012 Electric Drag Racing



UNIQUE

3-Day Forum Series & Workshops Focused on Consumers, Business & Planners

This is the first electric vehicle exposition to feature hands-on workshops and forums tailored for consumers, business and planners. Each morning, dedicated workshops will give attendees practical experience with and insights into the not only converted electric cars and two-wheeled vehicles to electric drive, but also on setting up and running successful EV businesses. In the afternoon, industry professions will share their knowledge in the operation of EVs of all types and sizes, with Day 1 devoted to consumers, Day 2 on business development, and Day 3 on planning for and managing the introduction of electric vehicles in the community. And, of course there will be a Ride & Drive session. Following the Expo will be the NEDRA-EVexpo, Florida Nationals 2012 Electric Drag Racing.



Workshops are held in 3 areas at same time: Salon, Hall and Patio...

Conferences held at Salon

Track A EV INTRO

Track B EV ECONOMICS

Track C EV OPERATION

Track D EV ENERGY

Track E EV INFRASTR.

Track F DO IT YOUR.

EV PARTIES

TUESDAY, 21st

CONSUMER

WEDNESDAY, 22nd

IMPLEMENTER

THURSDAY, 23rd

PLANNER

REGISTRATION & SERVICES OPEN

SALON	HALL	PATIO	SALON	HALL	PATIO	SALON	HALL	PATIO
DIY WORK SHOP First Session	DIB WORK SHOP First Session	DIS WORK SHOP First Session	DIY WORK SHOP Second Session	DIB WORK SHOP Second Session	DIS WORK SHOP Second Session	DIY WORK SHOP Third Session	DIB WORK SHOP Third Session	DIS WORK SHOP Third Session
2 WH WShop 1st S.	2 WH WShop 1st S.	2 WH WShop 1st S.	2 WH WShop 2nd S.	2 WH WShop 2nd S.	2 WH WShop 2nd S.	2 WH WShop 3rd S.	2 WH WShop 3rd S.	2 WH WShop 3rd S.

KEYNOTE • EDTA
WHERE ARE WE GOING
• BALLROOM •

KEYNOTE • OEM
WHAT DO WE HAVE
• BALLROOM •

KEYNOTE • GOV
WHAT DO WE MUST DO
• BALLROOM •

THE OEM PORTFOLIO
BILL MOORE'S PANEL

CONVERSIONS Panel I
DIY and ONE OFFS

NYC EV PARADIGMS
MARK SIMON

EV MARKET HYDROGEN
and **HYBRIDS TBA**

CONVERSIONS Panel II
RETROFIT BUSINESS

EVs & LOCAL GOVS
GET READY TAMPA BAY

EV 2 WHEELERS
ED BENJAMIN

EV FLEET OPPS
MARTIN SCHUERMAN

EV GOV FLEET
RICK SIKES

EV MARKET TODAY
PANEL: UTILITIES ROLE

ENERGY PACKS Panel
SANKAR DASGUPTA

EVs AS BACK-UP
THE V2GRID PROPOSAL

EVs HOME SAFETY
DAVID KERZEL

EV CHARGING OPT.
HOME & OFFICE

EV PUBLIC STATIONS
THE BUSINESS MODEL

EVs as RACING HOBBY
JOHN WAYLAND

EAA PRESENTATION
CARL VOGEL

EVs & ROADS
TAXES & BEYOND TBA

WELCOME
Network Cocktail

EV AWARDS
Presentation

Last update:
December 16, 2011



3 KEYNOTE LUNCHES
•
18 ONE HOUR CONFERENCES
•
6 HANDS-ON WORKSHOPS
•
2 COCKTAIL PARTIES

WORKSHOPS
4 Wheel +
Do It Yourself
3 day • 6 hours

Do It for Business
3 day • 6 hours

Do It for Service
3 day • 6 hours

WORKSHOPS
2-3 Wheels
Do It for Yourself
3 day • 3 hours

Do It for Business
3 day • 3 hours

Do It for Service
3 day • 3 hours

DYNAMIC

3-Day EV EXPO Featuring EV Products & Services for the Consumer, Hobbyists, Fleets, and Business. Exhibit space competitively priced.

EV Expo offers businesses the opportunity to expand beyond the B2B sector typical of other conferences by also catering to consumers, small business, entrepreneurs, fleet managers, community developers and planners. Best of all, the rates are some of the most affordable available at any similar gathering. And if you're a member of the community or EV-relevant association they are event better. To learn more, contact Victor Juarez (victor@evexpo.info) or Mark Federle (mark@evexpo.info).



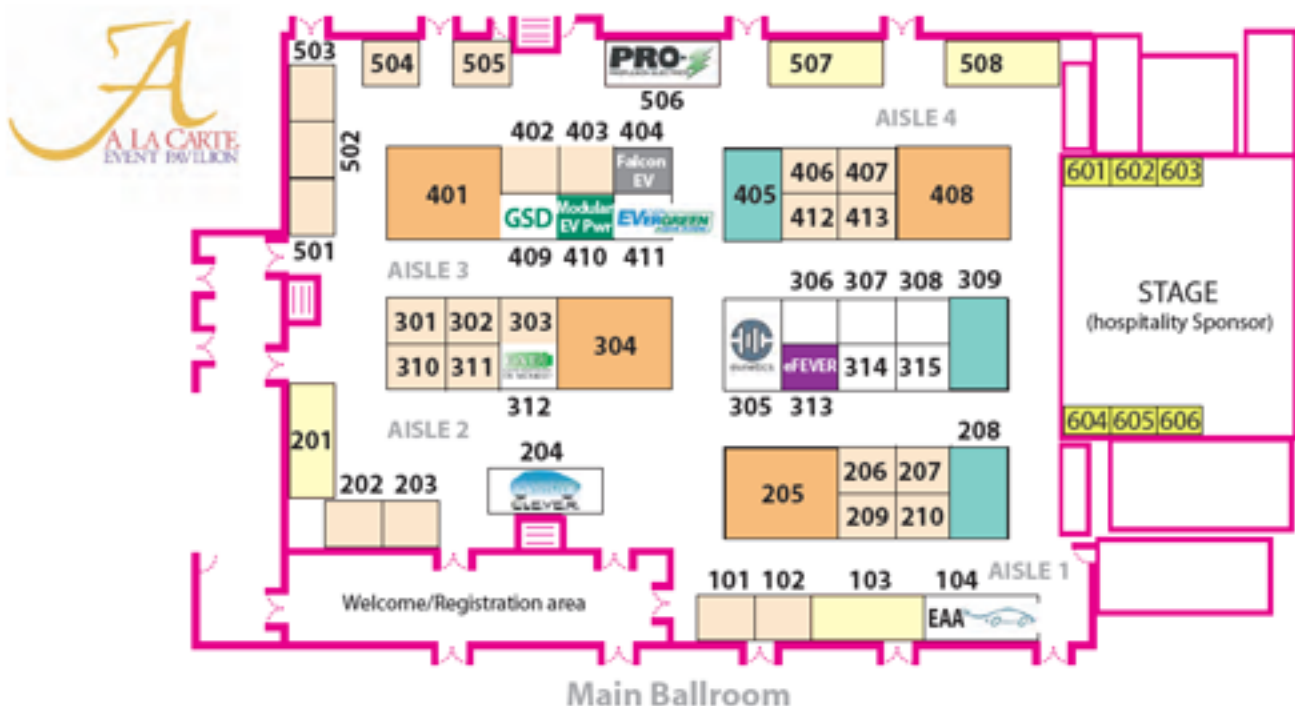
EVexpo® FLOOR PLAN

Last update November 04, 2011

TYPE	AREA	SIDES	Availability
AAA	320 Sq/ft	16' by 20'	4 spaces
AA	160 Sq/ft	16' by 10'	4 spaces
A	160 Sq/ft	8' by 20'	4 booths
B	80 Sq/ft	8' by 10'	30 booths
C	40 Sq/ft	8' by 5'	From DEC 15.

BOOTH PRICING

Discount	Cost Sq./foot
Base	\$22
Florida entities	\$20
EAA Members.	\$18
EDTA or Gov Memb.	\$16
Educational & Non profit	\$14



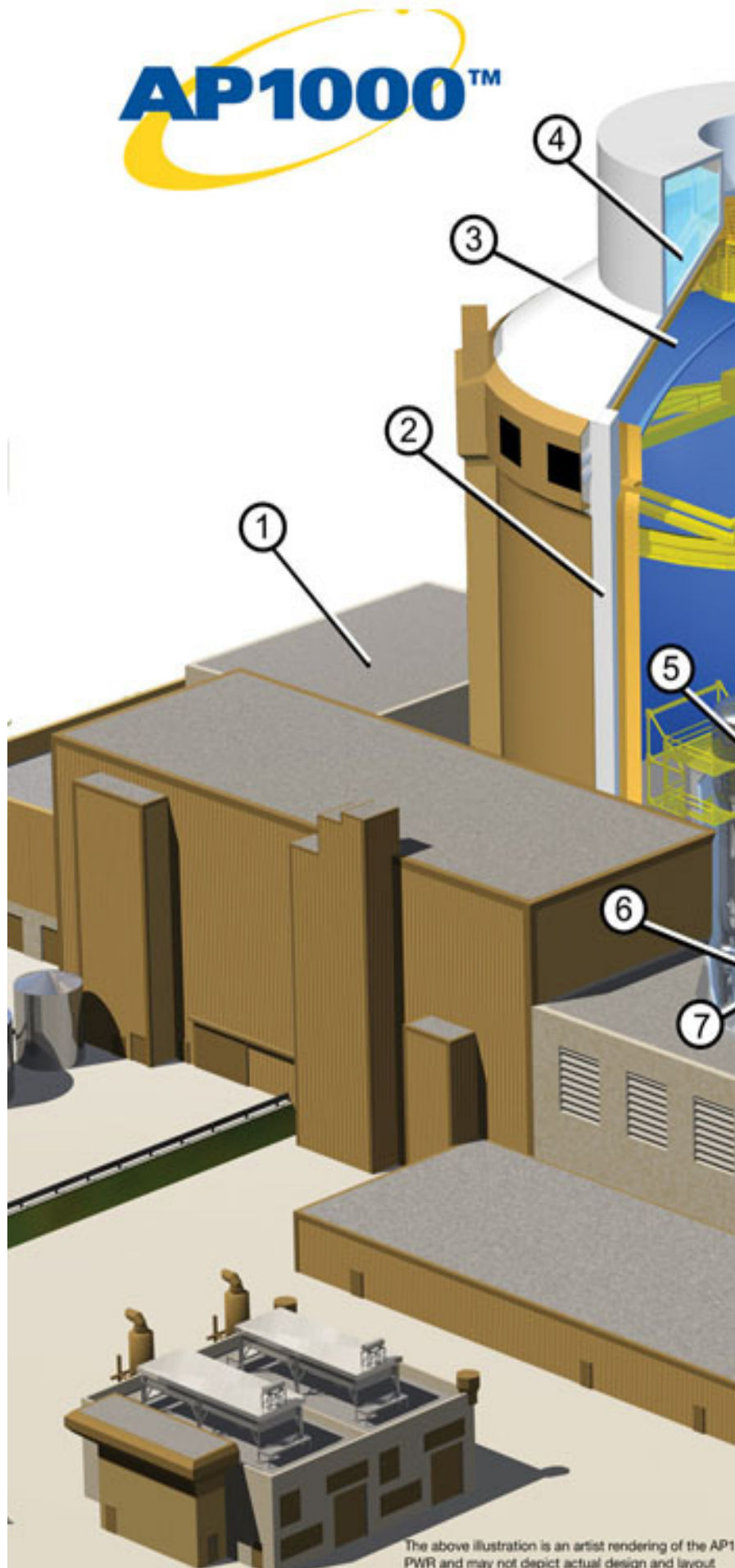
Safer Nuclear Power?

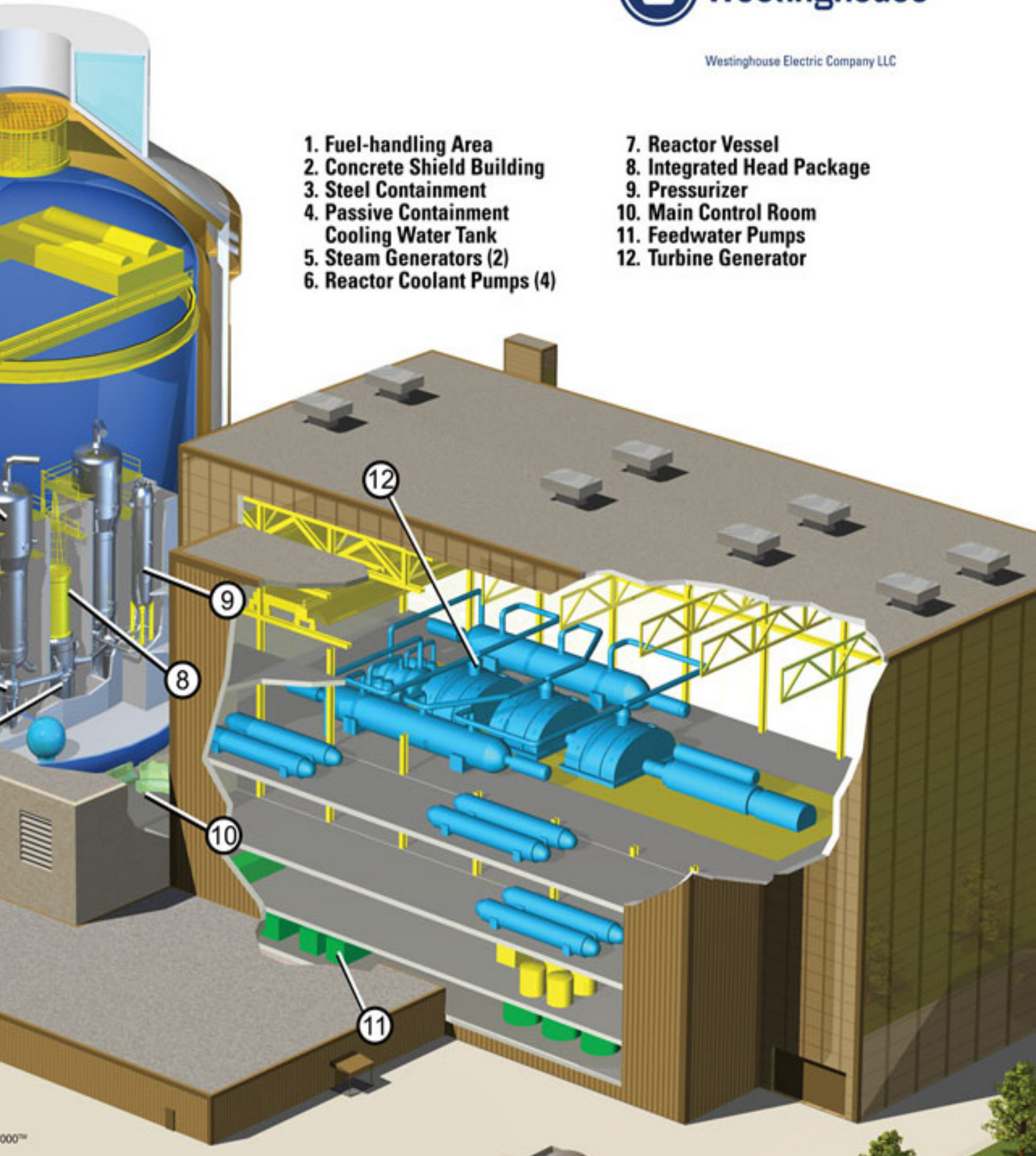
Nuclear Regulatory Commission Approves Westinghouse-Toshiba AP1000 'Passive' Reactor Design

Every time I read the term “safe nuclear power,” I immediately think of the ‘unsinkable’ Titanic, which, of course, wasn’t. Now, I admit that overall, the nuclear power industry has had a fairly good record, despite the three most famous disasters: Three Mile Island, Chernobyl and Fukushima. There have been less well known disasters: Simi Valley, Hallam plant here in Nebraska, the Army test reactor at Idaho Falls National Lab. But comparatively speaking, the number of deaths from mining coal probably far exceed those from these incidents, though that’s a very callous way to measure such things.

So, when the U.S. Nuclear Regulator Commission this week approved Westinghouse-Toshiba’s AP1000 design, it was greeted with both relief -- if you’re a proponent of nuclear power -- and skepticism if you’re not.

The key difference in this new Generation III+ design (most current US reactors are Generation II), is the use of passive safety measures. In the event of power failure, the core would be passively cooled by gravity-fed water for the first 72 hours. The valves that open to allow the water to flood the core will operate automatically without operator invention or loss of power. This is supposed to prevent







the problems that led to the meltdown of three reactors at the Fukushima Daiichi complex on the Pacific coast of Japan (page 21). After 72 hours, power must be restored to refill the water tank, which is the “cap” like structure above the reactor building in the above illustration. The AP 1000 is designed to produce 1,154MW of electric power, while occupying a smaller physical footprint. It also engineered to require 50% fewer safety-related valves, 35% fewer pumps, 80% less safety-related piping, 85% less control cables, all housed in 45% less building volume.

This is reassuring, no doubt, though critics have pointed out potential safety flaws in the design (<http://tinyurl.com/wtAP1000>). Also building these plants isn’t going to be cheap, despite promises to the contrary. When Westinghouse first proposed the concept in 2005, they estimated the per kilowatt cost would be \$1,400. The most recent estimates place this at \$3,500, making it just about the most expen-

sive energy technology available, and certainly a very expensive way to make steam, especially IF there is any merit to LENR, low energy nuclear reaction, where it might cost \$500 a kilowatt, while creating no radioactive waste in the process.

But construction costs and nuclear waste storage isn’t the only issue confronting conventional nuclear power. There’s another that is seldom mentioned: water. Coal and nuclear power both share this problem: they consume enormous quantities of water, depending on their type of cooling system. A University of Georgia study estimates a plant like the AP 1000 could consume between 55–88 million gallons of water per day, discharging it at a marine life killing 90 degrees Fahrenheit. Of course, the water might be cycled through low temperature applications like greenhouses, though buying produce from a facility next to an N-plant could pose definite marketing problems.



Fukushima Daiichi #3 reactor, one of three destroyed by hydrogen gas explosions caused by failed core cooling systems, releasing levels of radiation not seen since Chernobyl. A preliminary, 500-page report on the disaster faults TEPCO for being inadequately prepared for such a disaster. Only in December were all the reactors at the facility brought to a safe cool-down.



Force of March 11, 2011 tsunami carried a passenger ferry inland and left it marooned on top of the building. Mitsubishi i-MiEV electric car travels along road cleared among the rubble.

Vehicle-to-Home Then & Now

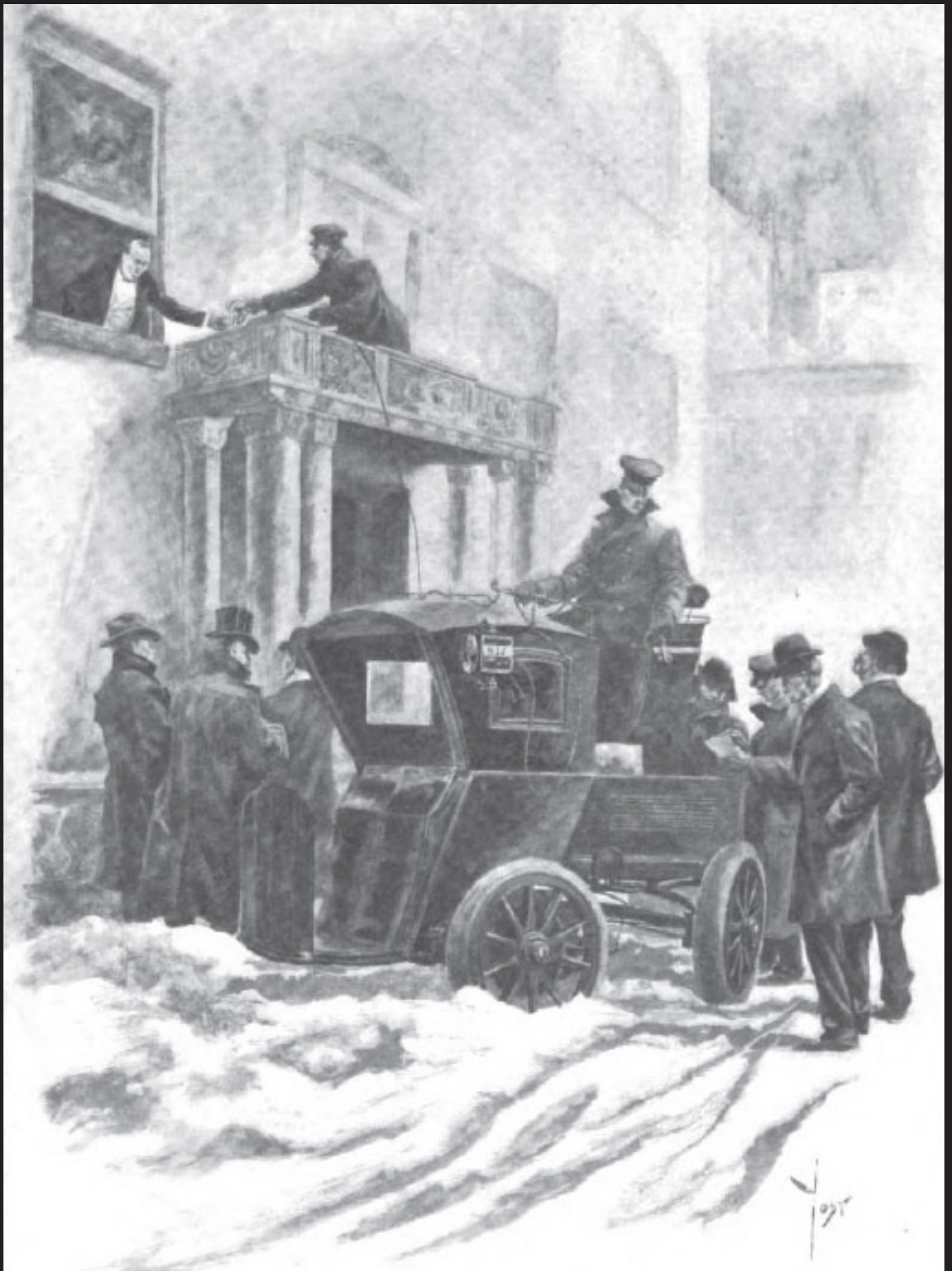
The triple disasters that stuck Japan in March 2011 had a curious silver lining of sorts: they demonstrated the practical value of electric cars in providing transportation in the disaster area where gasoline and diesel fuel were not readily available, but electric power was... just barely. The earthquake forced Japan to close down most of its nuclear plants. Only 8 of the nation's 54 reactors are operating, requiring mandatory energy conservation programs.

Paradoxically, this situation led all three Japanese electric car manufacturers in Japan -- Mitsubishi, Nissan, Toyota -- to integrate the ability to use the direct current power stored in their EV's battery pack to temporarily run small AC appliances in the event of an emergency. This capability is referred to as V2H or vehicle-to-home; maybe the first step to implementing revenue-generating vehicle-to-grid (V2G). V2H energy storage will be available on 2012 models

of the i-MiEV, LEAF and Prius PHV, respectively, but initially only in the home market.

V2H is such an obvious application of the energy onboard a LEAF or similar EV that we can expect to see it eventually incorporated into other electric car platforms in time, but it isn't all that new an idea, as the Harper's Weekly illustration from around 1899 shows. Here an electric taxi, which was first put into service in New York City in 1898 assists a physician who needs the power to run an x-ray machine at a patient's apartment, which didn't have electricity. The caption to the illustration reads...

"New York surgeons, hampered in the use of the X-rays in private homes, where there is no electric power, have recently devised the scheme of obtaining their power from the storage batteries of their automobiles. The wires are carried direct from the automobile in the street to the patient's room."



It's Really All About....

iSTREAM[®]

What F1 designer Gordon Murray really wants from his T-series micro-mini cars.

In October 2010, Dr Judit Nadal, a respected research scientist, died in a devastating car crash on the A-41 near Herndon, northwest of London, England. Her car, a G-Wiz electric built by Reva in India, was torn in two in the collision with a heavier SUV. The world lost a valuable scientist and the safety record of tiny electric cars suffered a serious setback.

That tragic accident, and earlier crash tests of the G-Wiz by Top Gear, had to be on the mind of South African-born Formula One race car designer Gordon Murray as he and his team at the design firm that bears his name engineered their T-series of micro-mini cars. There are two principle criteria when designing a modern F1 race car: make it go fast and insure the driver survives a crash, even at 200+ mph.



ABOVE: Gordon Murray. BELOW LEFT: Remains of Dr. Nadal's G-Wiz. BELOW RIGHT: T.27 crash test.

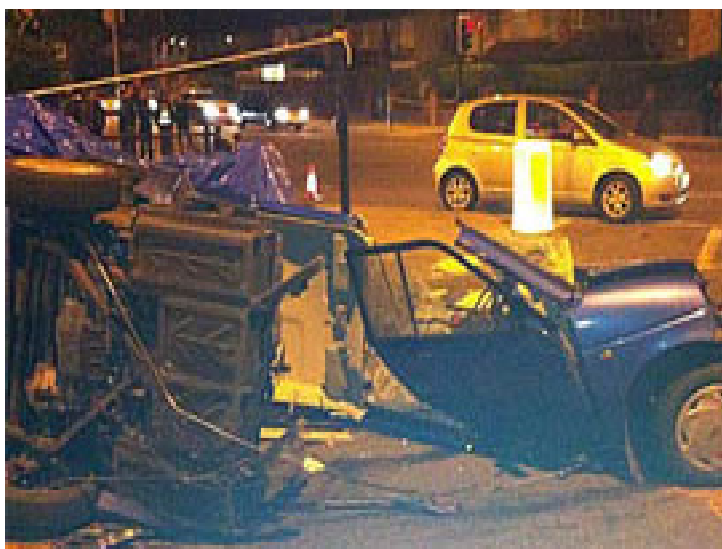
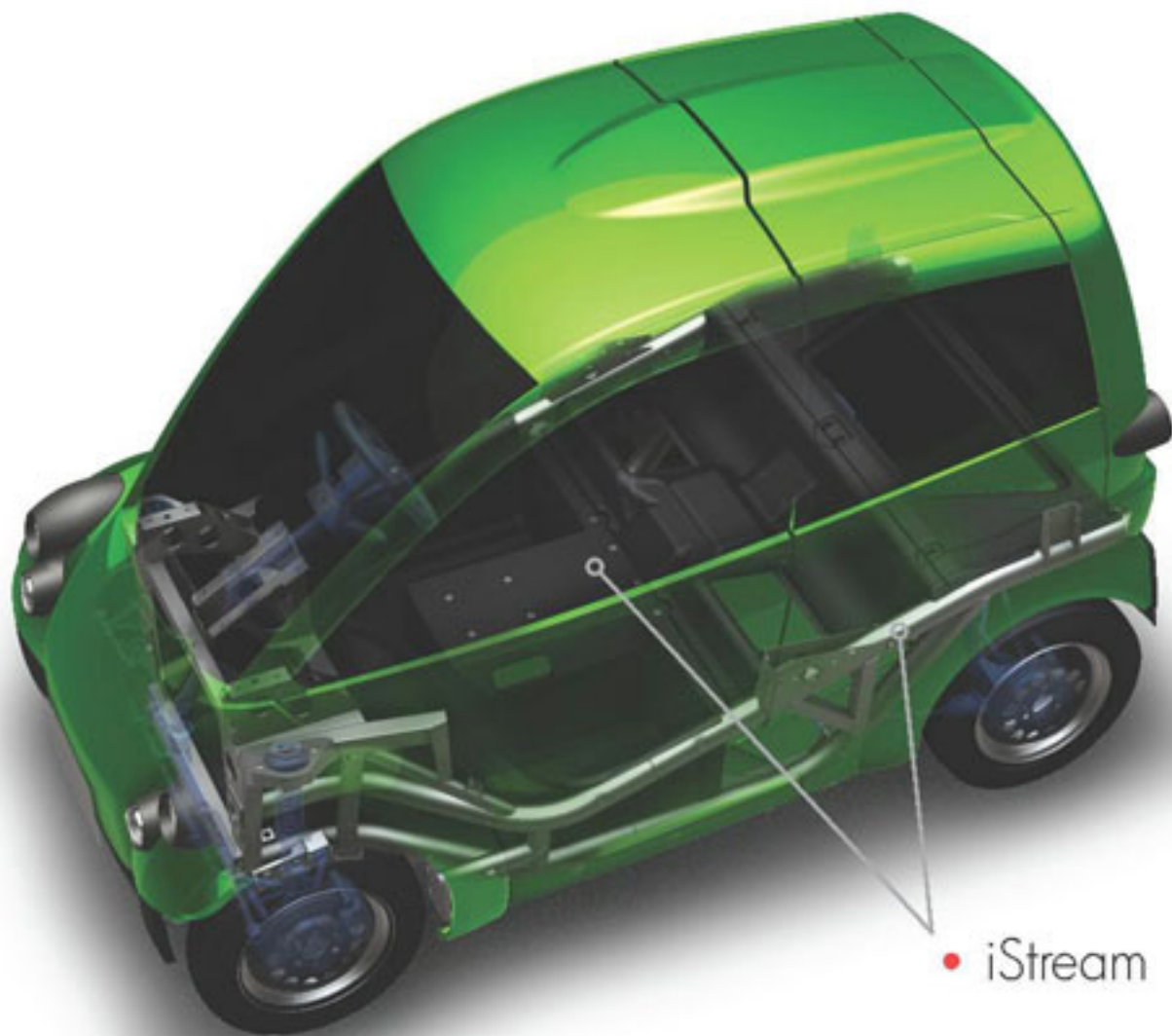


Photo credit: Nigel Howard



Before debuting the battery-powered T.27 recently, Murray subjected the car to the mandatory EEC 40% offset deformable barrier front high speed impact crash test conducted by MIRO, Britain's Motor Industry Research Organization. Smashing into the barrier at 60km/h, there was no cabin intrusion, thanks largely, Gordon Murray Design says, to the vehicle's F1-like chassis design.

While improved safety has been engineered into the car, the team also sought to improve its efficiency and its affordability, and it is the latter that is the principle driving force behind the T.27's creation. Gordon Murray un-

derstands that his strengths lie in engineering and not mass manufacturing, and this is what separates him from Tesla, THINK, and Fisker. He has no interest or intention of creating another car brand. The T.27 electric, and its gasoline twin, the T.25, are demonstrators, developed to show that it is possible to manufacture both safe and affordable micro-mini cars, in a process he dubbed iSTREAM®.

EV World recently had the opportunity to participate in an Internet chat session with Murray, hosted by Shell. We asked him several questions related to iStream, starting with

iSTREAM...

“Could you explain more about the iStream manufacturing process, and how will it contribute to lower the cost of vehicles like the T.27?”

He responded, “Good question. iStream manufacturing reduces capital investment by 90% and manufacturing energy by 60% thereby reducing the retail costs of the car.”

How does he do this? By beginning with the design of the car itself. Besides engineering F1-like safety features into the vehicle, the way the car is actually built is intended to reduce assembly costs. The chassis, running gear, suspension, drive system, etc. are assembled first. Then pre-painted body panels are attached to the vehicle, eliminating the need for the paint shop and reducing the amount of energy required to put the car together.

The illustration below compares the amount of factory space a typical auto assembly plant might require compared to that needed to put a T-27 together. Less space means less capital investment, means less energy, means faster return on investment.

Next, the T-series vehicles are, according to Murray, scalable. The same basic vehicle platform can be adapted to multiple models, further reducing development costs. He explained during the chat session, “It’s a common

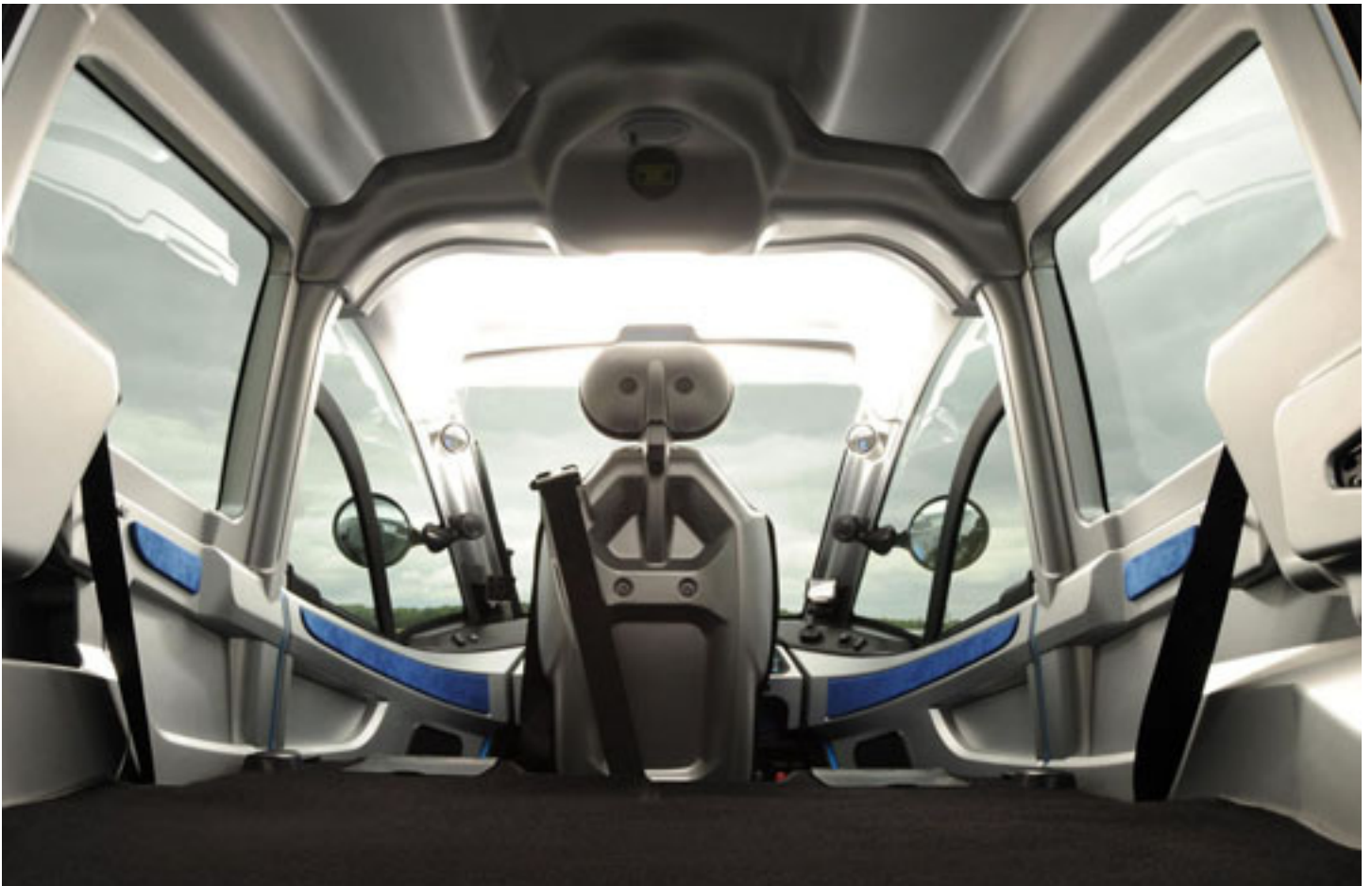
misconception that the T.25 is our only architecture. The T.25 is a working example of our iStream manufacturing process. This process will scale up to much larger vehicles. For example, we are currently working on a 13-seater light-weight transport vehicle!”

Important in driving down the cost of the T.27 electric model is improving its energy efficiency. The more efficiently it uses the energy stored in its battery pack, the smaller the pack can be and therefore the lower the production costs, and the final retail price paid by the customer.

The key to accomplishing this is reducing the mass of the vehicle that the 12kWh battery pack and 25kW electric drive system has to move. The T.27 is small, seating up to three with the driver positioned in the center of the vehicle (see top photo on page 18). Interior cabin space for luggage ranges from 190 liters (6.7 cu. ft) to 750 liters (26.4 cu. ft). depending on how many passengers are on board (see illustration at bottom of page 18). Including the lithium-ion battery pack, the car weighs just 680 kg (1,500 lbs).

Top speed is 105 km/h (65 mph). Acceleration is 0–100 km/h in less than 15 seconds. Initially, Murray and his team projected the range on a single charge at 80–100 miles (128km–160km). But once they rolled out the car for the public, they announced that the car





iSTREAM...

could drive 100+ miles based on the New European Drive Cycle and 130 miles on the European urban driving cycle, making it, they claim, the world's most efficient electric car, which it may well be. A quick 'back-of-the-envelope' calculation assumes they leave some reserve at the top and bottom of the battery's nameplate capacity, say 5% at each end or .6kWh for a total usable battery capacity of 10.8 kWh. That's equivalent to 10,800 watts. Assuming 85% efficiency getting the energy out of the battery to the wheels, that means 9,180 watts are used to propel the car. Using the New European Drive Cycle, that's less than 100 watt hours per mile travelled; and on the urban cycle, it's 70.6 watt hours per mile. Murray calculates the T.27 is "36 percent more efficient than the Mitsubishi i-MiEV and 29 percent more than the Smart car."

Much of the credit also goes to ZYTEK, which developed the 25kW (33hp) electric drive

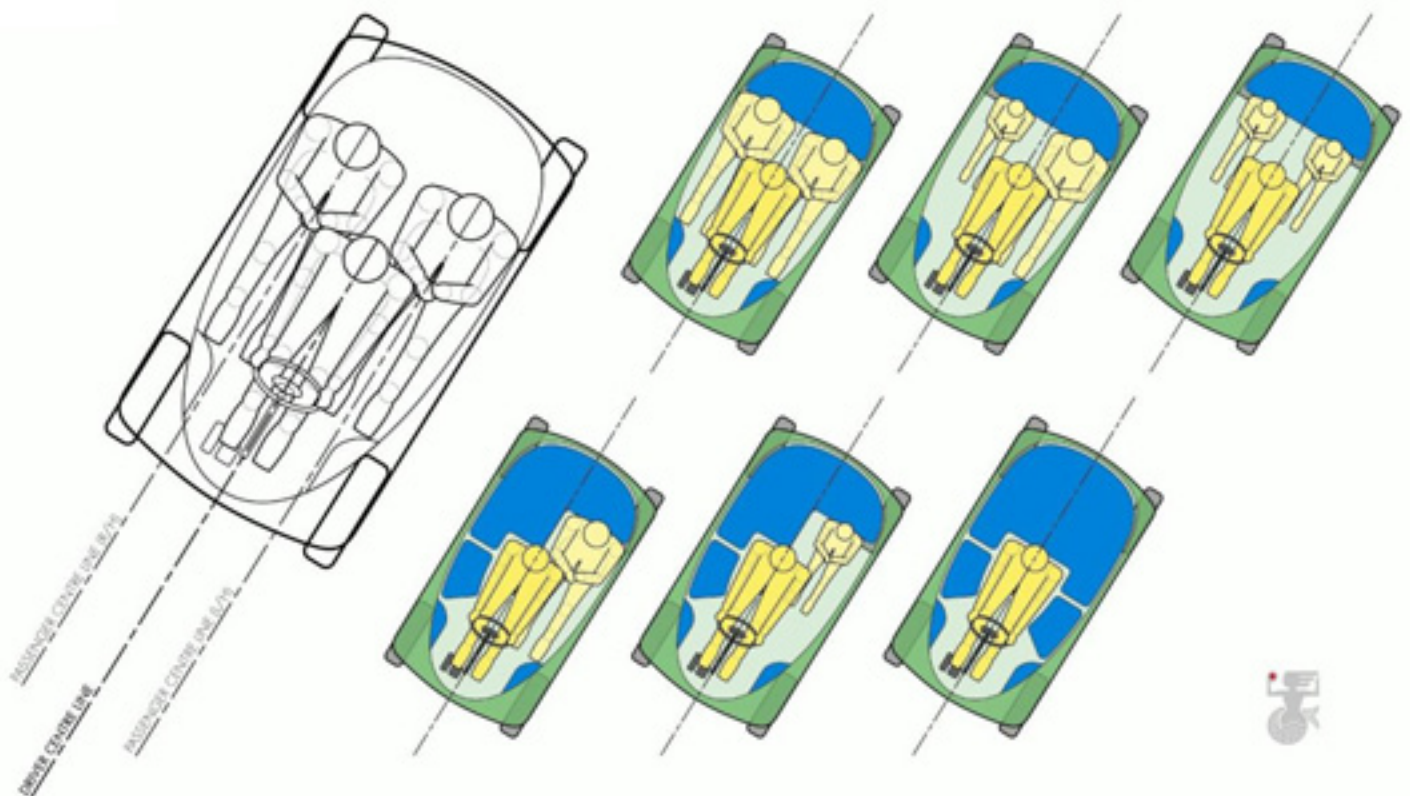
motor with single speed transmission pictured on page 19. In the T.27, it's mounted in the rear of the vehicle below the cargo deck, adding extra crush zone protection.

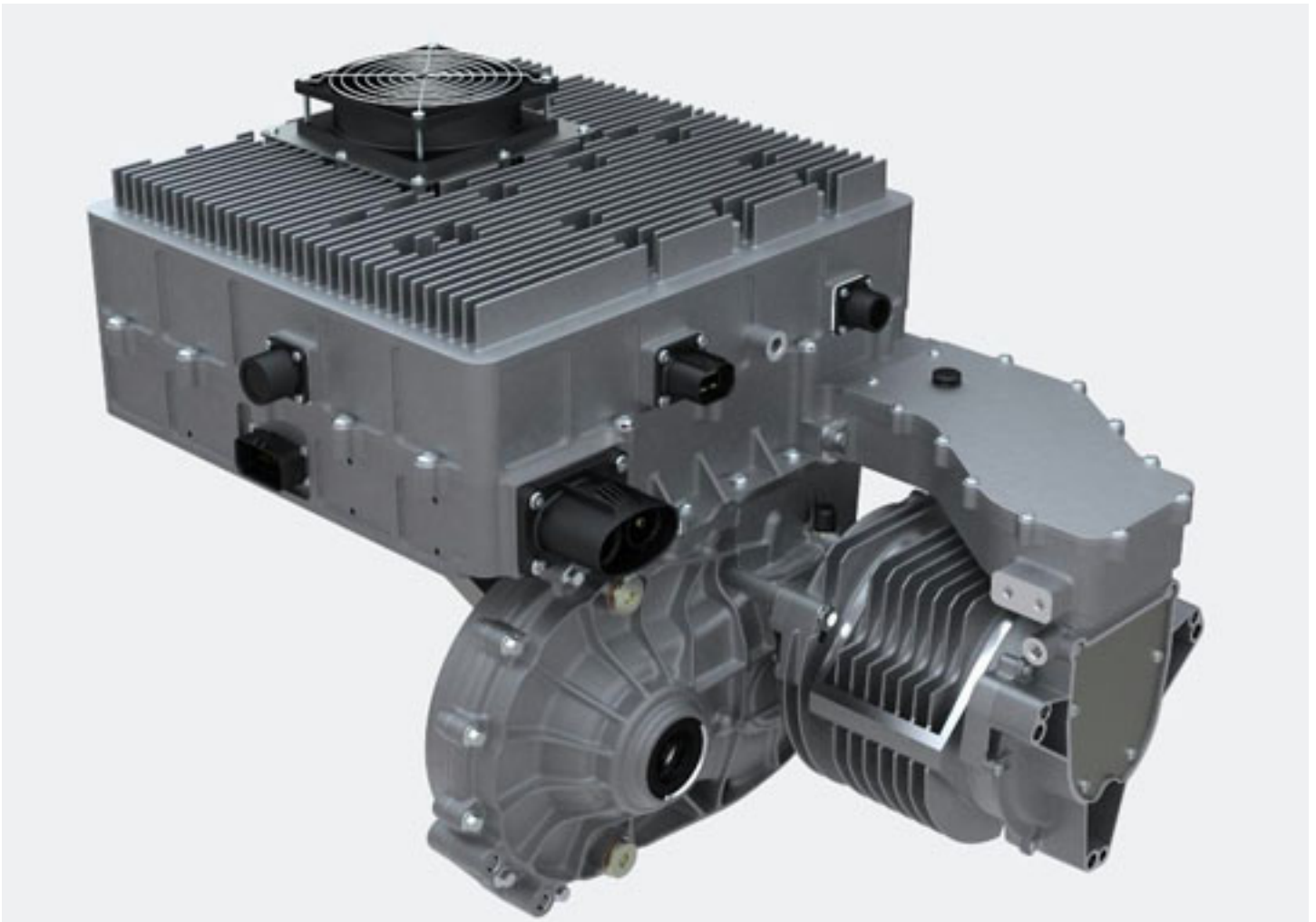
So, how much will these little wonders run, I asked Murray?

"We won't be manufacturing the cars ourselves but licensing the technology. However, the T.25 could be sold for under £7,000 and the [electric] T.27 for less than £15,000."

Near the end of the chat session, I asked him one last question. "Since your design firm is not going to be manufacturing the T-series vehicles yourself, can you discuss when and where we might see them produced, presumably under license using iStream processes? When would you like to see the T.27 become available and in which markets?"

He replied, "We are currently engaged with seven OEM's and several automotive start-ups in negotiating licenses for iStream. We would love to see the T.25 and T.27 built in

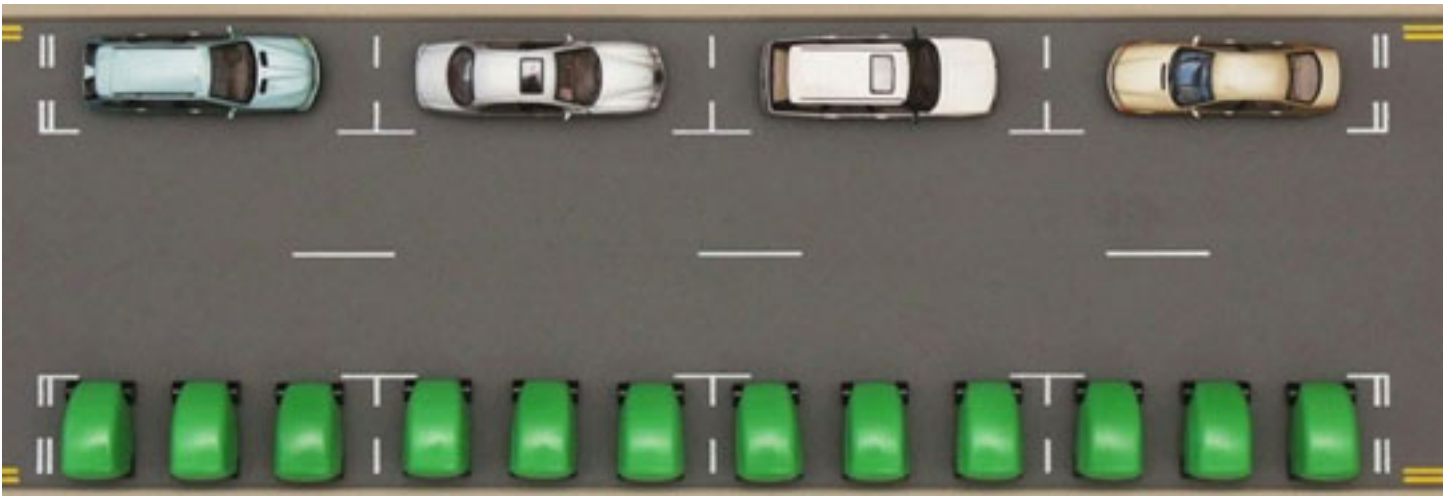




the UK and at this time we are talking to three potential manufacturers for these vehicles. The time to production post contract would be 24 months. The target markets for T.25 and T.27 are UK and Europe.” Early-on speculation had Murray supposedly talking with the likes of Apple, Virgin and Sony about building branded

vehicles for them.

Development of the T.27 took 17 months from a clean sheet of paper to the running prototype. Costs of the £9 million program were shared 50/50 with a £4.5 million investment from the British government-backed Technology Strategy Board.





Toyota Prius PHV plug-in hybrid offers up to 15 miles of EV driving range compared to the Chevy Volt at two to three times that number, but it may be that Toyota's approach is the better of the two.

Environmental Case for Hybrids, PHEV15s

Toyota may just be on to something.

While few commentators have been enamored with the Prius PHV plug-in's puny 4.4kWh battery pack, most considering it too small and offering a mere 12–15 miles of EV range, it could turn out that they are right on target for reasons that have to do not only with resource availability, but in terms of minimizing the environmental damage caused by the production of said battery and its associated Synergy Hybrid Drive.

A number of new academic studies are starting to argue that large battery hybrids and

even all-electric automobiles may not be the best thing for the environment, including a new study by the National Research Council. "Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use" looks at the consequences of how we produce and consume energy from fossil fuels to renewables, including in Transportation, which accounts for 30% of U.S. energy consumption, "the majority of which comes from fossil-fuel consumption."

The committee that authored the study

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explain that in the case of transportation, they “focused on both the nonclimate-change damages and the GHG emissions associated with light-duty and heavy-duty on-road vehicles, as they account for more than 75% of transportation energy consumption in the United States.” This sector alone produced in 2005 an estimated \$56 billion in health and other non-climate change damages, they report; \$36 billion from light-duty vehicles and \$20 billion from heavy-duty ones.

To arrive at their estimates, the committee, made up of academics from a number of American universities, evaluated the damages over four distinct segments of vehicle life cycle: (1) manufacturing of the vehicle; (2) fuel extraction, conversion and refinement; (3) fuel transport and distribution; (4) vehicle operation, including fuel combustion, tailpipe emissions and evaporative emissions.

What they found is, “Electric vehicles and grid-dependent hybrid vehicles showed somewhat higher damages than many other technologies for both 2005 and 2030.” Of course, the chief culprit here, they admit, is the fact that while operational emissions are low (grid-dependent hybrids) or non-existent (battery electric vehicles), they are largely powered by electricity produced by fossil fuel plants: the largest percent being coal-fired.

Additionally, they point out that battery and electric motor production, being energy – and material-intensive, added up to 20% of the damages from manufacturing. The charts on page 33 compare the relative merits/demerits of various vehicle/fuel combinations for both 2005 and 2030; and electric propelled models don’t fair as well as we’d like them to. In the

committee’s view, compressed natural gas vehicles come out quite well overall having “lower damages than other options.”

These and similar studies point out that while electric drive vehicles have their shortcomings both technologically and environmentally, they also have a significant advantage, they can be -- in theory -- powered by energy sources other than non-renewable fossil fuels, including natural gas. What we have to do, and automobile manufacturers like Ford, GM, and Mitsubishi are doing, is make sure that buyers of their electric cars are encouraged to power them with renewable energy sources: wind, solar, new hydro, geothermal, etc. That, of course, can add to the up front costs of electric cars if the purchaser wants to install the energy system as near to the vehicle as possible: either at home or at their place of work, which actually makes the best sense, though it clearly poses significant barriers.

Beyond the customer powering the vehicle with non-fossil fuel energy, car manufacturers and their suppliers have to find ways to reduce the amount of energy it takes to actually manufacture electric drive vehicles; and that is the biggest challenge. It almost seems axiomatic that the more efficient a product becomes in terms of its operation, the more embedded energy is required to produce it. Example: it is reported that the energy it takes to produce a single Apple iPad is comparable to the energy it takes to produce 30+ hardback books. Of course, the functionality and convenience of the iPad more than makes up for that.

But reducing the embedded energy in an electric car, be it a plug-in, battery or fuel cell EV, represents a significant engineering chal-

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lenge.

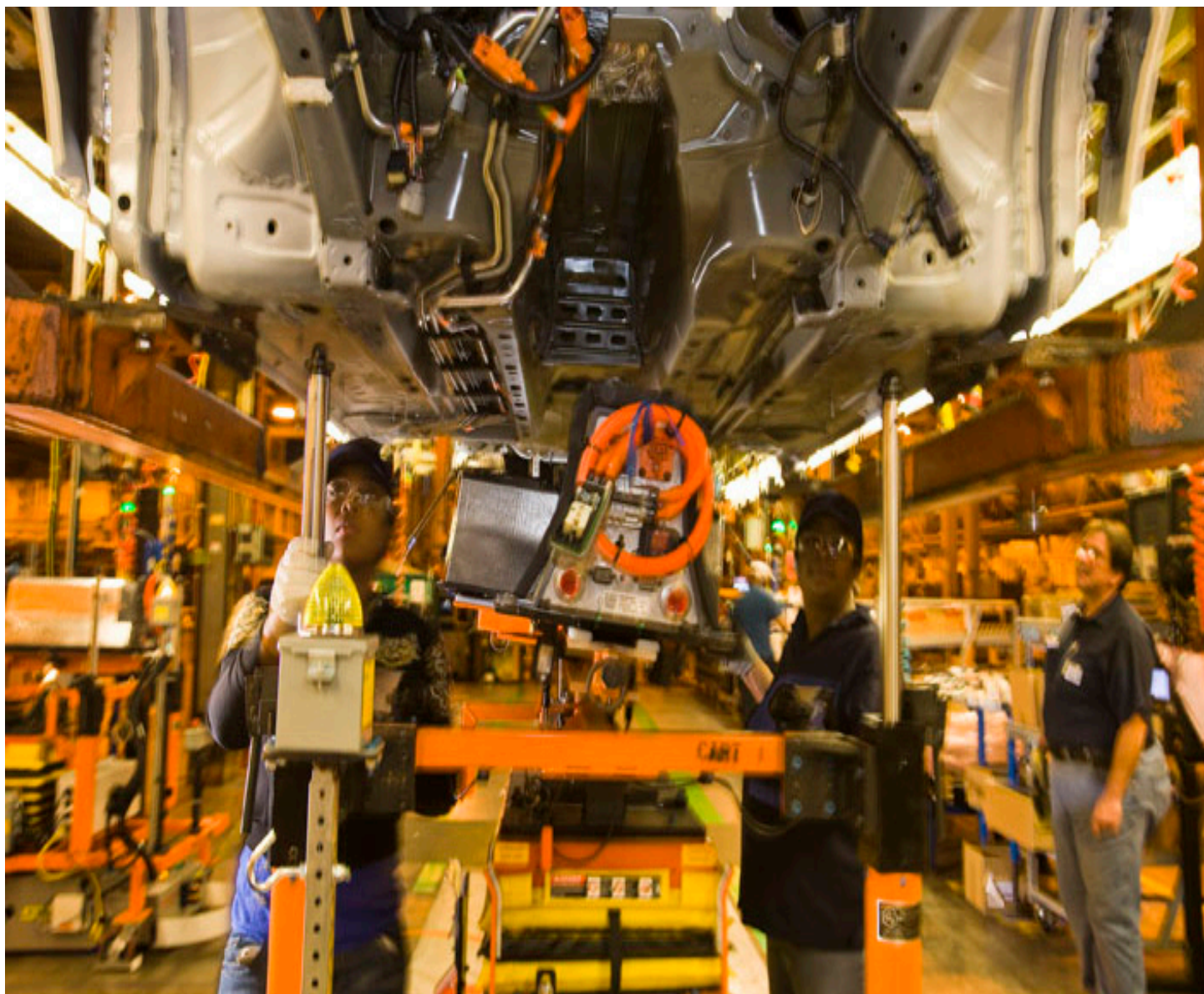
One of the ways to accomplish this is to rely less on battery storage and more in the chemical energy stored in liquid fuels, especially those produced from renewable cellulosic feed stocks, though here there are land and water constraints.

It would appear the answer to addressing the problem is the production of small battery vehicles with liquid fuel range extenders. These can include everything from a natural gas fueled

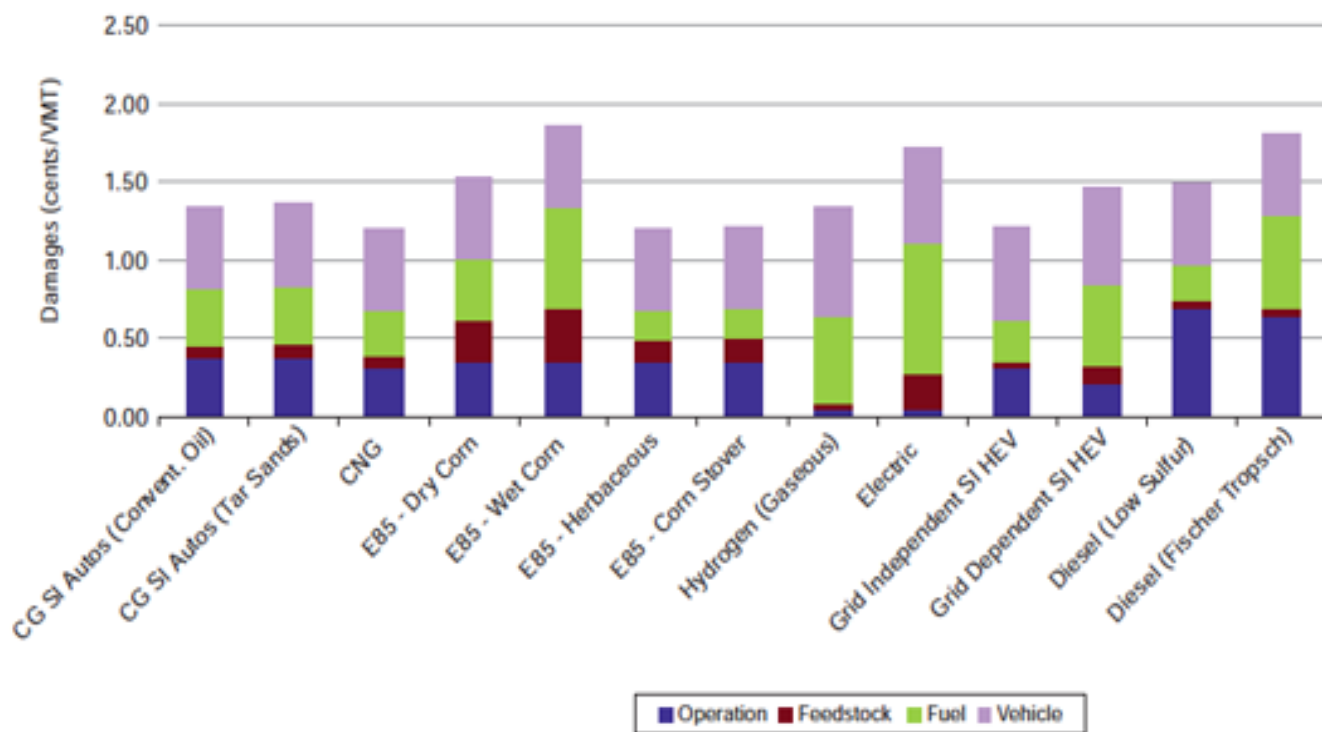
mild hybrid to flex-fuel versions of the conventional sub-2kWh hybrid like the Prius, to the sub-5kWh plug-in hybrid, also burning biofuel or natural gas.

I note that none of these options appear on the NRC diagram on the next page, in part, because, they simply aren't available at the moment. Perhaps the next time the committee gets around to updating this work, more EV owners will be using solar to power their cars, and OEMs will be offering these alternatives that are both efficiency and environmentally responsible.

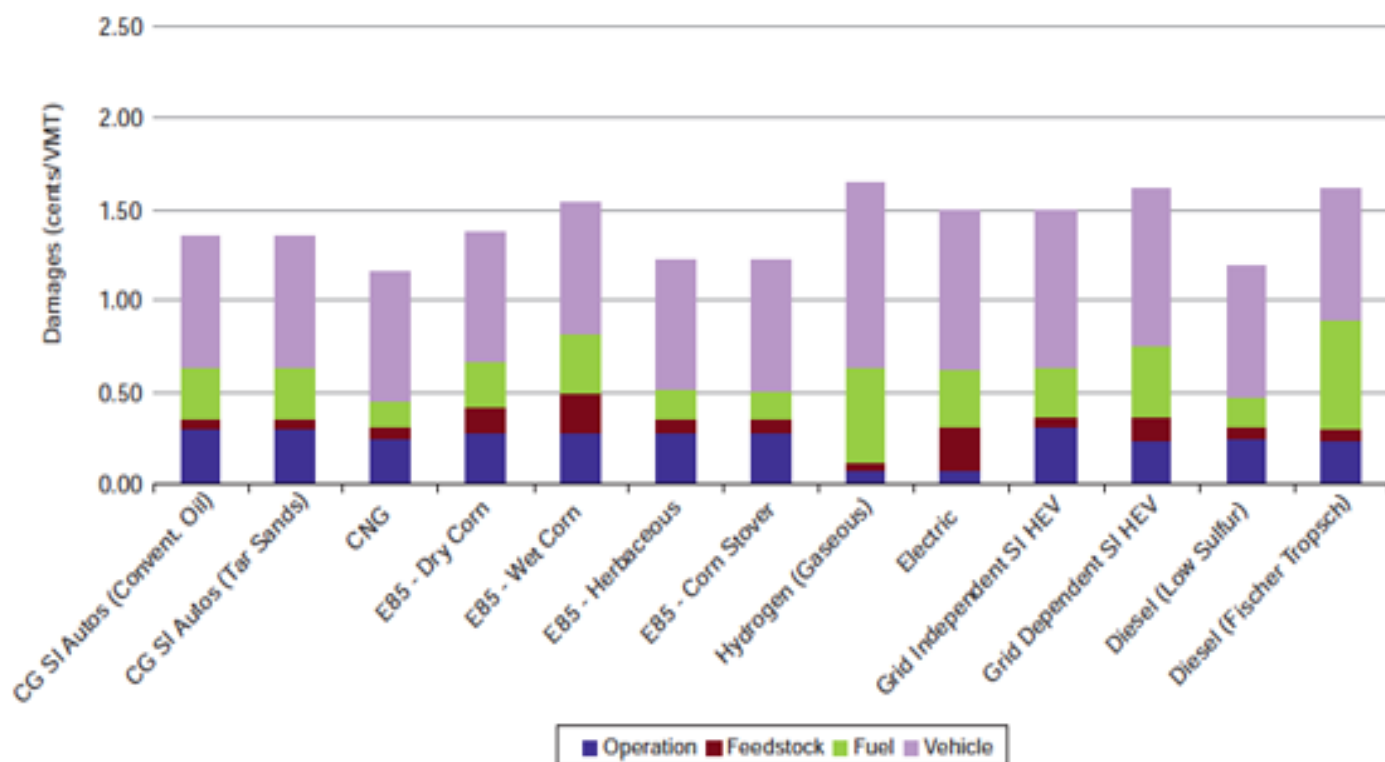
16kWh battery being installed in Chevrolet Volt, giving the plug-in hybrid an electric driving range of between 25-50 miles depending on road conditions, temperature, and driving style.



Health and Other Damages by Life-Cycle Component
2005 Light-Duty Automobiles



Health and Other Damages by Life-Cycle Component
2030 Light-Duty Automobiles





EV WORLD 'HOT SPOT' TOURS

EV World is organizing tours of international EV 'hot spots,' including the tiny principality of Monaco, site of the famed Grand Prix, EV Rally and Venturi Automobiles, the latter developers of an amazing range of electric vehicles from French postal vans to Antarctic explorers.

Our tours will be 7 days and nights, including visits to EV design and production facilities, tours of historic sites, electric vehicle ride & drives, first class accommodations and five-star meals.

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ABOVE: Venturi Volage, developed in Monaco, is the first vehicle to utilize Michelin's ActiveWheel technology.