Calculation 2: Multi Drive System CO_2 Emission

Calculating CO2 Emission

Factors Affecting Energy Efficiency

Reducing to the minimum possible the number of power actuators while maintaining the desired features unaffected has major ecological advantages. The CHEVALIER products use of totally recyclable materials is one appreciable advantage. However, the reduction of the number of motors and power actuators to an absolute minimum has a substantial effect on the level of consumption of energy and materials such as fuel, metal, plastics and other polymers. Materials consume substantial amounts of energy before they reach the state in which they become available for use. Energy is spent on mining the mineral ores, on processing these ores to extract the desired elements from them. Energy is spent on forming and forging the parts in use in any power actuator and on transportation and finally on recycling. The magnitude of energy savings and reduction in CO_2 emission as result of implementing the CHEVALIER technology in the automotive, aviation, marine and railway industries is without doubt considerable.

The chain of advantages the CHEVALIER technology brings forward is real and substantial as can be seen from the two real examples below in relation to the Single Motor Latch and Single Motor Multi Drive System.

Basic Background Facts

- **Petrol is principally made of octane carbon chains, i.e. for every single octane molecule that is burned, 8 molecules of CO2 are produced. Each one litre of petrol burned produces 2.3 kg of CO2 (or 1300 litres of CO2).**
- **When fuel oil is burned, it is converted into energy and as a side product carbon dioxide and water vapour. The combustion of one litre of jet fuel produces 2.7 kg of CO2 (i.e. 18% greater than motor vehicle emissions) and yields 37 Mega joules (i.e. 16% greater than fuel oil)**
- **Every single 50 litre tank full of petrol will produce over 63,400 litres of CO2 gas (63.4 m^3) which will fill a room (4metres x 4metres x 4metres).**
- **The amount of energy in one litre of petrol varies depending on the quality and type of petrol. A reasonable estimate is 32 Mega joules per litre (Diesel 36Mj per litre).**
- **Only about 20% of thermal energy is converted to mechanical energy through the process of combustion. This means to get 32 million Joules of mechanical energy 5 litres of petrol will have to be burned.**
- **As a minimum a vehicle will travel 300 million metres (300,000 Km - 190k miles) in its lifetime.**
- **In the UK alone, there were about 29.3 million passenger cars on the road in 2004. However, the effect of weight reduction on the environment is calculated in the examples below in relation to just 10 million cars. The magnitude of the potential is self-explanatory.**
- **In February 2007, the European Commission announced plans for CO2 reduction for the car industry. The proposed law states that the CO2 emissions of an average new car sold in Europe in 2012 should not exceed 130g/km as measured on the official EU test cycle. At present, this CO2 limit, which is voluntary, is 160 g/km.**
- **The level of carbon dioxide "CO2" emission of a motor vehicle or an aircraft is determined to a very large extent by its weight. An average weight passenger car (1200 kg) emits CO2 at a rate of 0.2 kg/km. A small passenger car (1 litre – around**

800 kg) will emit CO2 at a rate of 0.1 to 0.15 kg/km and a large one (4 litre - around 1800 kg) at a rate of 0.35 to 0.5 kg/km.

- **By the time one average weight passenger car has travelled (300,000 Km - 190k miles) (average passenger car lifecycle) it would have burned 26,000 litres of petrol (on average 1 litre of petrol per 11.5 km), emitted 60 tons of CO2 (2.3 kgCO2 x 26L) (or 34 million litres of CO2) and used up energy to the value of 884 billion Watts (26k x 34MJ).**
- **For the purpose of the calculations presented below the following laws of physics were used:**

  W=F.d ⇒
  W = (m.a).d ⇒
  $V = \sqrt{2.a.d}$ **⇒**
  V^2 =2.a.d ⇒
  a = V^2÷2.d ⇒
  E_k=1/2m.V^2 ⇔ W= E_k

Calculation 2

The following table exposes the extent of the positive environmental effects in terms of energy efficiency and CO_2 emission of the CHEVALIER Multi Drive System in relation to just one aspect: component weight reduction.

Calculation 2: CHEVALIER Multi Drive System **(Potential Energy Savings)**		
Level of energy saving resulting from a reduction in weight of 9.6 kg		
Calculation **(9.6 kg)**		
1 Passenger Car (average weight 1,200 kg) Travel distance completed: 300,000 km		
CO2 Emission in Kilograms	**60,000 kg x 9.6 kg ÷ 1200kg**	**480 kg**
Petrol Saved in Litres	**480 kg ÷ 2.3 kg**	**209 litre**
CO2 Emission in Litres	**209 litre x 1300 litre**	**272,000 litre**
Energy Saved in Megawatts	**209 litre x 34 Mega joules**	**7,100 Megawatts or (2 Megawatt/hour)**
10 million Passenger Cars (average weight 1,200 kg each) Travel distance completed: 300,000 km		
Petrol Saved in Litres	**209 litre x 10,000,000 cars**	**2.09 billion litre**
CO2 Emission in Kilograms	**480 kg x 10,000,000 cars**	**4.8 billion kg**
CO2 Emission in Litres	**272,000 litre x 10,000,000 cars**	**2.7 trillion litres**
Energy Saved in Megawatts	**7,100 Megawatts x 10,000,000 cars**	71 billion Megawatts or (20 million Megawatt/hour)