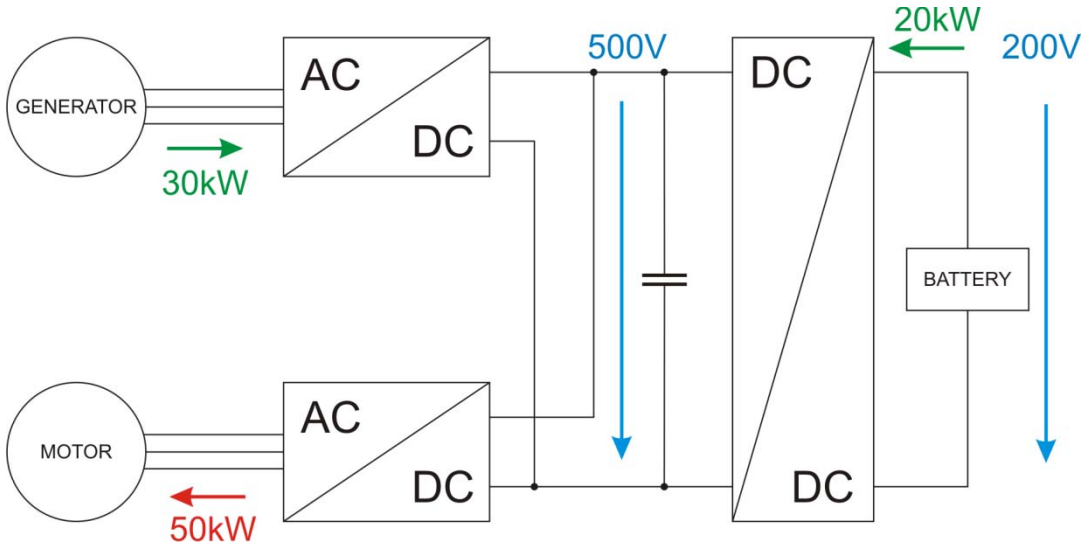
Elektrische Aandrijvingen

ET3026WB



Lokatie / evenement

P.BAUER

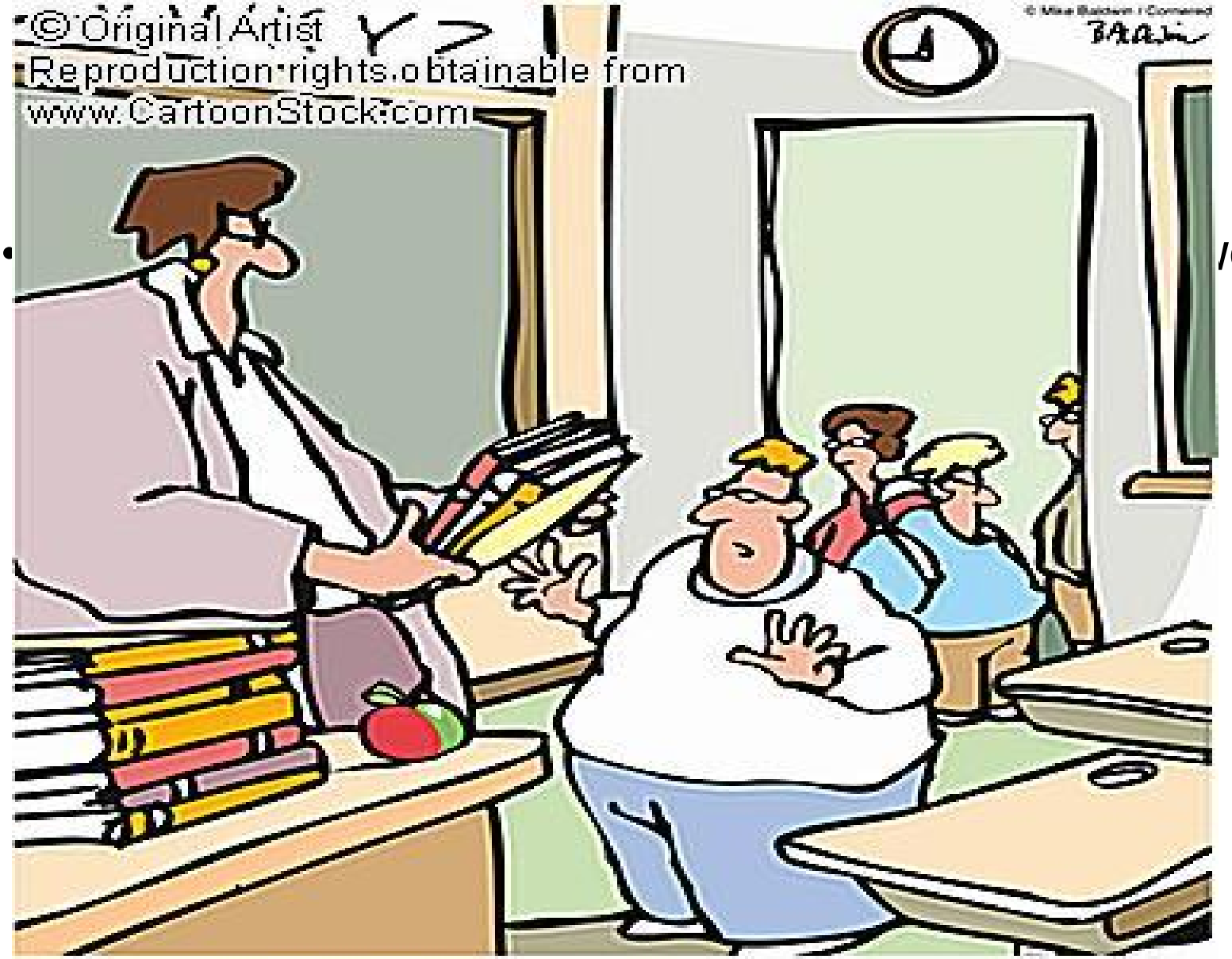
February 22, 2013

TU Delft

Introduction

- Language (English or Nederlands)
- Organization of the lectures, homework and examination
- BB test (homework, no bonus)
- Blackboard
- Equations

- ver



"No textbooks. I'm strictly Web-fed."

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Prerequisities for Examination

1 Satisfactory result of at least 55% of the homework test
2 Satisfactory results (pass) of the 4 hours practical

Prerequisities for Examination

1 Satisfactory result of at least 55% of the homework test

Explanation
Every week a homework test will be given. This homework test on Bb is meant for practicing the theory. To take part in the exam a satisfactory result, that means minimum of 55% of the test must be correct. Every test has a weighting factor (5%,10%,10%.15%,20,%20%20%) and 100% can be achieved if all answers are correct. There is no requirement that all homework tests must be made as long as the result of 55% is achieved. Homework test number 1 can be made several times, for the test number 2 – 7 only 2 trials are allowed. This is offered with respect to many requests concerning the typing errors.

Prerequisities for Examination

2 Satisfactory results (pass) of the 4 hours practical

The practical in the duration of 4 hours is scheduled on different days during the third quarter. You can enroll for a practicum via blackboard. Every student is allowed to enroll only for one date/time slot.

Transition arrangement
The students who did the practical in 2010, 2011 or 2012 are released from the abovementioned requirement.

Examination

- **Example of the examination is placed in the Course Documents**
- **2013 multiple choice Maple TA exam**

Lectures and practicals

wk	date	Lectures		Practicals		Practical group
3.1	11/2-15/2	Wed	13/2, 10:45-12:45			
		Fri	15/2, 13:45-15:45			
3.2	18/2-22/2	Wed	20/2, 10:45-12:45	Thu	21/2, 8:45-12:15	Pgrp1
		Fri	22/2 13:45-15:45	Thu	21/2, 13:45-17:15	Pgrp2
3.3	25/2-1/3	Wed	27/2, 10:45-12:45	Thu	28/2, 8:45-12:15	Pgrp3
		Fri	1/3 13:45-15:45	Thu	28/2, 13:45-17:15	Pgrp4
3.4	4/3-8/3	Wed	6/3, 10:45-12:45	Thu	7/3, 8:45-12:15	Pgrp5
		Fri	8/3, 13:45-15:45	Thu	7/3, 8:45-12:45	Pgrp6
3.5	11/3-15/3	Wed	13/3, 10:45-12:45	Thu	14/3, 8:45-12:15	Pgrp7
		Fri	15/3, 13,45-15:45	Thu	14/3, 13:45-17:15	Pgrp8
3.6	18/3-22/3	Wed	20/3, 10:45-12:45	Thu	21/3, 8:45-12:15	Pgrp9
		Fri	22/3, 13:45-15:45	Thu	21/3, 13:45-17:15	Pgrp10
3.7	25/3-28/3	Wed	27/3, 10:45-12:45	Thu	28/3, 8:45-12:15	Pgrp11
				Thu	28/3, 13:45-17:15	Pgrp12
				Thu	4/4, 8:45-12:15	Pgrp13
				Thu	4/4, 13:45-17:15	Pgrp14

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Lectures

• Lecture 1:	Chapter 7	7.0-7.10
• Lecture 2:	Chapter 7	7.11-7-17
• Lecture 3:	Chapter 8	8.0-8-19
• Lecture 4:	Chapter 9	9.0-9.10
•	Chapter 10	10.0-10.4
• Lecture 5:	Chapter 10	10.5-10.18
• Lecture 6:	Chapter 13	13.0-13-18, 13.22
•	Chapter 14	14.0-14.1
• Lecture 7:	Chapter 14	14.3-14.20
• Lecture 8:	Chapter 15	15.0-15.9,
• Lecture 9:	Chapter 16	16.0-16,24
• Lecture 10:	Chapter 17	17.0-17.14,
• Lecture 11:	Chapter 21	20.17-20.21
•	Chapter 21	21.0-21.35
• Lecture 12:	Chapter 21	21.36-21.50
• Lecture 13:	Chapter 22	22.0-22.16

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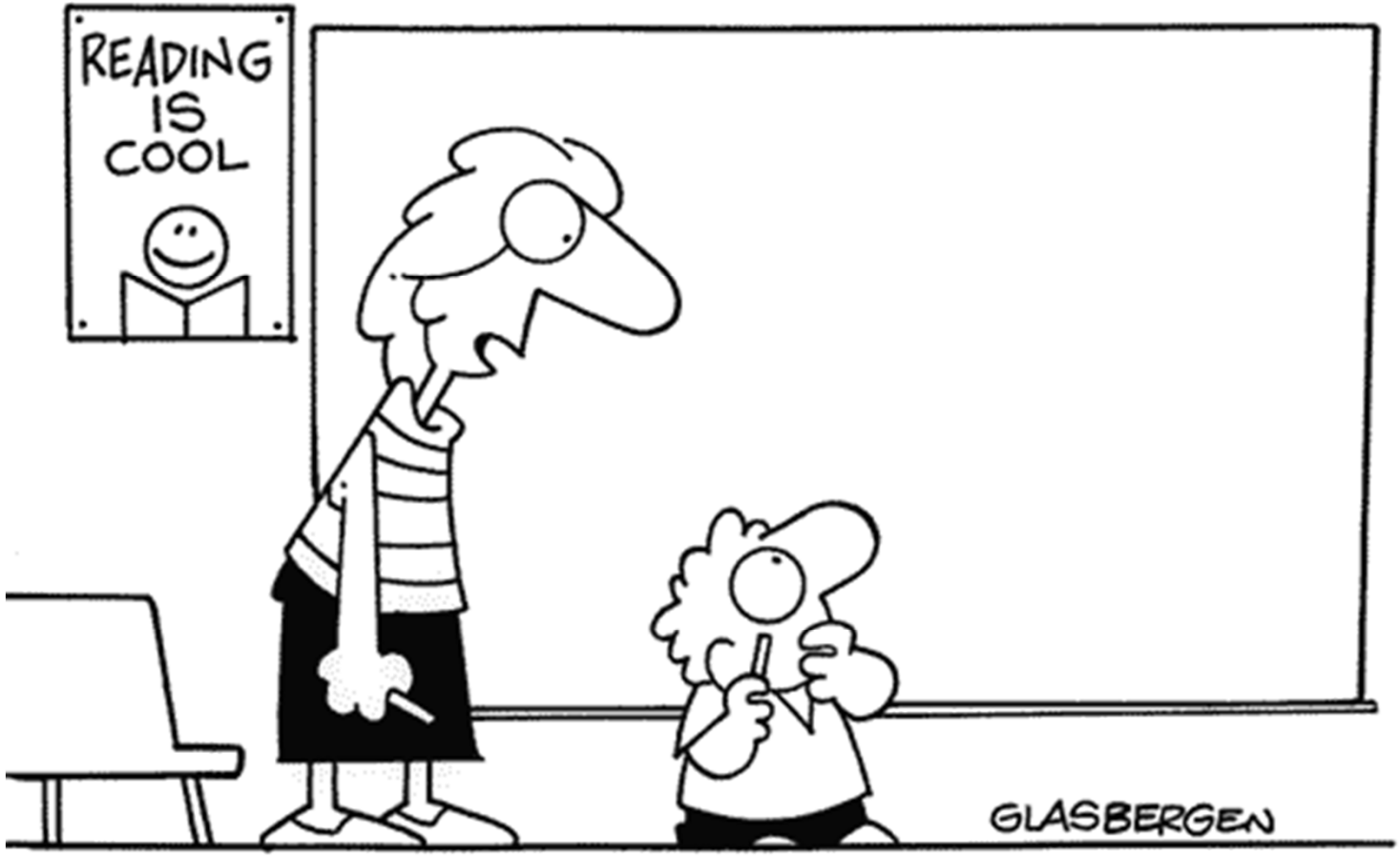

"There aren't any icons to click. It's a chalk board."

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Schedule homework test 2013

wk	date	day	On 9.00 AM	Off
3.1	11/2-15/2	Wed	HW1	
		Fr		
3.2	18/2-22/2	Wed	HW2 cf	
		Fri		HW1 at 13:30
3.3	25/2-1/3	Wed	HW3	
		Fri		HW2 cf at 13:30
3.4	4/3-8/3	Wed	HW4 cf	
		Fri		HW3 at 13:30
3.5	11/3-15/3	Wed	HW5 cf	
		Fri		HW4 cf at 13:30
3.6	18/3-22/3	Wed	HW6	
		Fri		HW5 cf at 13:30
3.7	25/3-28/3	Wed	HW7	
		Fri		HW6 at 13:30
3.8	2/4-5/4	Wed		
		Fri		HW7 at 13:30

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Homework test 2012

- **Instructions for homework:**
- Read the 'paper' assignment first !!
- You can find them in **Assignments****Homework**\Wb06_xuk.doc (English) or Wb06_xnl.doc (Dutch)
- If you have read the questions and understand them, then open the assignment and give the answers. **X.DD** (X dot DD)
  Beware, the answers are sign sensitive.
  The resulting value has to be in this format
- The first homework you can submit several times.
- From second homework on you have only two chances to make the test.

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Homework test 2013

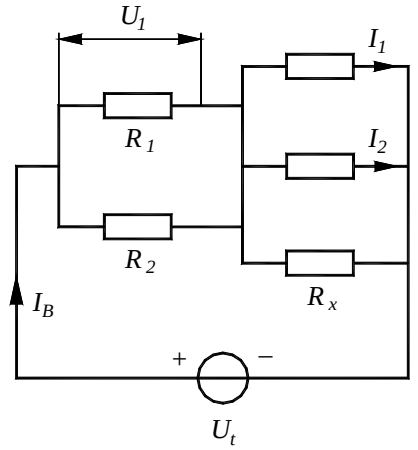
- **Instructions for homework with cf added.**
- **Different values for tests.**
- From homework with cf added in the title, some of the values presented in the homework on "paper" version might be slightly different from the values presented on the test version of the homework.
- So you have to re-calculate the values once you open the test in Blackboard.
- **Second attempt.**
- If you do a second attempt, it is possible that different values are presented in the test are different from the values of the first test. For the different values you have to re-calculate the values.
- **Saving values.**
- You can save the values and resume later, the values will be saved.

Homework test 2013

1 For this circuit:

U_t = 100V; U_1 = 60V;
R_1 = 10 Ω; R_2 = 20 Ω;
I_1 = 1A; I_2 = 3A.

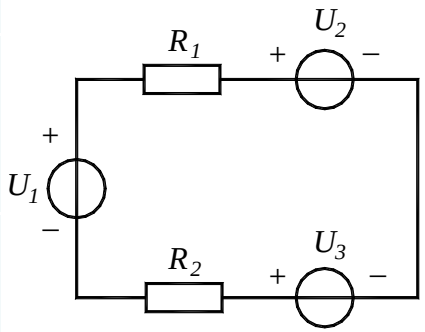
Calculate the value of the resistor R_x [in Ω]?



2 For this circuit:

U_1 = 100 V; U_2 = 60 V; U_3 = 70 V;
R_1 = 5 Ω; R_2 = 15 Ω;

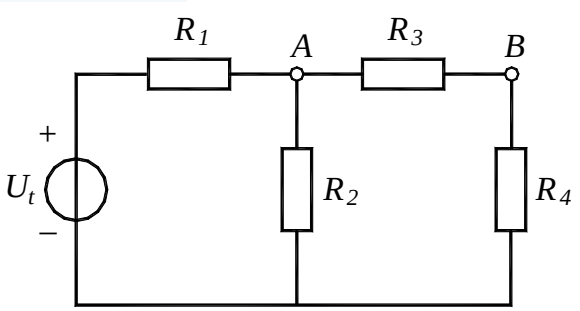
What is the voltage of R_1 [in V]?



3 For this schematic:

U_t = 230 V;
R_1 = 2 Ω; R_2 = 48 Ω;
R_3 = 2 Ω; R_4 = 48 Ω;

What is the voltage in point A (to ground) [in V]?



4 For the same schematic:

What is the voltage in point B (to ground) [in V]?

5 A resistor of 46 Ω is connected to the end of a power cable.
The voltage a the begin of the cable is 230 V.
The length of the cable is 25 m. The copper area is 1.0 mm²
The specific resistance of copper is $0.0175.10^{-6}$ Ω.m

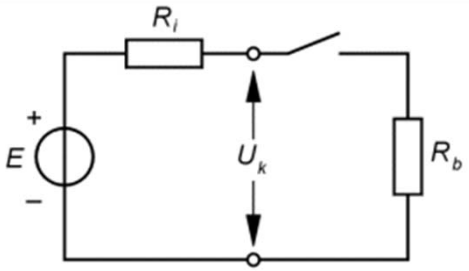
What is the voltage on the resistor of 46 Ω [in V]? (Think twice! The current flows to the resistor and from the resistor back to to source. The length of the core is 2x the length of the power cable.)

6 For the same situation:

What is the power loss in the in the copper cable [in W]?

7 The voltage on the terminals of a battery in no load condition is 4.6 V.
With a load current of 0.25 A the voltage will drop to 4.2 V.

Calculate the inner resistance of the battery [in Ω]?



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An inconvenient truth

- **You can believe the facts presented in this film or not. But one important thing that becomes clear is the fact that the earth is small. Small compared to the number of 'citizens.' Small compared to what we ask from it.**

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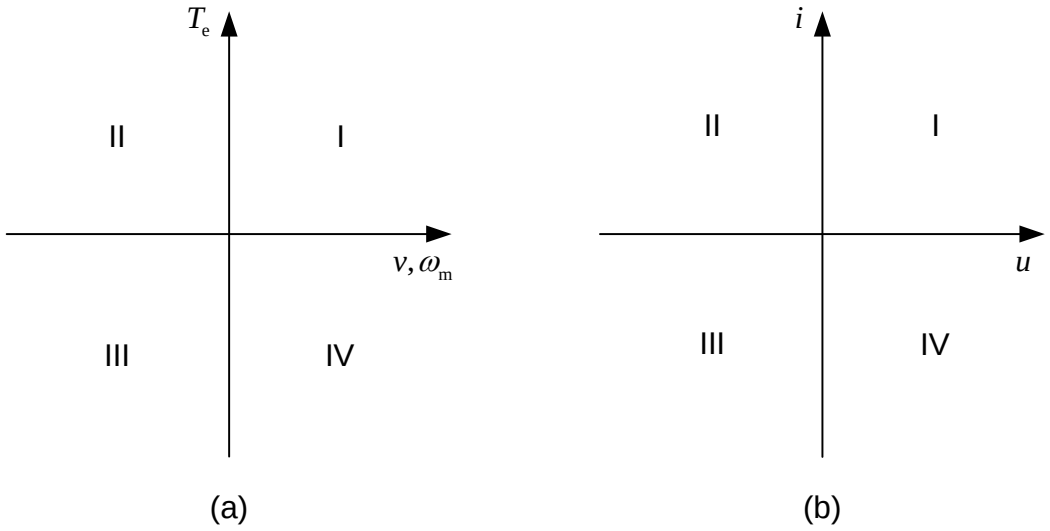
- **The mechanical and electrical power of the AC-machine is given by :**

$$P_{\mathrm{m}} = \omega_{\mathrm{m}} T_{\mathrm{e}} = \frac{d}{dt}\left(\tfrac{1}{2} J \omega_{\mathrm{m}}^2\right) + \frac{d}{dt}\left(\tfrac{1}{2} m v^2\right) \qquad P_{\mathrm{e}} = ui$$



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- **Energy storage**

+

- **Power Electronics**

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- **Hybrid car**
- **Electrical drive**

An inconvenient truth

- making the end-use electrical systems more efficient,
- making other end-use systems more efficient,
- making passenger vehicles more efficient,
- making other transport systems more efficient,
- using renewable energy sources and
- making energy supply more efficient and store carbon dioxide.

Vehic

- Conv sel
- Natu
- Adva
- Alte o-fuel
- Fuel
- Mor
- Hybr
- Plug
- All-e

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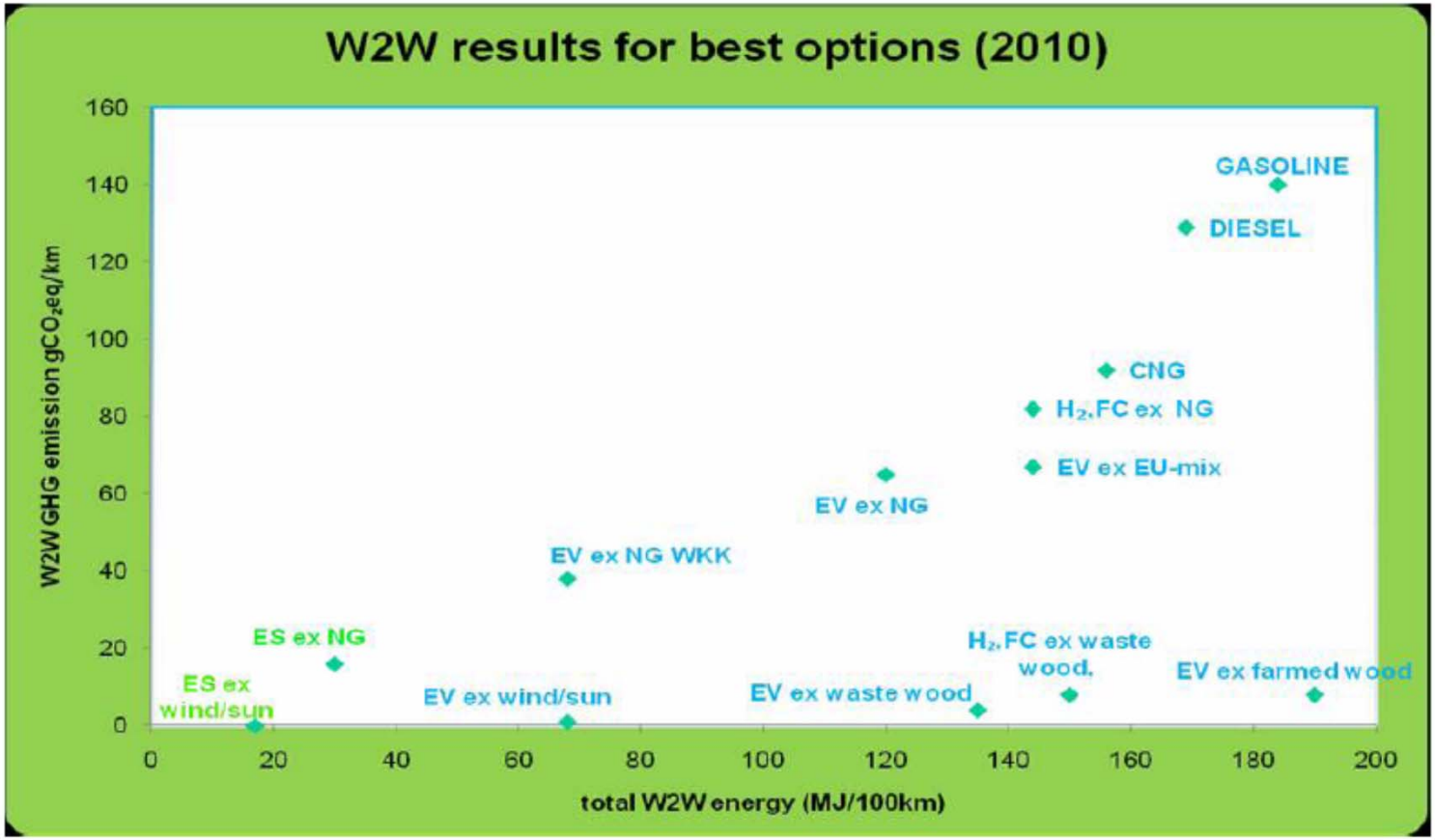
Vehicles

- Conventional vehicles – gasoline, diesel
- Natural gas vehicles
- Advanced diesel vehicles
- Alternative fuel vehicles – ethanol, bio-fuel
- Fuel cell vehicles
- More electric vehicles
- Hybrid electric vehicles
- Plug-in hybrid electric vehicles
- All-electric vehicles

Energy use and CO2 emissions



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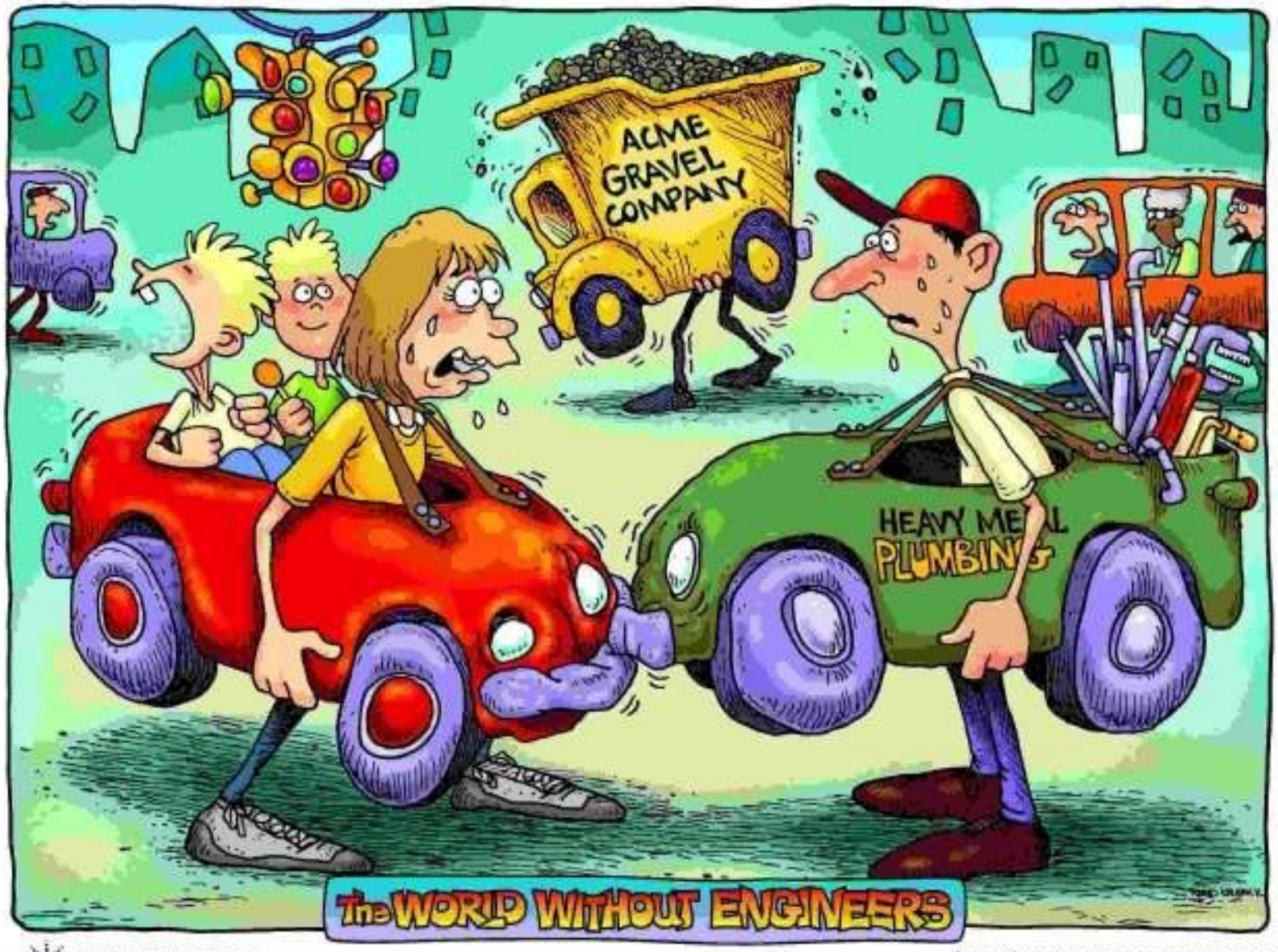
Conventional versus BEV

- **5-8 l fuel, 50-80 kWh /100 km**
- **Grid to wheel efficiency 15%**

- **15-20 kWh/100km**
- **Grid to wheel efficiency up to 65%**

Prediction

- 2030 in NL 1 milion BEV (from 7,3 milion cars 2010)


ACME
GRAVEL
COMPANY
HEAVY METAL
PLUMBING
The WORLD WITHOUT ENGINEERS

Hybrid electric vehicle

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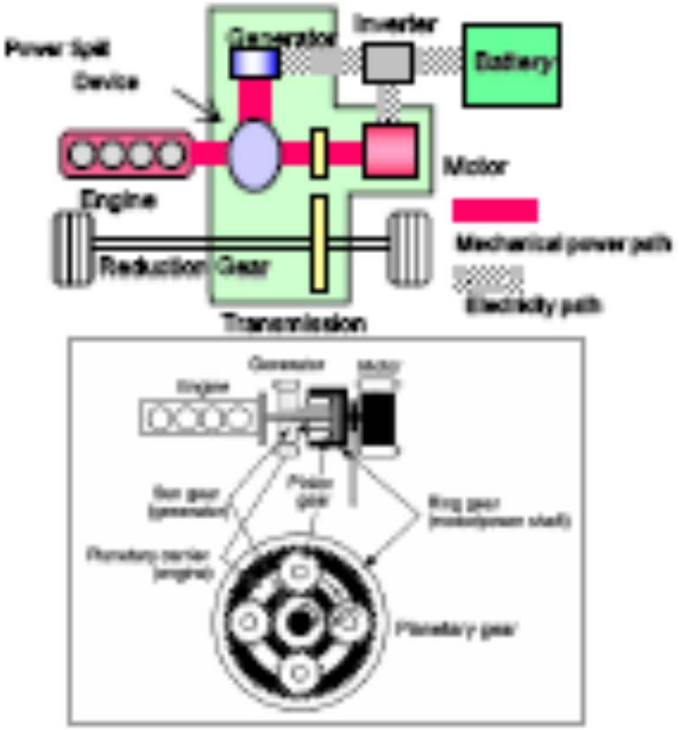
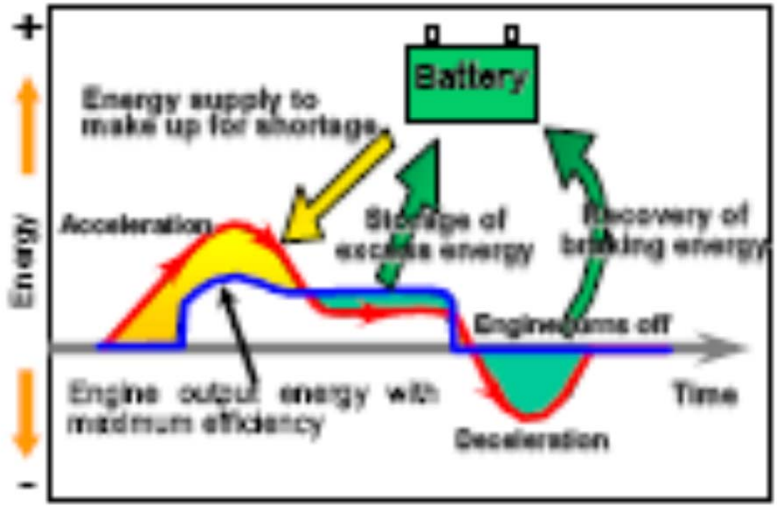
Energy management





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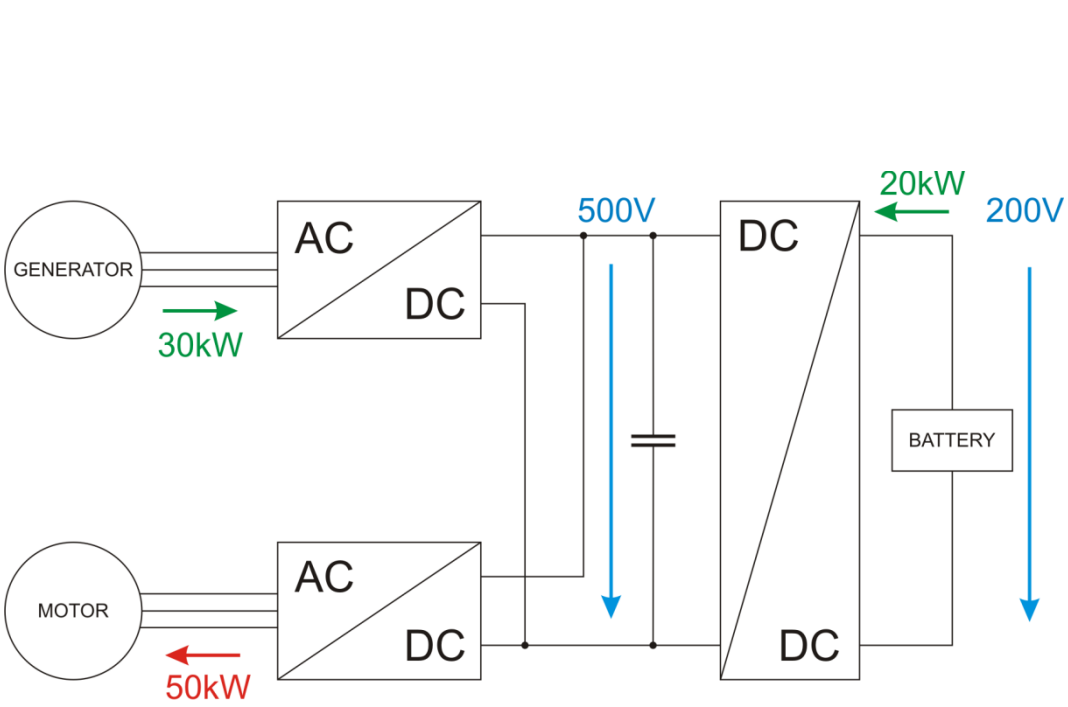
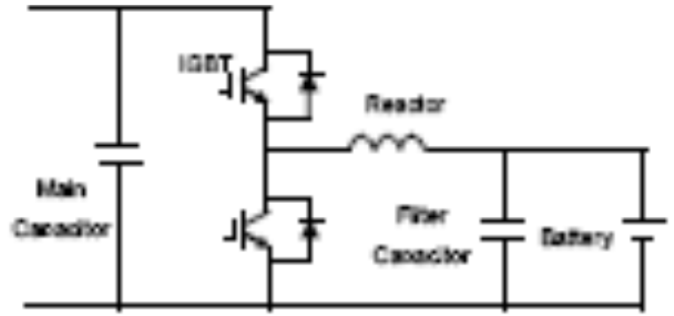
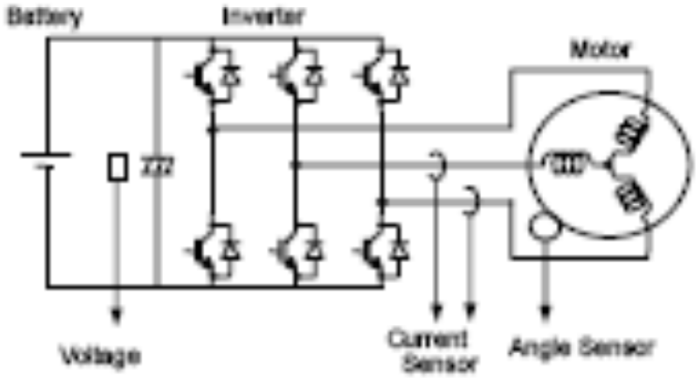
Variable voltage system







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- **Recover energy through regenerative braking and store in the vehicles batteries.**
- **Selectively shut off the engine**

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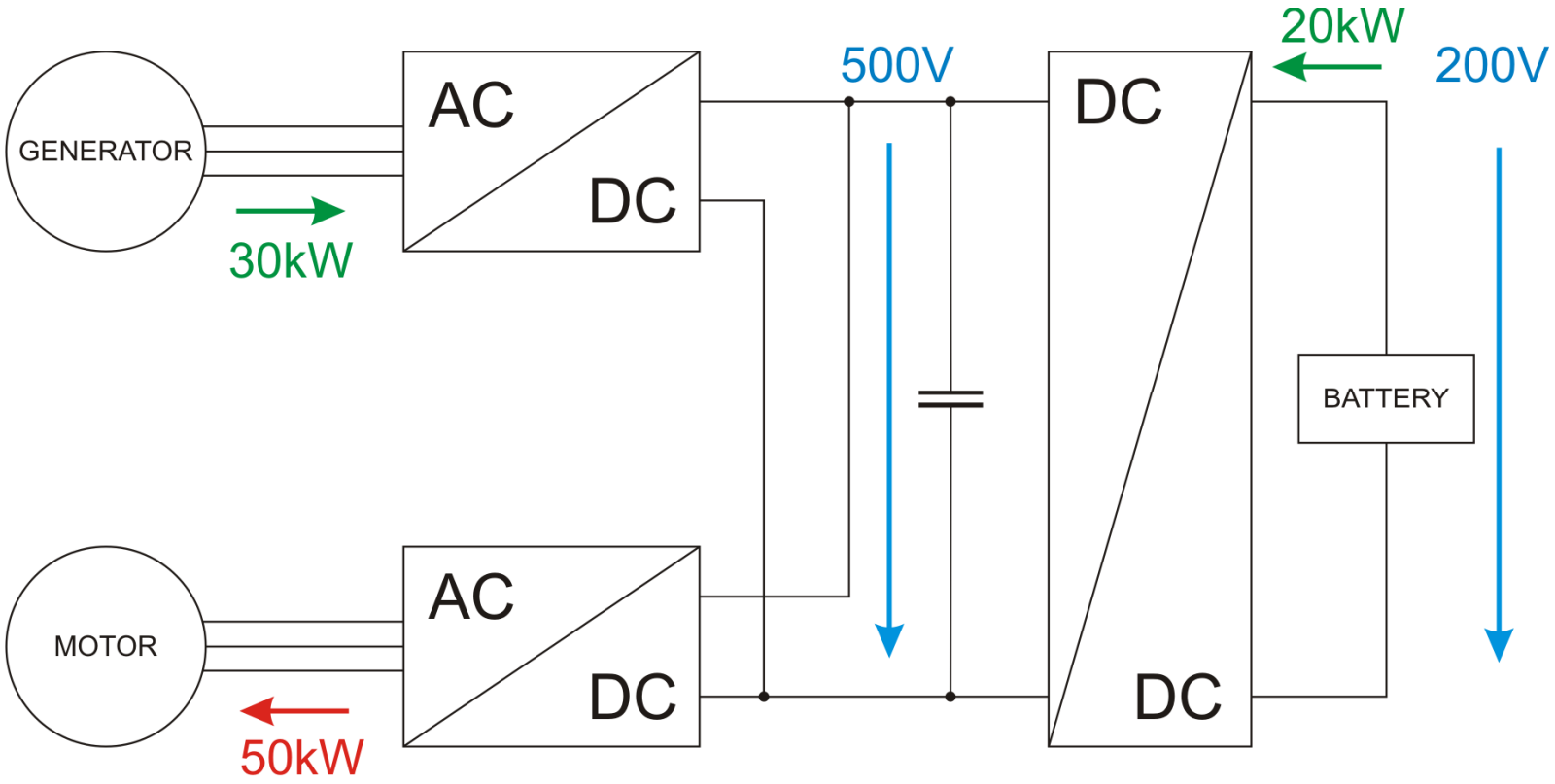
GENERATOR
30kW
AC
DC
500V
20kW
200V
DC
DC
BATTERY
MOTOR
50kW
AC
DC

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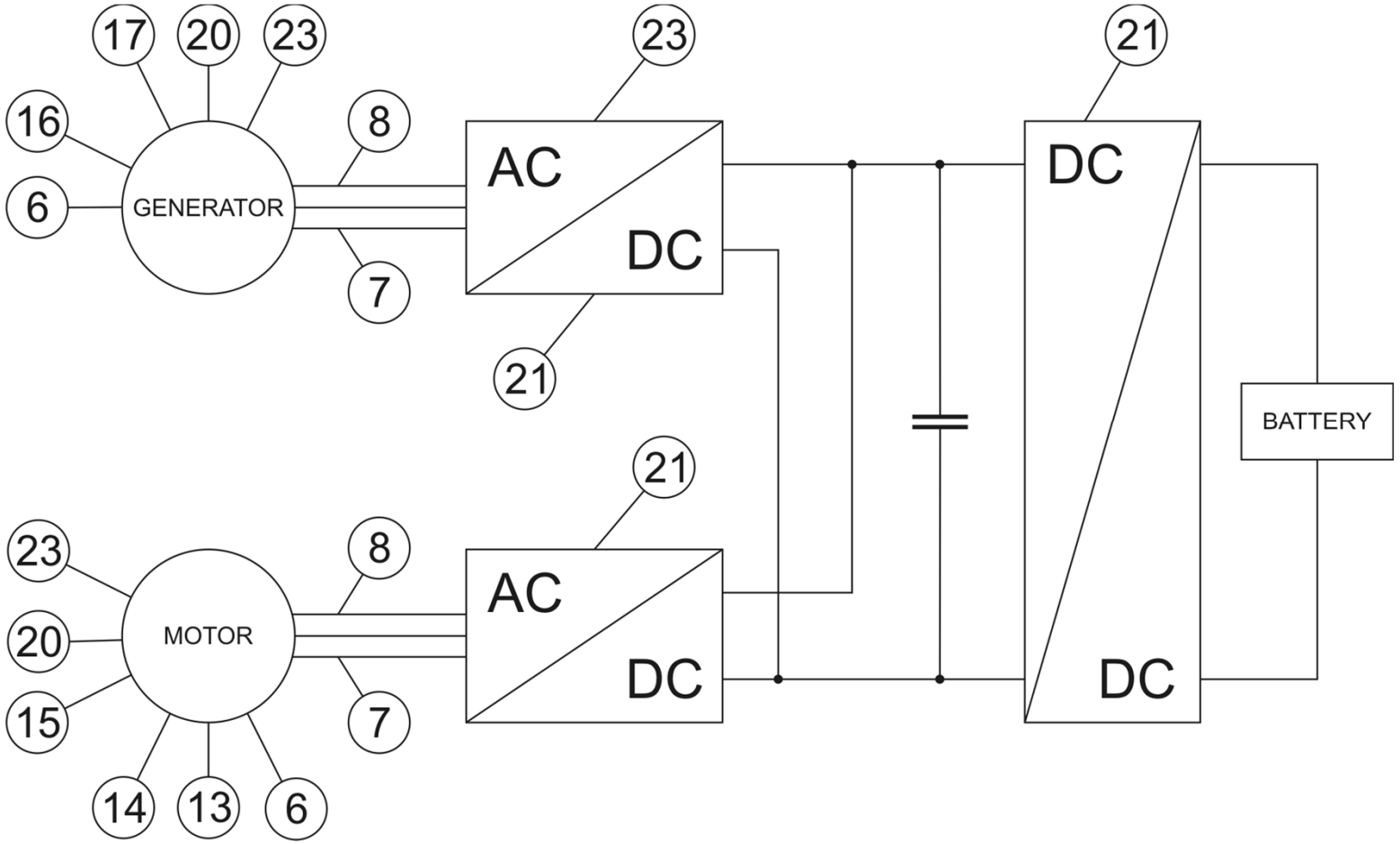
Energy management



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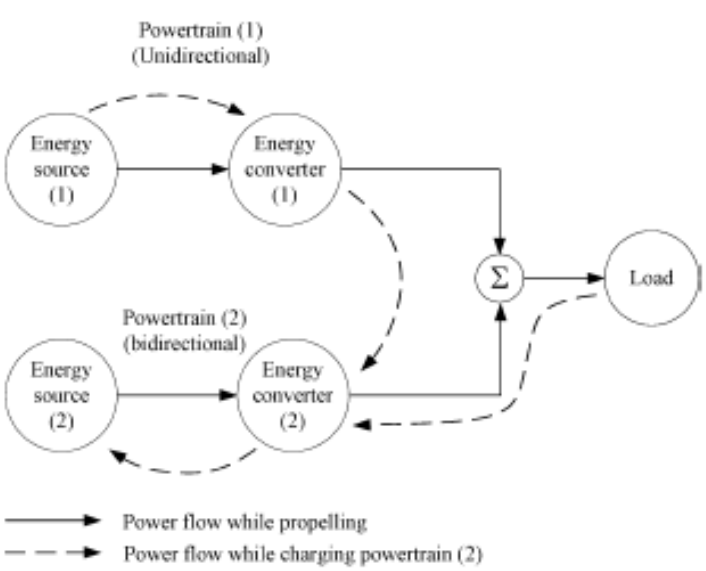
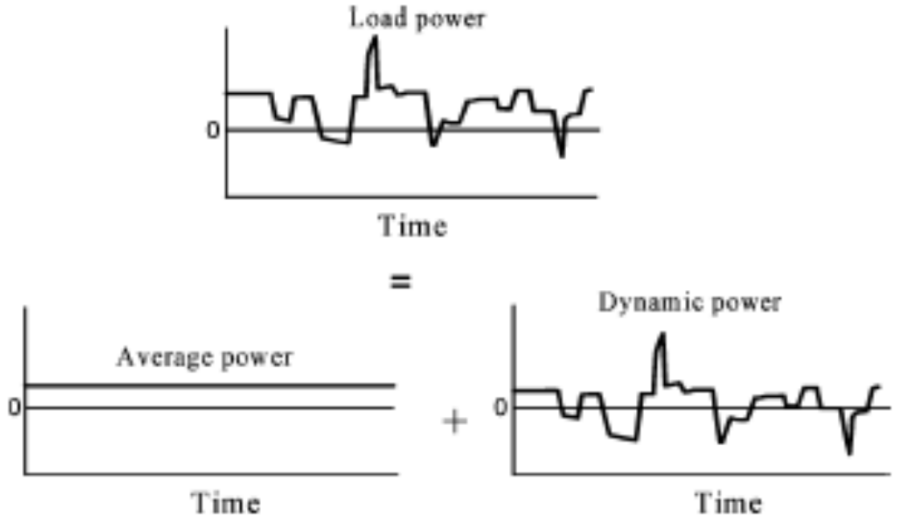

Powertrain (1)
(Unidirectional)
Energy source (1)
Energy converter (1)
Σ
Load
Powertrain (2)
(bidirectional)
Energy source (2)
Energy converter (2)
Power flow while propelling
Power flow while charging powertrain (2)


Load power
0
Time
=
Average power
0
Time
+
Dynamic power
0
Time

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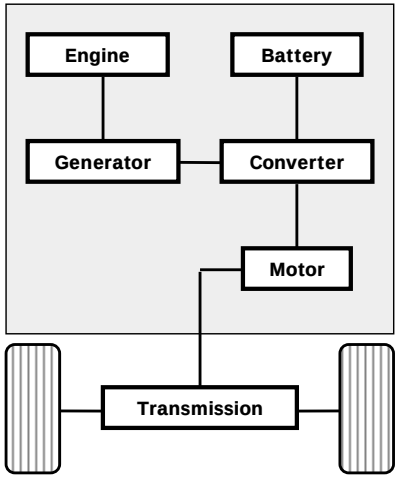
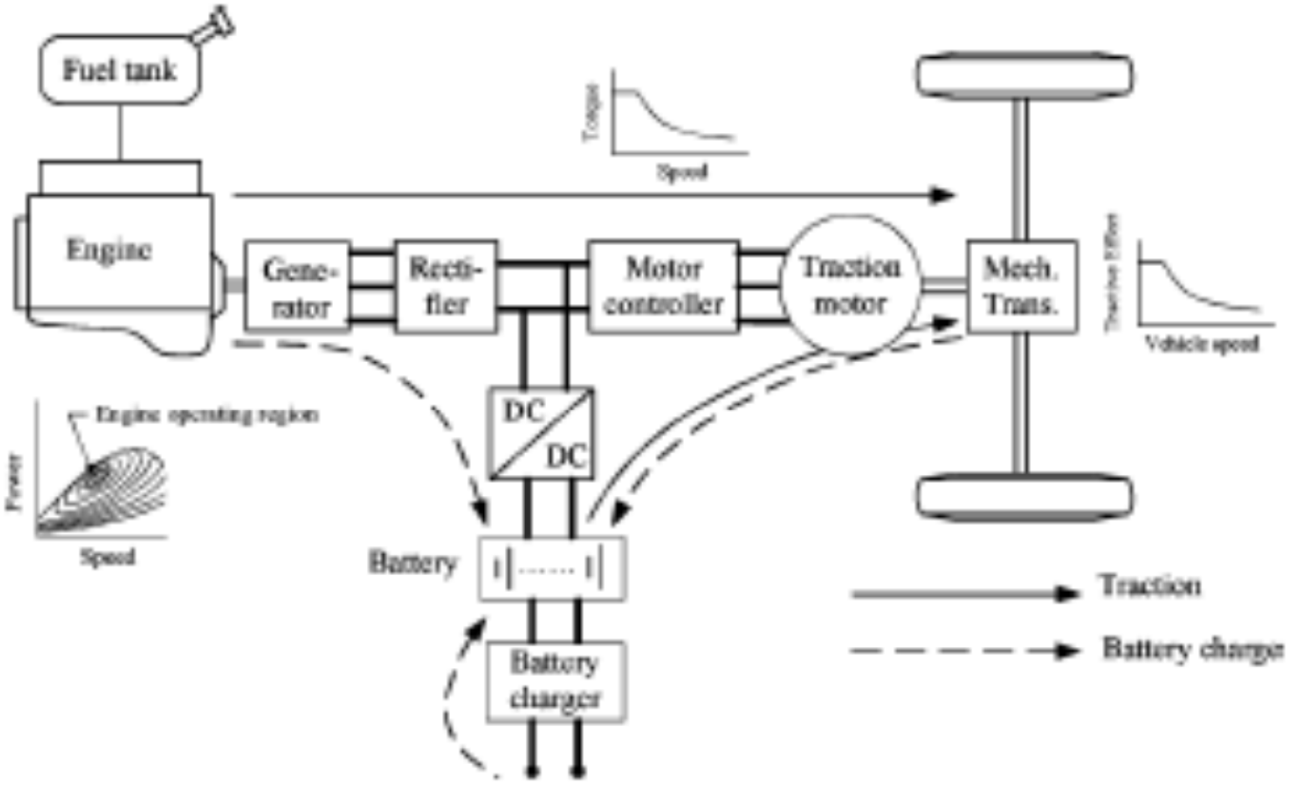
Series hybrid drivetrain





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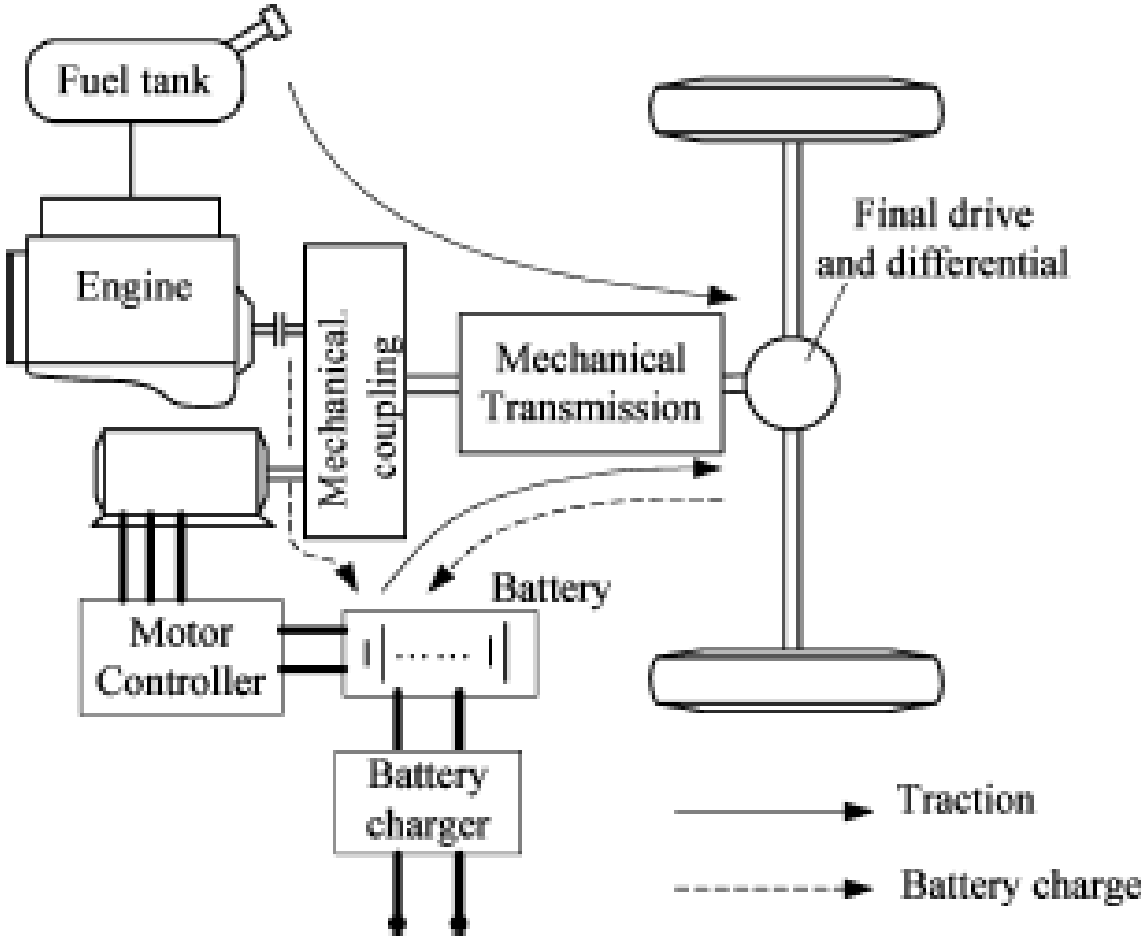
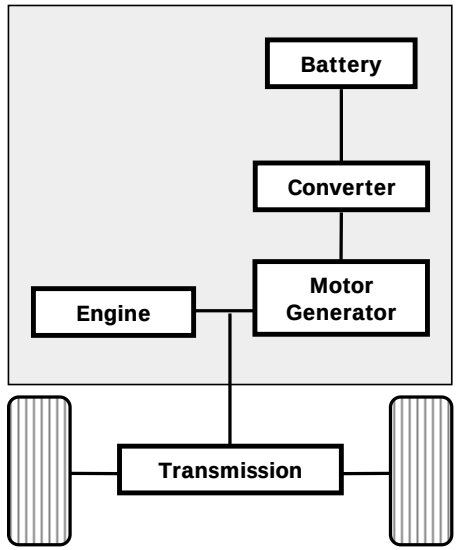
PB1 The use of an internal combustion engine to drive a generator and provide electrical power for one or more traction motors is a common propulsion method which has been used in locomotives for many years [80]. This is the technology that the series hybrid is based on, with the addition of some form of energy storage. The traction motor is the only power supply unit with a direct connection to the road wheels. The advantage is that the internal combustion engine can be operated at its most efficient point to generate the necessary current for driving the traction motor or charging the battery. This type of configuration is most advantageous for start-stop style driving, such as public urban transport.

P Bauer; 2-2-2010

Parallel hybrid drivetrein





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PB2 The parallel hybrid architecture can simultaneously transmit power to the drive wheels from both internal combustion engine and the battery-powered electric drive. Although most parallel hybrids have a traction motor between the vehicle's engine and transmission, a parallel hybrid can also use its engine to drive one of the vehicle's axles while the electric motor drives the other axle and/or a generator used for recharging the batteries.

P Bauer; 2-2-2010

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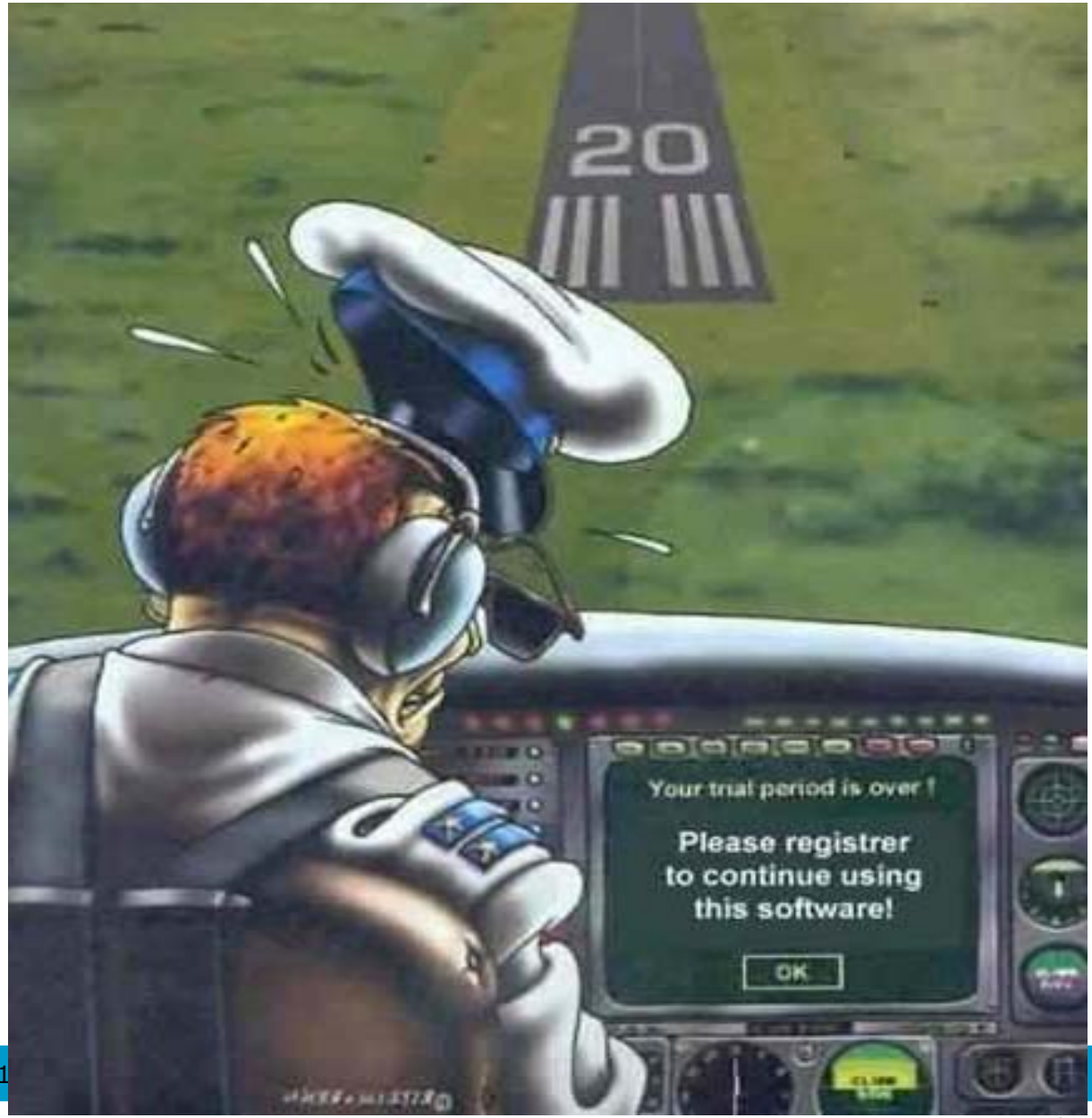
20
Your trial period is over !
Please registrer
to continue using
this software!
OK

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