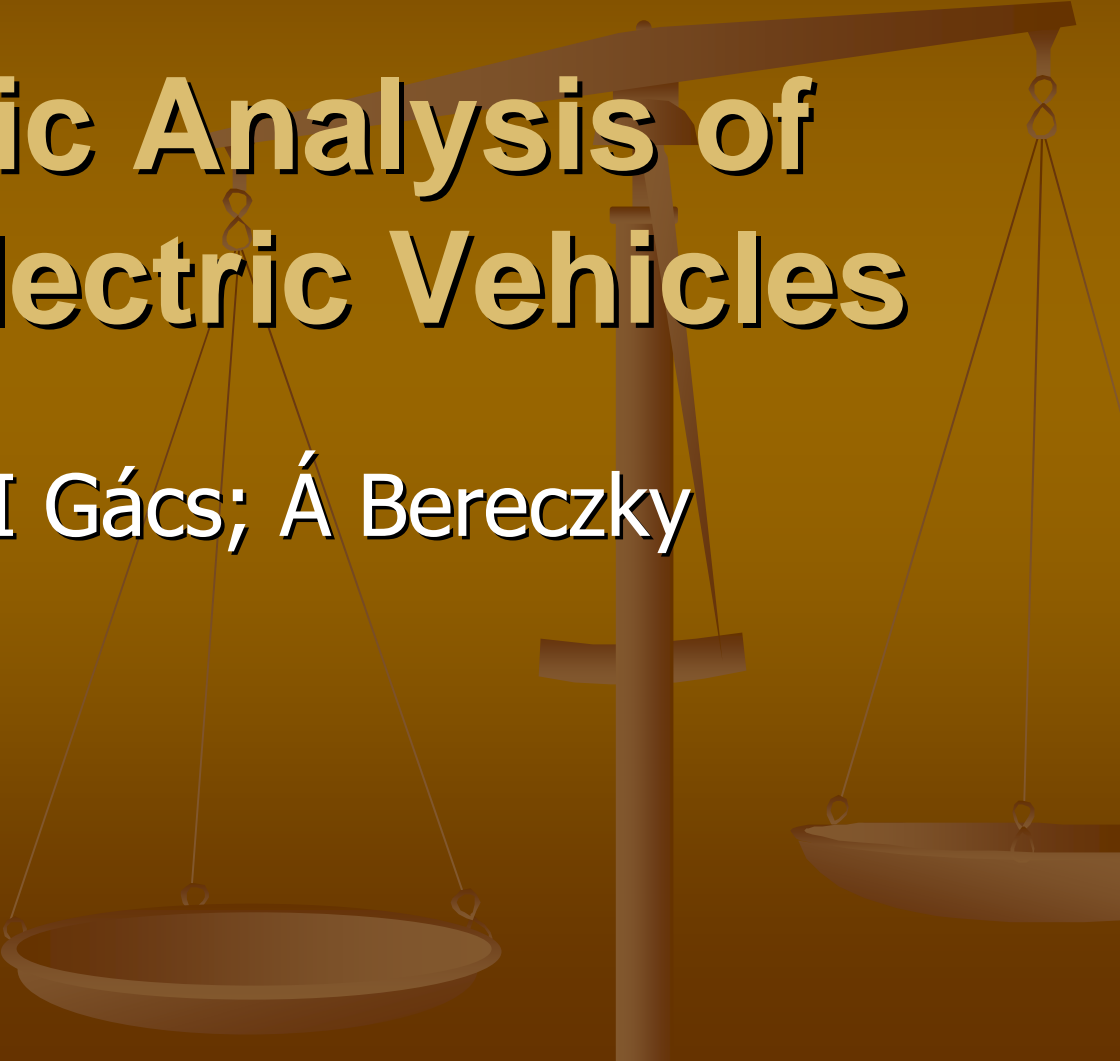


Energetic Analysis of Plug-In Electric Vehicles


A faint, stylized illustration of a balance scale is visible in the background. The scale is tilted, with the right pan being higher than the left pan. The pans are simple, shallow bowls. The entire background is a solid dark brown color.

Á Török; I Gács; Á Bereczky


Electric Vehicles

THE SUPER

Go electric, get more than a car.



INSTANT TORQUE

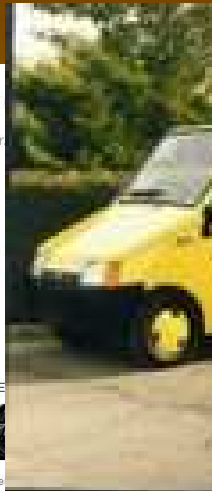


The AC induction motor and single speed gear box create instant torque from 0 rpm. Up to 295 lb/ft of torque and 298 horsepower are produced as the car smoothly accelerates.

SUPER

The electric motor produces instant torque. The Roadster becomes an extension of the driver and reacts in an instant. The optional

electric cars monocoque resin-bonded



Who Killed the Electric Car? (2006)



Case Study: General Motors EV-1

- Power: 102 kW (7 000 rpm)
- Torque: 150 Nm @ 0-7 000 rpm
- Acceleration: 9 second to 97 km/h
- Top speed: 129 km/h
- Charging time: 6-8 hours (in case of NiMH batteries)
- Charging power: 6.6 kW (220 V)
- Range: 110 km
- **energy consumption: 16.6 kWh/100 km (0.268 AC kWh/mile)***

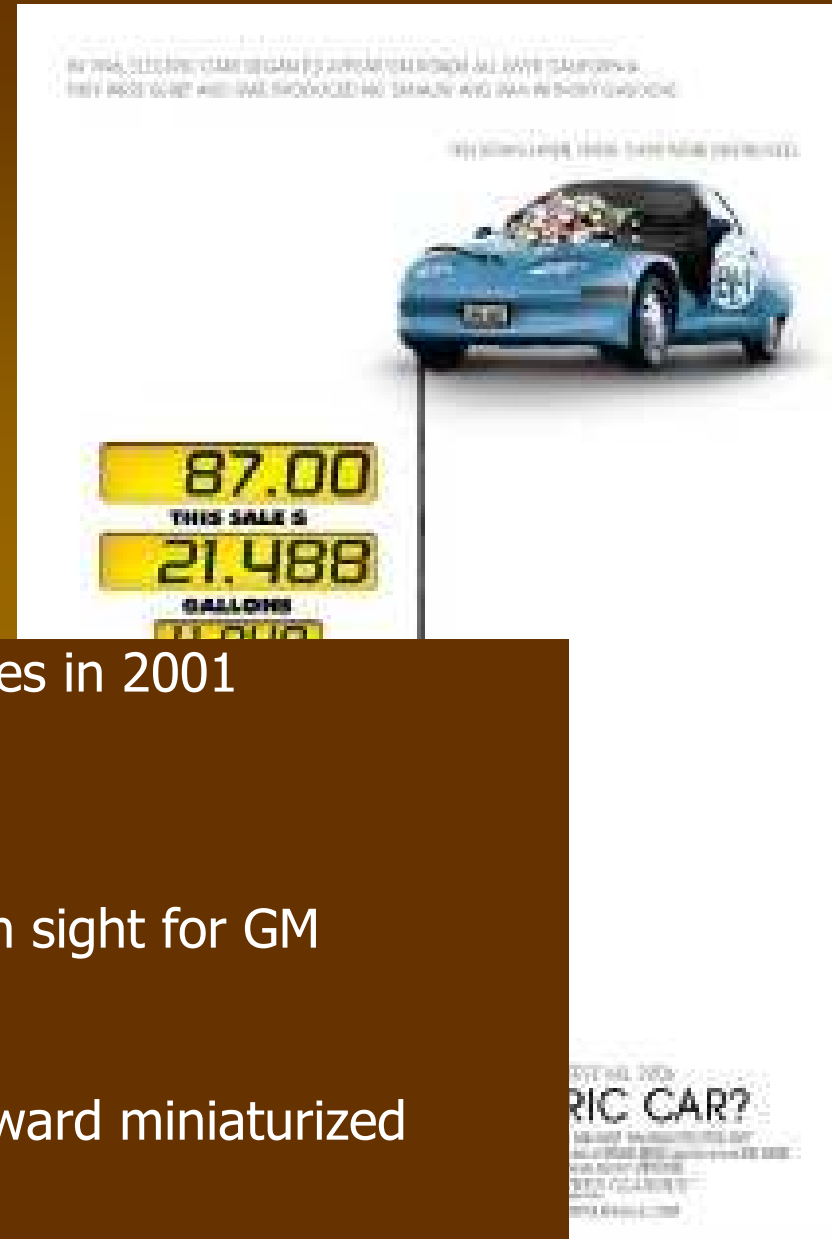


Sources: [7], [14]

2004-2006



- Removal of government mandates in 2001
- Poor driving range
- Long charging times
- Infrastructure of chargers
- Lack of funding with no profits in sight for GM
- Low gas prices (2006)
- Fuel usage efficiency
- This was one of the first step toward miniaturized power electronics

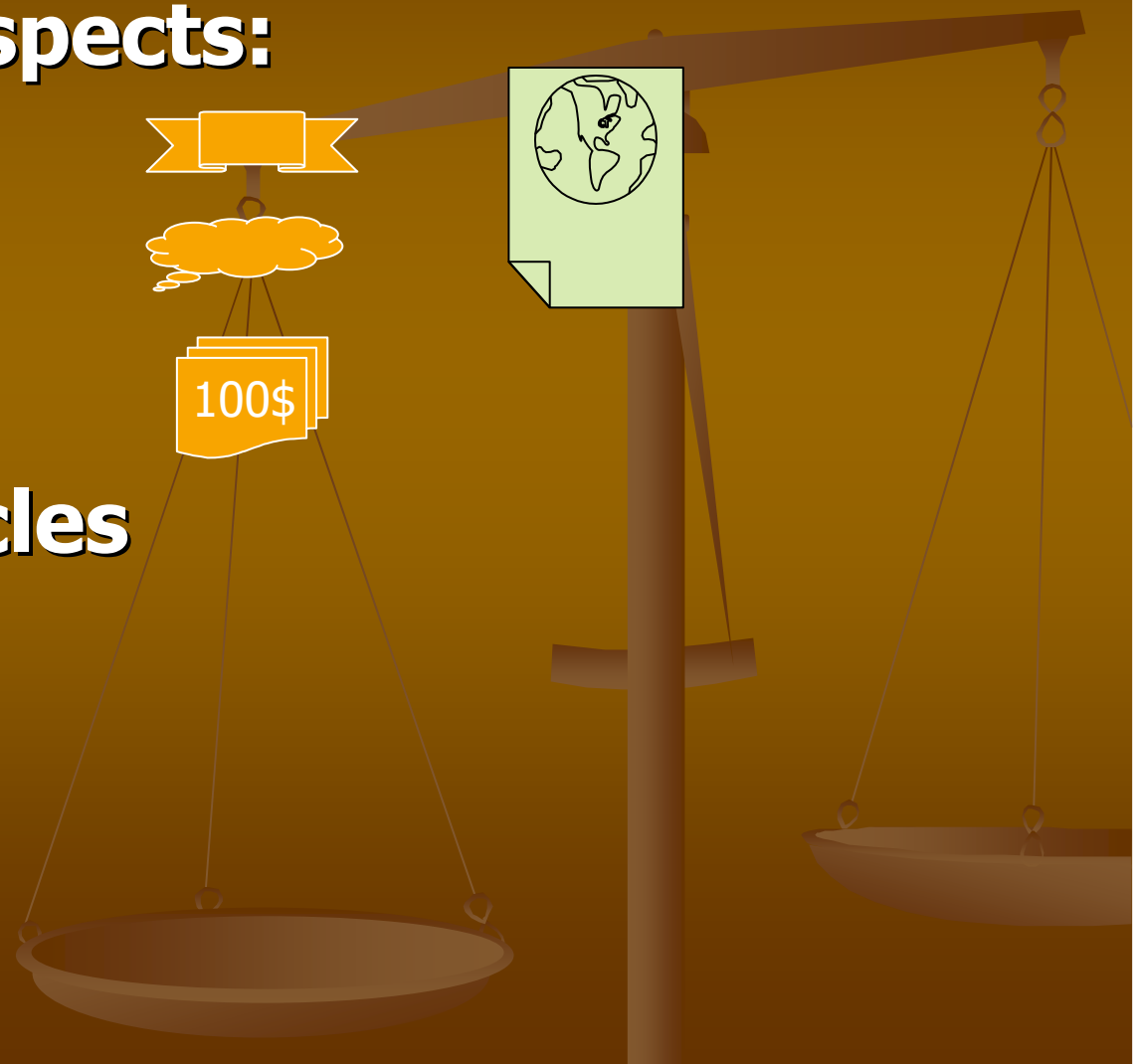


Based: [8]

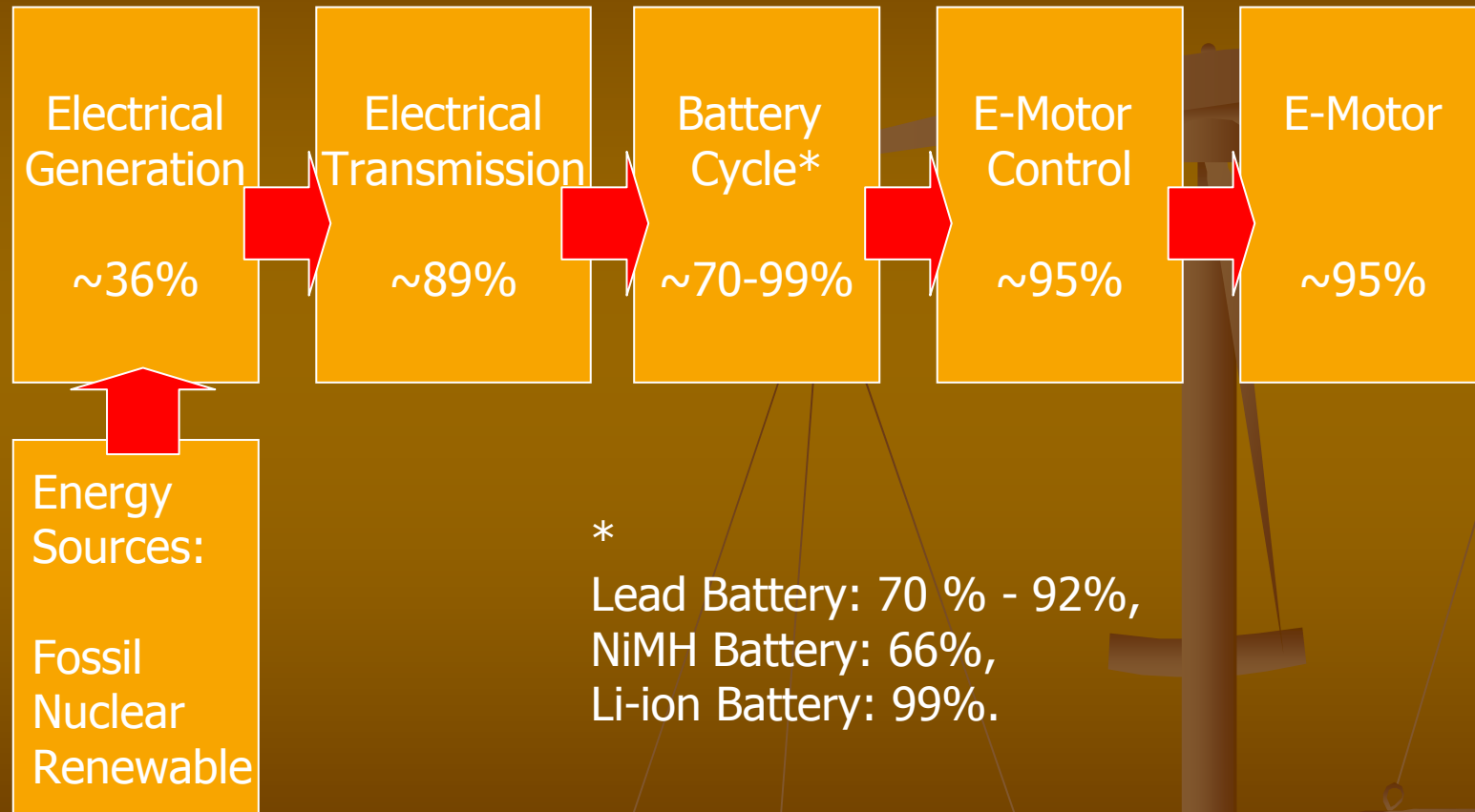
Our Case Study

Energetically Aspects:

- Efficiency
- Emissions
- Economic of electric vehicles

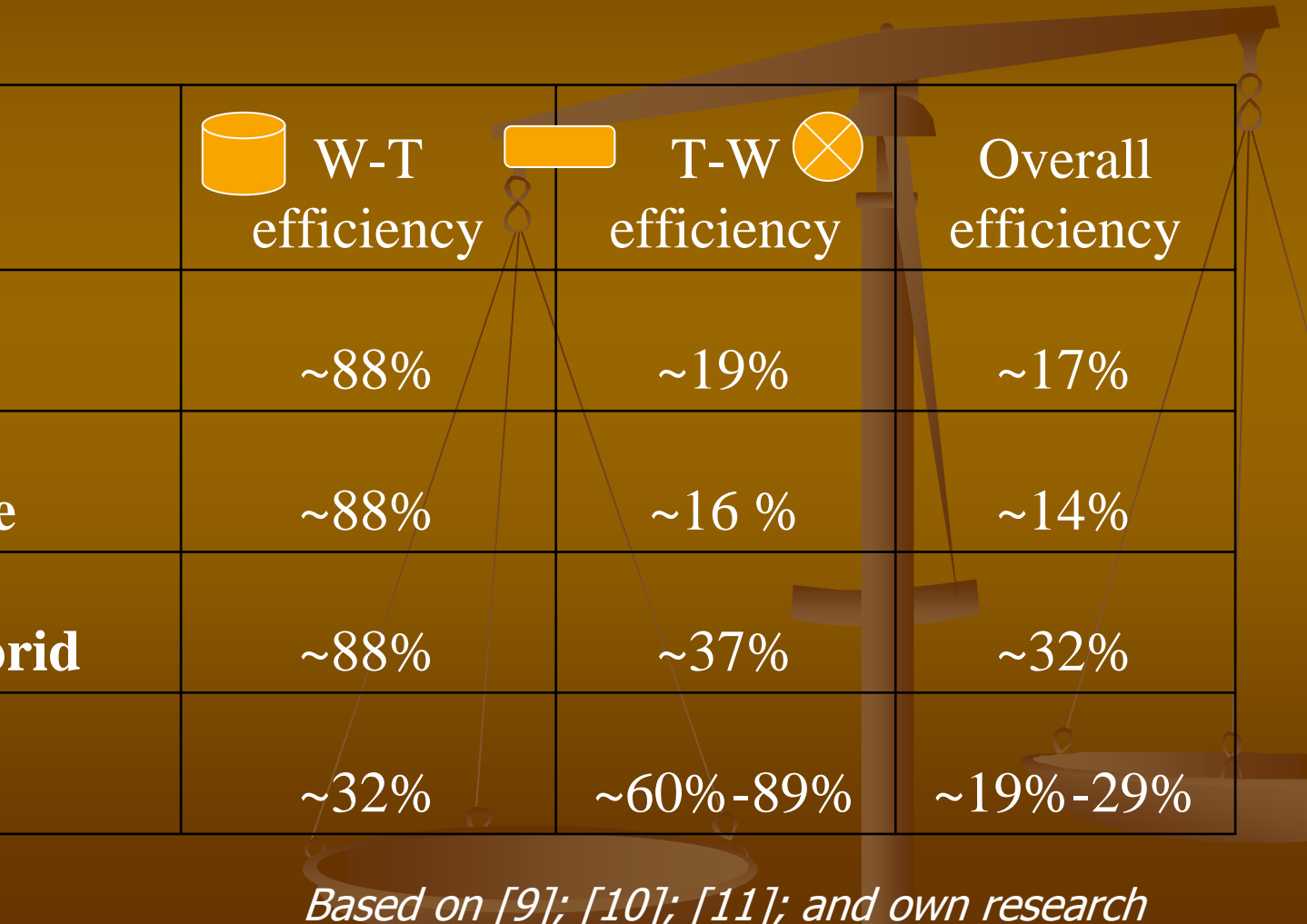





Efficiency



Based on own research

Comparison of Different Drive Trains



	 W-T efficiency	 T-W  efficiency	Overall efficiency
ICE Diesel	~88%	~19%	~17%
ICE Gasoline	~88%	~16 %	~14%
Gasoline hybrid	~88%	~37%	~32%
EV	~32%	~60%-89%	~19%-29%

Based on [9]; [10]; [11]; and own research

Emissions



Electrical
Generation

~36%

Energy
Sources:

Fossil
Nuclear
Renewable

Life-cycle emissions of various power plants

type	SO ₂ [g/MWh]	NO _x [g/MWh]	PM [g/MWh]	CO ₂ [kg/MWh]
Nuclear	32	70	7	9-21
Coal	9000...48000	1250...2150	182	800...1300
Gas	7...10	300...600	18	520...700
Oil	4000...5000	1100...1700	67	630...1000
Wind	15	20	4.6	9-44

Sources: SO₂ and CO₂ are calculated and experimental values; NO_x on the basis of Hungarian legislation 10/2003. (VII. 11.) and [12], [13])

Comparison of Emissions

	SO ₂	NO _x	PM	CO ₂	CO
	g/km	g/km	g/km	g/km	g/km
Nuclear	0,005	0,012	0,001	1,49-3,49	NA
Coal	1,49 - 7,96	0,28-0,36	0,030	124-215	NA
Gas	0,001-0,002	0,05-0,1	0,003	54-113	NA
Oil	0,66 – 0,83	0,18-0,28	0,011	58-155	NA
Wind	0,002	0,003	0,001	1,5-7,3	NA
ICE Diesel EURO-6	NA	0,08	0,005	>100	0,50
ICE Gasoline EURO-6	NA	0,06	0,005	>100	1,00


energy consumption: 16.6 kWh/100 km

Comparison of Emissions



	SO ₂	NO _x	PM	CO ₂	CO
	g/km	g/km	g/km	g/km	g/km
Nuclear	0,005	0,012	0,001	1,49-3,49	NA
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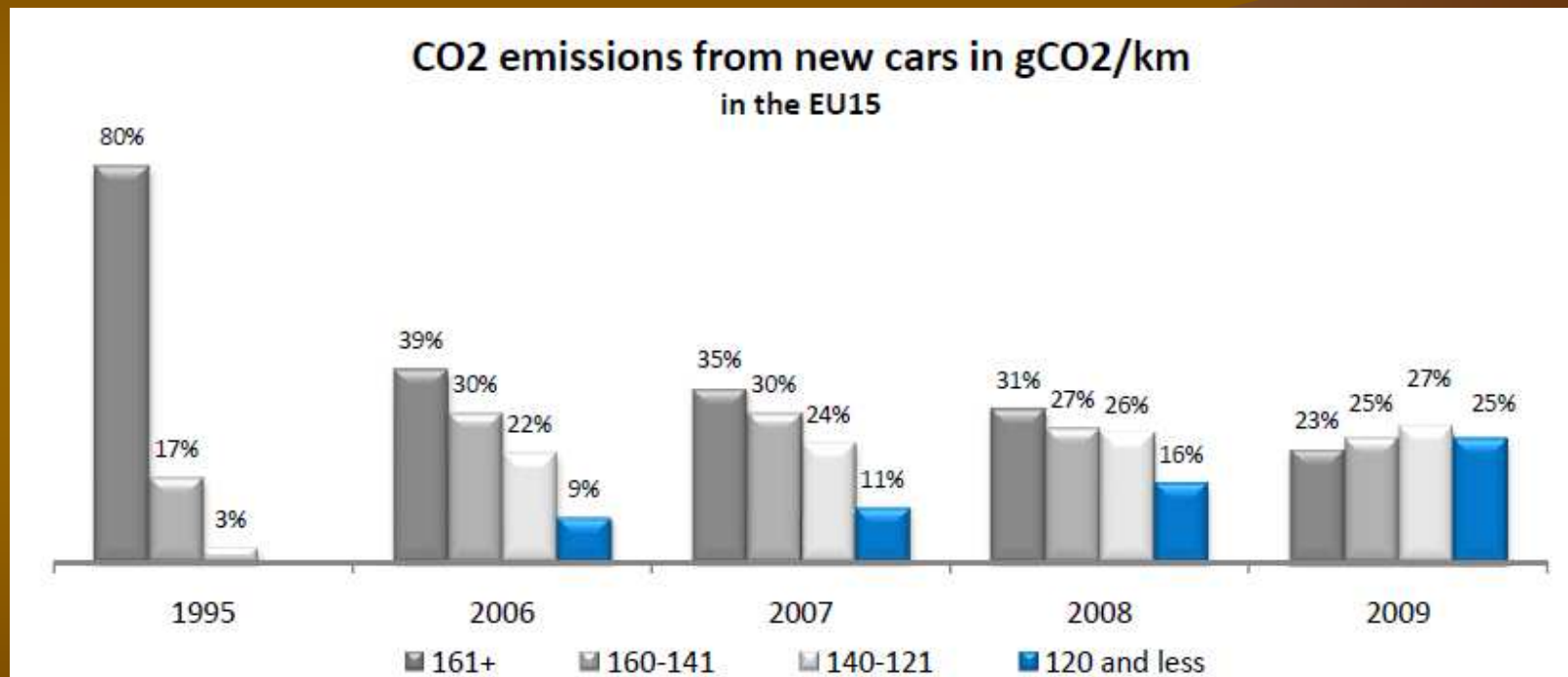
Electric Vehicles Reduce Pollution



	THC	CO	NOx	SO ₂	PM
France	-99	-99	-91	-58	-59
Germany	-98	-99	-66	98	-96
Japan	-99	-99	-66	-40	10
U.K.	-98	-99	-34	407	165
U.S.	-96	-99	-67	203	122
California	-96	-97	-75	-24	15

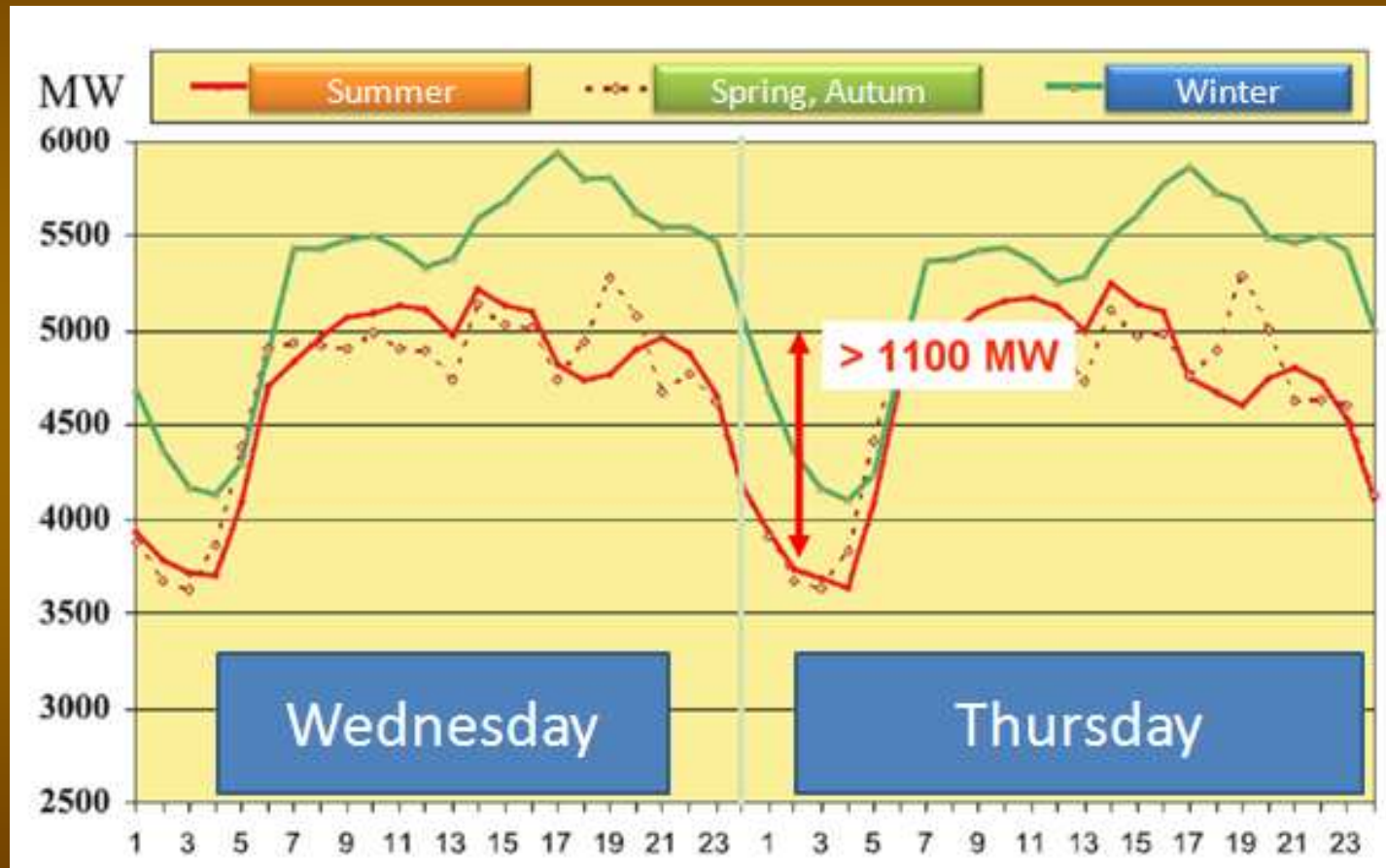
Sources: [14]

Change in the CO₂ emission of vehicles [CO₂ g/km]

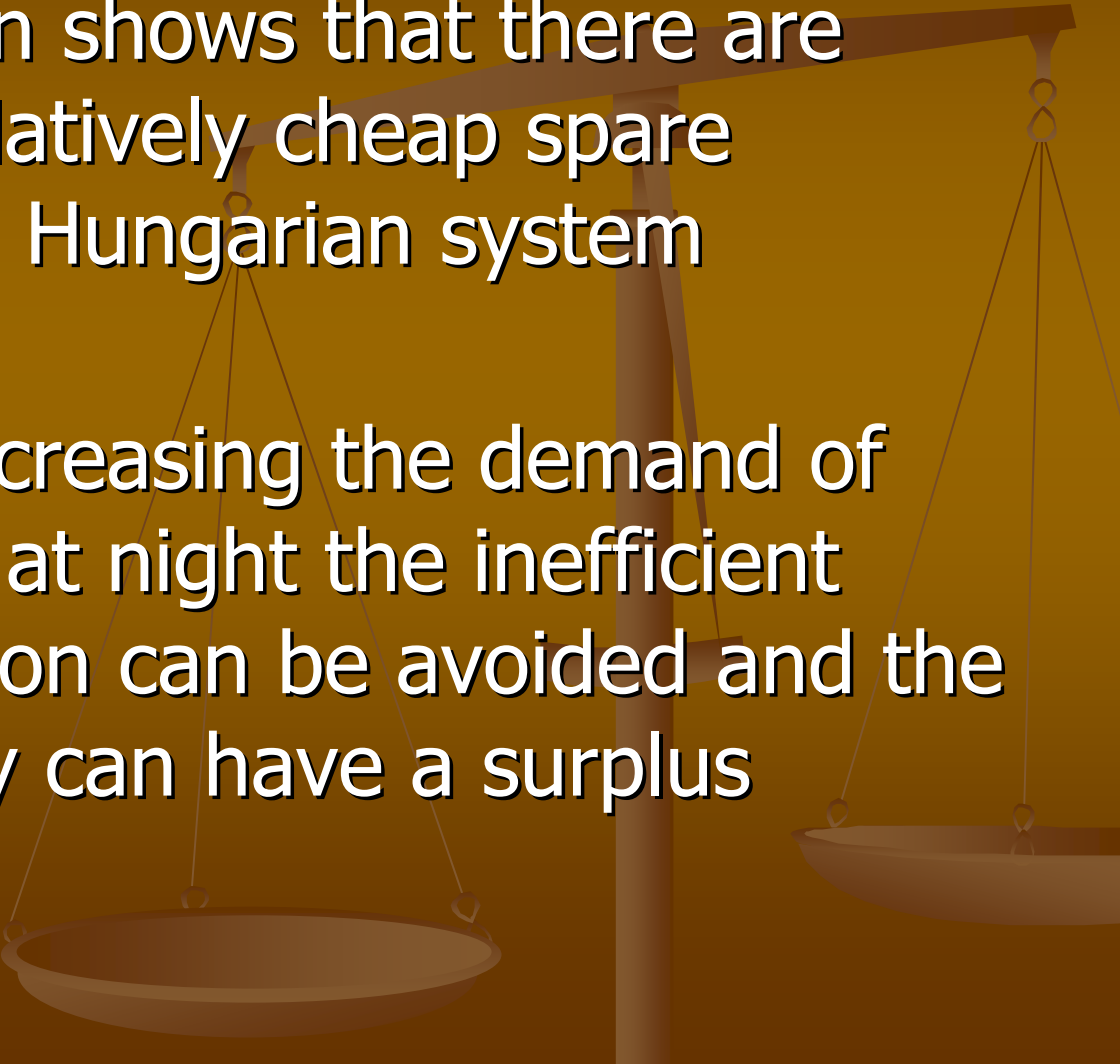


Source: European Automobile Manufacturers Association

Daily Load Distribution in Hungary



Source: [25]

- 
- The investigation shows that there are only 500 MW relatively cheap spare capacities in the Hungarian system nowadays
 - After partially increasing the demand of non-peak hours at night the inefficient low-load operation can be avoided and the overall efficiency can have a surplus

Conclusion

- The electrical transport can become a reliable alternative to the urban and suburban public transport,
- The W-W efficiency is lower the Hybrid Systems
- Considering the EU-6 standard the environment impact will decrease with the spread of electric vehicles only if the necessary electricity will be produced in nuclear, gas or wind power plants,
- 100,000 car could be charged at present in Hungary

Thank you for the Kindly
Attention !



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