The Automotive Trends Call for Transformative Technology
(or why the status quo won’t remain so)

by Gary S. Vasilash
Editorial Director
Sacrifice
Seduction
Welcome to the world of Environmental Vehicles 2.0
It’s not just about looking good

Alison Brie & Chevy Volt
But manufacturing, too
Well, the former is more intriguing
This is serious stuff
Sonata Hybrid Transmission
You need this
To get this
To make this
Which is done here: Valmet factory in Finland (also builds Porsche Boxster)
Fisker Karma

- 0 to 60 mph—5.9 seconds
- 125 mph
- 67 mpg
- Two 201.5-hp electric traction motors
- 2.0-liter, 260-hp GM Ecotec engine (generator)
- 50 miles EV; total 300
Fisker, incidentally, got a $528.7-million loan from the Department of Energy
So, how relevant are the alternatives?
Toyota Prius
Cadillac sales through April: 53,639 —Autodata Corp.
Prius sales through April:
55,256 –Autodata Corp.
Lutz on EVs

“How could we, the world’s largest and, arguably, the most technologically capable car company in the world, declare the lithium-ion battery not feasible for motor vehicles when some outfit run by a couple of dot-com billionaires was making it work?”

Car Guys vs. Bean Counters
Lutz was talking Tesla
Tesla makes this

The Lotus Elise-based Roadster
And it will be making this Tesla Model S
Tesla Factory
Fremont, California

“Everything from body panel stamping to final quality testing will take place at the Tesla Factory.”--Gilbert Passin, VP, Manufacturing

Tesla photo
Tesla & Toyota

• Tesla buys the NUMMI plant in Fremont, CA—former GM/TMC jv
• Toyota invests $50-million
• Companies sign cooperative agreement
Akio Toyoda on Tesla

“I’ve felt an infinite possibility about Tesla’s technology and its dedication to monozukuri.”
Monozukuri?
Skills & spirit for making things.

Yes, even dot-com billionaires impressed him with their ability
BTW: Fisker bought the GM Wilmington Assembly plant ($18 m) to produce the Project NINA ($39,900 after tax credits)
Isn’t it curious that two non-trad builders own major plants?
So What Did Lutz (GM) Do?
This: The Volt
A tech tour de force
But Nissan has brought the LEAF
The LEAF: 2010
100-mile range
Parent company Renault is serious, too
VÉHICULE ÉLECTRIQUE: LES ORGANES SPÉCIFIQUES

1. BATTERIE LITHIUM-ION
   LITHIUM-ION BATTERY

2. ONDULEUR ET TRANSFORMATEUR
   POWER INVERTER AND TRANSFORMER

3. BOÎTIER D'INTERCONNEXION ET CHARGEUR
   JUNCTION BOX AND BATTERY CHARGER

4. MOTEUR ÉLECTRIQUE ET RÉDUCTEUR
   ELECTRIC ENGINE AND REDUCER

5. PRISE DE CHARGE BATTERIE (LENTE/RAPIDE)
   SLOW/QUICK BATTERY CHARGE SOCKET

6. AFFICHAGE TABLEAU DE BORD
   DASHBOARD DISPLAY
Renault-Nissan Alliance. . .

• . . . and the People’s Government of Wuhan
• The Irish Government, the ESB, the nation’s largest electricity utility, and . . .
• Madrid City Council and . . .
• The municipality of Sao Paulo and . . .
• Milton Keynes Council and . . .
• . . . and All Japan Ryokan Association

All working to deploy EVs and installing EV infrastructure (a.k.a., charging stations)
Because movie starts love EVs, here’s the Renault Fluence Z.E @ Cannes
And Ford is bringing this by 2013—Focus Electric
“Electric mobility is the task of the century for the automotive industry. . . . Manufacturers, suppliers, energy providers, scientists, and politicians—everyone must step up to the plate here.”

--Martin Winterkorn, VW Group Chairman, 5/6/11
So it is about the diffusion of tech. And some people are concerned.
Some people are always concerned.
“If I asked people what they wanted, they’d say a better horse.”—Henry Ford
Good thing he didn’t listen.
Still, the early automobile had issues.
Consider circa 1900

- No gas stations
- No paved roads
- No traffic signs
- No traffic signals
- No AAA
- No headlights
- No roofs
- No self-starters
- No lease programs
Deloitte Consulting’s 6 EV barriers (2010)

1. Familiarity
2. Brand
3. Range
4. Charging
5. Infrastructure
6. Price & ownership cost
Deloitte Consulting’s 6 EV barriers
Applied to early cars

1. Familiarity—Who owned a car?
2. Brand—Ford?
3. Range—No gas gauge until 1922
4. Charging—Not many pumps
5. Infrastructure—Not many roads
6. Price & ownership cost--$850 for ‘08
So as we move to this, we’ve got to keep things in perspective
China drives past US as world's No.1 auto market

BEIJING, April 21, 2010 (Reuters) - China's auto market, which overtook the United States as the world's largest last year thanks to a raft of policy incentives, has been a major bright spot amid a global industry downturn.
On the one hand, this means plenty of opportunity for vehicle manufacturers in China—nice, for them, but not necessarily helpful here.
On the other hand, this means that when the Chinese—who have significant money because of things like this:
--start buying more things like this
How long will it take to get to this?

$20 Per Gallon

How the Inevitable Rise in the Price of Gasoline Will Change Our Lives for the Better

CHRISTOPHER STEINER
“The U.S. has 750 cars for every 1,000 people. China...has 4 cars for every 1,000 people. If China gets to only half the ownership rate of the U.S., it means an additional 400 million cars on the road...like adding another two U.S.’s worth of cars to the world.” — Christopher Steiner

$20 Per Gallon (2009)
And let’s not forget about this:

CAFE
CAFE for Cars

2008: 30.3 mpg
2016: 37.8 mpg
↑ 25%
CAFE for Trucks

2008: 22.2 mpg
2016: 28.8 mpg
↑ 30%
The U.S. may require annual fuel-efficiency improvements of 2 percent to 7 percent from 2017 to 2025 for cars and light trucks, according to the National Highway Traffic Safety Administration.

The agency said in a May 10 Federal Register notice it will evaluate the costs and environmental effects of boosting fuel efficiency in the proposed rule it’s scheduled to publish in September.

Automakers must have a fleet-wide average of 34.1 miles per gallon, according to the existing fuel-economy rule that applies through model-year 2016 vehicles. NHTSA is developing the next rule with the Environmental Protection Agency and California’s Air Resources Board.

The U.S. said last year automakers selling cars in the U.S. may be required to almost double fuel economy to as much as 62 miles per gallon by 2025 models with annual fuel-economy increases of as much as 6 percent.
“Over the next few months, regulators are scheduled to set the next round of U.S. fuel economy standards for manufacturers. Among the proposals under consideration is one that would lift average fuel economy under the law to as much as 62 mpg by 2025.”

And there is this
According to Energy Information Administration, during the week of 5/9/2011 regular gas cost $1.06/gallon more than a year earlier.
And let’s not forget about this
So is it all smalls, hybrids, or EVs?
Nope.
These are not going away anytime soon
But they need to get more efficient.
(Remember those CAFE numbers?)
So here’s how to build a better engine: what you get & what it costs (data from John German, then with American Honda, now with International Council on Clean Transportation)
Homogeneous charge compression ignition (HCCI)

cost: $233-606  benefit: 10-12%
Camless valve operation
cost: $336-673  benefit: 2.5%  Valeo
Lean Burn Direct Injection
cost: $500-750  benefit: 9-16%  GM
Piston w/oil cooling jet for DI
Turbocharging

cost: $120-690  benefit: 5-7%  Honeywell
Cylinder deactivation
cost: $203-229  benefit: 4.5-6%  Honda
Start-stop systems
Cost: $563-600  Benefit: 7.5%  GM
Multivalve DOHC with variable valve timing and lift
cost (6 cyl): $1,262  benefit: 1-4%

![Image of engine](image-url)
Electric Power Steering

cost: $118-197  benefit: 1.5-2%  Nexteer
Continuously variable transmission

cost: $100-139  benefit: 3-5%  Nissan
Dual-clutch AT
cost: $141  benefit: 4.5-7.5%

Audi Q5
7-Gang-Doppelkupplungsgetriebe S tronic
7 speed dual-clutch gearbox S tronic
07/08
H.E. Alternator & electrification
cost: $124-166  benefit: 1-2%  Denso
Internal combustion engines have to get much better. It will take new tech. And new manufacturing processes.

Cases in point:
The changes to the Prius hybrid system.
Changes: 2\textsuperscript{nd} & 3\textsuperscript{rd} gen Prius inverters
Changes: 2\textsuperscript{nd} & 3\textsuperscript{rd} gen Prius MG1
Changes: $2^{\text{nd}}$ & $3^{\text{rd}}$ gen MG2
Changes: 2\textsuperscript{nd} & 3\textsuperscript{rd} gen Prius transaxles
Changes: 2\textsuperscript{nd} & 3\textsuperscript{rd} Gen Prius power split device
No auto company is getting here without all that

CAFE for cars:
2008: 30.3 mpg
2016: 37.8 mpg
↑ 25%
And there is the Hydrogen future
Toyota, Air Products, Shell, DOE, and South Coast Air Quality Mgmt. District open 1st pipeline-fed station in Torrance, CA May 10, 2011
“We plan to bring a fuel cell vehicle to market in 2015, or sooner.”

Chris Hostetter, group vp, Product & Strategic Planning, Toyota Motor Sales
Honda FCX Clarity driver likes it, too
Shai Agassi: Making a Better Place
Better Place has signed partnerships with:

- Israel
- Denmark
- Australia
- California
- Hawaii
- Ontario, Canada
- Japan
“Importantly, the new DNA transforms the automobile from simply a means to get from point A to point B to a node in a global network that integrates the flows of vehicle, information, and power.”
Shanghai World Expo Rolling in GM ENVI vehicles
Bottom Line: How many people thought this was feasible?
So maybe...
Seduction
Jaguar C-X75

• 205 mph
• 0 to 62 mph in 3.4 seconds
• Four 145-kW electric motors at each wheel
• Two 80K rpm micro turbines
• 560-mile range
Jaguar C-X75

• “There is a clear business case for this exclusive halo model. No other vehicle will better signify Jaguar’s renewed confidence and excellence in technological innovation than this.” -- Adrian Hallmark, Jaguar Brand Director

• 250 to be produced
• Price starts at £700,000
Remember: Back in the day (1912) this was exotic, too
But I’m guessing rather than the Jag, most of us will get something like this.
Thanks