

## **Affordable PHEV's—Now.**

The PHEV (Hybrid plug-in vehicle) has the potential to help America achieve independence from foreign oil: This is the objective behind the following proposal.

PHEV's, have an extra rechargeable battery<sup>1</sup> and should be able to get over 100 miles per gallon of gasoline. The rechargeable battery would be plugged into an ordinary house outlet and be recharged at night: Every home becomes a battery charging station.

PHEV's would initially cost about \$10,000 more than a standard vehicle due to the cost of the extra battery; probably a Lithium-ion battery<sup>2</sup>. While two EPRI reports<sup>3</sup> show that life cycle costs of PHEV's will be comparable to those of standard Hybrid vehicles, the high first cost could easily discourage most people from purchasing a PHEV when it becomes available<sup>4</sup>.

In addition, Lithium-ion batteries are still under development (though rapid progress is being made).

The fundamentals that seem to be keeping manufacturers from manufacturing production model PHEV's are (1) final proof that PHEV's can obtain over 100 mpg of gasoline (2) the availability of proven Lithium-ion batteries and (3) fear that the market will be small due to the high initial selling price of a PHEV. The two technical hurdles should be resolved in the near future.

With resolution of the technical hurdles, production model PHEV's could be manufactured in the near future; if there was a market for them. In other words, the final hurdle may be the sales price of PHEV's being no higher than comparable standard hybrid vehicles.

How will it be possible to sell a PHEV that has a battery that costs \$10,000?

The answer is to uncouple the battery from the selling price of the vehicle. This can be done by leasing the battery. The buyer would purchase the PHEV at the same price as a standard hybrid from the dealer and lease the battery from a separate corporation.

For reasons explained later, the leasing program would be offered by a corporation formed as a public-private partnership. This corporation would lease the Lithium-ion battery to the PHEV owner. In so far as the buyer of the PHEV is concerned, the initial cost would be the same as any standard hybrid vehicle.

The cost of the lease at around \$85 per month would be approximately the same as the monthly cost of gasoline for a standard hybrid vehicle; assuming the vehicle is driven 1200 miles each month and premium grade gasoline costs \$2.80 per gallon (with the standard hybrid getting 30 mpg): Depending on the price of gasoline, the lease payments are offset by the savings in gasoline. (Based on the latest Department of Energy forecast for the price of oil in 2025—up 64% from the previous forecast—the price of gasoline is likely to increase between now and 2025.)

Leasing the Lithium-ion battery would instantly make the PHEV a reasonable purchase in the eye's of a buyer.

Pro forma financial statements show that such a corporation could be profitable.

Attachment A shows the essential elements of a pro forma statement using a spread sheet format. It shows the initial year 2007 through the year 2025.

This corporation would probably have to be a public private partnership for the following reasons.

1. To achieve a satisfactory return on investment, the typical private corporation would require a lease price that is two or three times the lease price needed to make the lease attractive to the buyer of a PHEV. A lease price substantially greater than \$85 would deter most buyers and create a barrier to the purchase of the PHEV.

It is not until the cost of the Lithium-ion battery is cut in half that the lease price approaches that which a private corporation would typically charge. Based on the projections in Attachment A this point isn't reached until around 2025.

2. The capital requirements are extremely large. The corporation will have to invest approximately \$9 billion by 2025; and would probably need to invest more after 2025. There are very few companies who have this kind of cash available for such an investment.
3. There is substantial risk; especially during the period between now and 2025. (E.g., Hydrogen vehicles may become attractive and diminish the attractiveness of PHEV's: It may not be possible to reduce the cost of Lithium ion batteries by any significant amount: PHEV's may not live up to their potential.)

These factors may not eliminate the possibility of a private company (such as the automobile manufacturer) or a consortium of private companies from entering the business of leasing Lithium-ion batteries; but they make such a venture highly unlikely.

The purpose of the private-public corporation is to jump start the production of PHEV's and obviate the problems and risks outlined above.

The private-public corporation would be structured so that the private partner could buy out the government's share. It would also pay the government interest on money loaned to the company.

The proposal shown in attachment A is not intended to depict the only way the corporation could be structured: It is simply a way to show that such a corporation is viable.

## **Details of the proposal as depicted in Attachment A.**

### Battery costs<sup>5</sup>.

A 90% learning curve is used to forecast the cost of batteries in future years. In essence, the cost of batteries is reduced 10% from their previous cost every time production doubles.

### PHEV sales.

Sale of hybrid plug-in vehicles (PHEV's) begin in 2007 at a volume of 7000 vehicles. PHEV sales increase 30% year over year for the forecast period or until sales of PHEV's reach 100% of all vehicles sold in any year. Sales of PHEV's as shown in the projection in 2025, represent 4% of total vehicle (cars and light trucks) sales. Under the scenario of 30% year over year growth, PHEV's do not reach 100% of total vehicle sales until 2037.

There is no intention to infer that PHEV's will ever actually achieve 100% of the market for cars and light trucks.

### Debt.

By the year 2025 the corporation will have incurred a debt of \$8.8 billion (all of which is borrowed from the government): And the corporation will have paid the government \$2.4 billion in interest payments.

Debt will continue to grow while sales of PHEV's with leased batteries increase at 30% year over year. When sales level off or grow at a slower rate, debt will decrease. Ultimately, the debt will be repaid to the government in addition to the interest paid yearly.

### Expenses:

Details of expenses are shown on Attachment B

## **Conclusion:**

For reasons of national security, it is imperative that America kick its dependence on foreign oil. A comprehensive strategy is shown in the paper published by the non-profit *The Second of August* ([www.TSAugust.org](http://www.TSAugust.org)) titled "A Strategy for Achieving Independence from Foreign Oil". Such a strategy can avoid any war for oil or massive disruption of America's economy from supply disruptions: providing it is quickly adopted.

An important element of this strategy is the rapid introduction of PHEV's with rapid growth in sales. Leasing batteries, as described above, removes the financial barrier that would prevent customer acceptance of the PHEV; and allows buyers to pay no more than they would for a standard Hybrid vehicle; while their battery lease payments approximate what they would have paid for gasoline.



## Attachment B

<b>Administrative Costs</b>		<b>2007</b>	<b>2025</b>
CEO		\$150,000	\$255,365
CFO		\$125,000	\$212,804
Accountant		\$0	\$106,932
Warehouse Mgr		\$70,000	\$119,170
Warehouse Employee		\$30,000	\$51,073
Warehouse Employee		\$0	\$30,000
Secretary		\$30,000	\$51,073
Software and IT (purchased, maintenance fees & development)		\$30,000	\$150,000
Computers		\$15,000	\$0
Furniture, Office supplies, phone as % of salaries and wages	2%	\$8,100	\$16,528
<b>Total</b>		<u>\$458,100</u>	<u>\$992,946</u>
Benefits at 30% of salaries and wages	30%	<u>\$121,500</u>	<u>\$247,925</u>
<b>Total salaries</b>		\$579,600	\$1,240,871
Office and warehouse @ \$20/sq ft	\$20	<u>\$100,000</u>	<u>\$155,797</u>
<b>Total Admin Expense</b>		\$679,600	\$1,396,668
	Initial sq ft	5000	
	Additional sq ft in 2026	5000	
	inflation rate 3%	3%	

### NOTES

1. PHEV's with a single battery are possible. The single battery could also be leased.
2. Nickel metal Hydride NiMH batteries may be an alternative to Li-ion batteries.
3. *Advanced Batteries for Electric Drive Vehicles*, EPRI Technical Report, May 2004; and its companion report, March 2003.
4. While the EPRI reports indicate that people would be willing to pay extra for PHEV's, the history of other products that provided life time savings but had high first costs would indicate that most people are reluctant to spend a higher initial price "betting" they will save more over the life of the product.

The best example of this is the compact fluorescent bulb that has been available for 15 years with a first cost several times that of a comparable incandescent bulb: Tests prove compact fluorescent's pay for themselves over their life times. The vast majority of people still buy incandescent bulbs due to the high first cost of compact fluorescent's even though these are relatively low cost items (a few dollars versus thousands of dollars for a vehicle).

5. The initial \$10,000 cost is the estimated cost of a battery for an SUV size vehicle. Batteries for smaller vehicles would probably cost around \$7,000. The mix of batteries and vehicles and lease costs for the different size batteries would result in different financial projections. The projections using the \$10,000 battery represents the worse case scenario in terms of debt requirements.