

## DEVELOPMENT OF HYBRID VEHICLE BASED ON BULGARIAN (EU, USA, India) PATENTED TECHNOLOGIES

### SHORT PROJECT PRESENTATION AND OVERVIEW

Hybrid cars are entering the mass market increasingly in parallel with the conventional economic cars that pollute less the atmosphere.

In June this year for the first month through the financial crisis, sales of new cars showed growth in Europe. This is due to the state and municipal financial incentives for the purchase of new more economical and more environmentally friendly cars. The need for these incentives arises from at least two objectives:

The first is the continuous rapid global warming and the second- the accelerated depletion of world reserves of conventional petroleum fuels. Without a doubt the cars passed over the time of high oil consumption. New eco normatives in the European Union are aimed at providing a significant reduction in consumption of petroleum fuels, and the pollution caused by their combustion in car engines (internal combustion engines).

That prompted the beginning of the revival of pure electric cars. So far their range is limited by their small autonomous drive distance, high weight and high cost of operation because of the need for periodic replacement of the necessary electric batteries. And the electricity to charge the electric cars is also obtained from predominantly exhaustible primary energy sources - coal, gas, oil, nuclear fuels and others. Therefore they do not significantly reduce pollution and address the shortage of conventional fuels. Their essential advantage is the ability to cyclically regenerate the energy created in stopping the car through the reversible electromagnetic processes in their motors/generators, than stored in their electric batteries, with a view to its use for the further movement of car.

Because of the greater autonomy of the hybrids compared with the electric cars, while preserving the cyclical regeneration of electric energy in the suspension they are preferred option. So far the most viable option was electric vehicles with internal combustion engines.

#### **1. Benefits of the Patented fuel-effective technical solutions for environmentally friendly cars**

The hybrid electric vehicles with internal combustion engines, apart of the fact that are heavy, more expensive to run and with higher operating costs, also have the disadvantage that in frequent stoppages and accelerations in urban traffic conditions, are losing the kinetic energy in stopping of the car, which does not accumulate sufficiently in effective manner.

One of our innovative and most- energy efficient technical solution to this problem is described in the patent № 65 421 October 2008 by "Automated power system for hybrid vehicles" that optimizes the energy cycle "stop - start" on hybrid cars with electric engines by the following link:

[http://v3.espacenet.com/publicationDetails/biblio?DB=EPODOC&adjacent=true&locale=en\\_EP&FT=D&date=20080731&CC=BG&NR=65421B1&KC=B1](http://v3.espacenet.com/publicationDetails/biblio?DB=EPODOC&adjacent=true&locale=en_EP&FT=D&date=20080731&CC=BG&NR=65421B1&KC=B1).

Also for energy optimization of the cycle has been developed a hydraulic engine-braking system for vehicles described in the same № 65 480 patent in November 2008 by the following link:

[http://v3.espacenet.com/publicationDetails/biblio?DB=EPODOC&adjacent=true&locale=en\\_EP&FT=D&date=20080930&CC=BG&NR=65480B1&KC=B1](http://v3.espacenet.com/publicationDetails/biblio?DB=EPODOC&adjacent=true&locale=en_EP&FT=D&date=20080930&CC=BG&NR=65480B1&KC=B1)

Further development of hydraulic hybrids consists in using them for integrated performing of several functions, such as power supply to any auxiliary vehicle systems (e.g. power steering, cranes and self loading systems in heavy duty vehicles, etc.) and recovery of energy of exhaust gases of the internal combustion engines. That further development in respect of system integration is patented by the patents and patent application as follows:

## Patented Hybrid Car Projects - Summary

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- Integral multifunctional system for motor vehicle – BG Pat. № 62128; US Pat. № 6,539,711 ; EU Pat. № 1144824 and IN Pat. № 214277 (see at:

[http://v3.espacenet.com/publicationDetails/biblio?DB=EPODOC&adjacent=true&locale=en\\_EP&FT=D&date=20030401&CC=US&NR=6539711B1&C=B1](http://v3.espacenet.com/publicationDetails/biblio?DB=EPODOC&adjacent=true&locale=en_EP&FT=D&date=20030401&CC=US&NR=6539711B1&C=B1) )

- Integral multifunctional system for motor vehicle – BG Pat. Application BG 109643, US Pat. Application U.S. Application No. 12/376,392 and IN Pat. Application No.: 0818/KOLNP/2009 (see at: [http://v3.espacenet.com/publicationDetails/biblio?DB=EPODOC&adjacent=true&locale=en\\_EP&FT=D&date=20080331&CC=BG&NR=109643A&KC=A](http://v3.espacenet.com/publicationDetails/biblio?DB=EPODOC&adjacent=true&locale=en_EP&FT=D&date=20080331&CC=BG&NR=109643A&KC=A) )

Unlike the electrical cyclic regeneration, cyclical energy accumulation by hydro accumulators described under patent № 65 480, is more energy efficient in urban traffic and in general is economically preferable because of the much cheaper and lighter hydro accumulators, compared with electrical ones. Hydraulic hybrid vehicles are a cheaper, much lighter and much lower operating costs, not only because of the lower cost of the miniature hydro accumulators but also mainly because of their longer operating life, compared to the electrical ones.

### 2. Our Innovative Concept

All versions of the implementation of the above patented technical solutions for hybrid vehicles, either individually or in combinations, are conceptually distinguished in the fact that the motor in its working regime is most economical. That has been achieved by the selection and design of various motors and transmissions that work in the best regime - energy consummation versus cost-effectiveness ratio-required in the vehicle's working environment. In its braking modes our patented technical solutions are also the most economical, due to the partial recovering of the accumulated kinetic energy, instead of leaving it to turn into heat- which is the case with all vehicles stopped by conventional brakes, and the regeneration of part of the "waste" energy at work which assists the work of the installed on the vehicle internal combustion engine.

### 3. Our Project Description

The project aims to develop, design, implement with the use of Bulgarian patents and know-how a light vehicle, able to be tested in a variety of real road / weather conditions and to finally present an operational demonstration hybrid car.

A parallel goal of development is to demonstrate that the specific units and assemblies in the hybrid vehicles, namely electric and hydraulic machines can be produced locally, either in Bulgaria, where we have extensive experience, or in other EU countries, where it would present huge boost of the local economy together with other numerous benefits.

At present in a process of development, design and testing through computer simulations there are six main versions of the hybrid light vehicle (see attached block diagrams A, B, C and D).

Both options A, B are based on the autonomous electric drive with on board power supply and hydro transmission.

Option A is a serial electro hydraulic hybrid, variant B is a parallel electro hydraulic hybrid. In the third option C the hydraulic power system is driven by internal combustion engine. This scheme is for a serial hydraulic hybrid, the fourth option D is similar to the third one, but presents a parallel hydraulic hybrid.

The fifth and sixth options (not shown as car schemes) correspond to the third (C) and fourth (D) options, which just have additional gas turbines capturing the waste energy of the exhaust gases of the internal combustion engine and hydraulic pumps transferring that energy in pressurized hydraulic liquid in the hydraulic accumulators. These options ensures continuous useful operation of the systems in both stop and go urban driving and highway driving, which dramatically extends fuel and emissions savings.

Used in development are the latest technical solutions in this area, as well as the vast practical experience and accumulated know-how in the design and testing of the patented hybrid cars schemes A, B, C, D and the fifth and sixth options according to two authors' patents (**№ 65 421 of October. 2008 "Automated power system for hybrid vehicles and 65 № 480 from November 2008" Hydraulic engine-braking system for vehicles, Integral multifunctional system for motor vehicle – BG Pat. № 62128; US Pat. № 6,539,711 ; EU Pat. № 1144824 and IN Pat. № 214277 , Integral multifunctional system for motor vehicle – BG Pat. Application BG109643, US Pat. Application U.S. Application No. 12/376,392 and IN Pat. Application No.: 0818/KOLNP/2009** ).

**4. Technology quick overview**

In the first two options A and B the energy accumulation is achieved with two batteries - electric and hydraulic. In the latter two options C and D the energy accumulation is achieved through greater hydraulic accumulators, working with higher pressure.

Schemes A and B present more expensive technical solutions and will require more expensive maintenance due to the necessary periodic replacement of the vehicle's electric accumulators. Schemes C and D are looking to be significantly less expensive technical solutions, which will not require periodic replacement of the hydraulic accumulators due to their much longer length of safe working life. With the use of hybrid vehicles are covered the standard EU environmental requirements for Euro 5 discharge of harmful gases into the atmosphere.

It is calculated these discharged gasses to be even less than the internal combustion engines in the schemes working with bio fuels or natural gas.

Systematic summary and comparison of hybrid cars proprietary schemes A, B, C and D is made in the following table.

**Systematic Summary table for comparison of the hybrid vehicles**

<b>Comparison criteria:</b>	<b>A series hybrid car scheme A (B) *</b>	<b>A series hybrid car scheme C (D) *</b>
Projected calculated Reduction of the consumption of fossil fuel in city driving conditions compared with similar conventional vehicles with internal combustion engines	20 – 34%	10 – 18%
Projected Reduction of the consumption of scarce fuels in country/long distance driving	10 – 20 %	3 – 7 %
Reduction of the consumption of scarce fuels in urban / suburban driving	15 - 22%	6 – 10 %
	<b>Electro hydraulic vehicle schemes A and B</b>	<b>Hydraulic vehicle schemes C and D</b>
<b>Comparative Cost of the vehicle</b>	155 %	100%
<b>Exploitation(Running) cost per 1 000 km</b>	155%	100%
<b>Comparative own weight %</b>	140%	100%
<b>Energy effectiveness per unit own weight</b>	85%	100%
<b>Comparative own weight</b>	140%	100%
<b>Usable loading space per unit own weight</b>	70%	100%
<b>Annual reduction of CO<sub>2</sub>. Based on 15 000 km distance covered per year.</b>	2 900 tonne	2 370 tonne
<b>Frontal air resistance of the vehicle Cx</b>	Approximately the same for the two types	

**As far the options according to Integral multifunctional system for motor vehicle related patent (see above the fifth and sixth options), they provide for about 50-75% better fuel and emissions savings than the above options C and D. These are the results of the systems integrations achieved by the said systems.**

**5. Energy efficiency assessment of the provided options of hybrid cars**

Due to the newly patented solutions in the four provided Hybrid options the regime of work of the engine/transmission is characterized with highly cyclical regeneration of the kinetic energy of the car. This provides the basis of the high economy of operation of the developed hybrid vehicles.

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Evidenced by the attached Schedule A, B, C and D, percentages of coefficient of performance (C.P.) of various units and assemblies differ substantially.

But uniquely, it is clear that hydraulic assemblies and units - pumps, motors and batteries operate with high efficiency - over 90%. Internal combustion engines in all variants operate with the lowest efficiency 30 - 40%, and electrical assemblies and units (batteries, generators, and motors) have an average efficiency of 65 to 80 percent. C.P. of the mechanical transmission of the vehicle is constant to the different schemes -95%.

Energy efficiency ultimately depends on driving style and most of urban traffic congestion. In general in Sofia taking in consideration the high density of traffic lights, thus the higher number of acceleration and stoppage of the vehicle, leads to higher economy of fuel and reduction of pollutant gases. This process is greater in application of variant of vehicle with pure hydraulic energy storage, because it recycled stored kinetic/hydraulic energy is released more rapidly and energy losses are smaller because of higher efficiency (C.P.) of hydraulic components in the working circle.

\* Hybrid cars with schemes B and D (parallel hybrid) have slightly better dynamic performance and are considerably cheaper in comparison to those in schemes A and B - serial hybrids. Serial hybrids are more energy efficient.

### PROPOSAL

Based on the above points and technologies and know how the Inventors /Company members are proposing the following scheme of Partnership with Investor in the venture as follows:

**1. Final research and development of an energy efficient, fuel saving and economical viable innovative power/drive/braking system propelled hybrid vehicles for urban and suburban use**

**2. The Development team will have the following obligations:**

- At best of its ability and skill to develop, design, implement with the use of Bulgarian patents and know-how a light vehicle, able to be tested in a variety of real road / weather conditions and to finally present an operational demonstration hybrid car
- To demonstrate and set path forward for development of production cycle connected with partial or complete production of the assemblies and various units on the local market, as well as the complete certification and further subsequent prove of economic, environment and road worthiness of the created vehicle.

**3. The Development Team will provide The Investor with the following security of the Venture Investment:**

**3.A. Licenses of granted patents for the INVESTOR**

- Namely issue of License to the Sponsor of the patent № 65 421 issued October 2008- "Automated power system for hybrid cars – Owner and Patent proprietor D-r Eng. Sc. G. Tonchev
- Namely issue of License to the Sponsor of the patent № 65480 from November 2008 "Hydraulic engine-braking system for vehicles - Owner and Patent D-r Eng. Sc. G. Tonchev

**3.B. Licenses of know-how of project of hybrid car for the INVESTOR**

**3.C. Partnership of company Ecowat LLC**

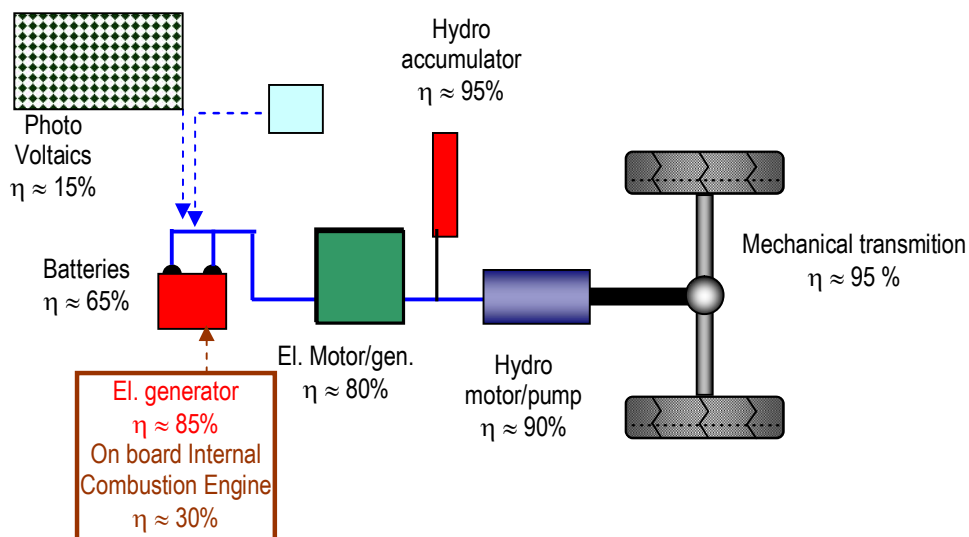
### CONCLUSION

**The Team is open to negotiate at any convenient for both parties time and place the particulars of the above proposal such as terms, conditions, payment , obligations of the sides, only following the Provision from interested party of Letter of Intent , Bank Guaranty, and signature of a Non Disclosure agreement for the provided technical and other information.**

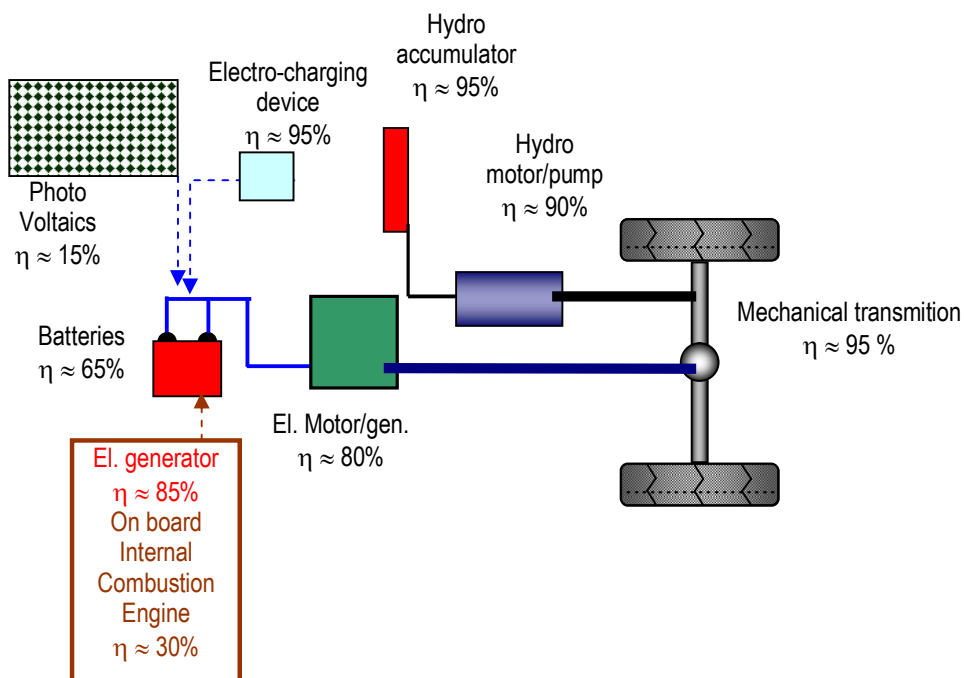
**Dr. Eng. Sc. George Tonchev  
Galina Raychinov  
2009**

Electro-charging  
device  
 $\eta \approx 95\%$

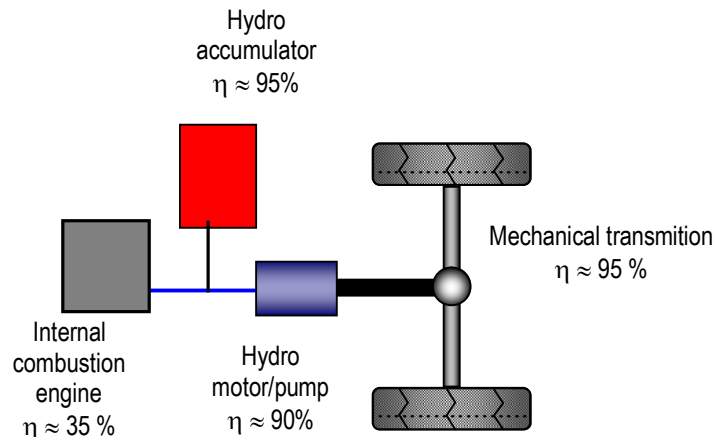
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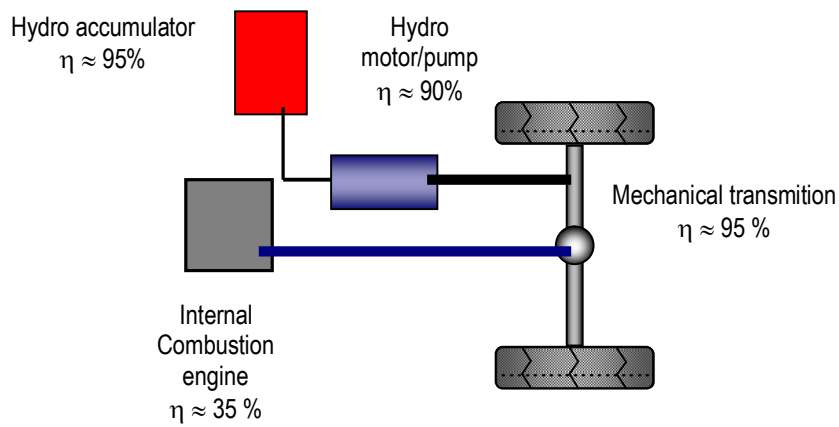
Scheme A



Scheme B



Scheme C



Scheme D