sanedi
South African National Energy Development Institute (SOC) Ltd.

Energy & *Mobility*

Sustainable Solution!

REN21 Renewable Energy Policy Network for the 21st Century

SANEDI: Green Transport

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The Vision of SANEDI

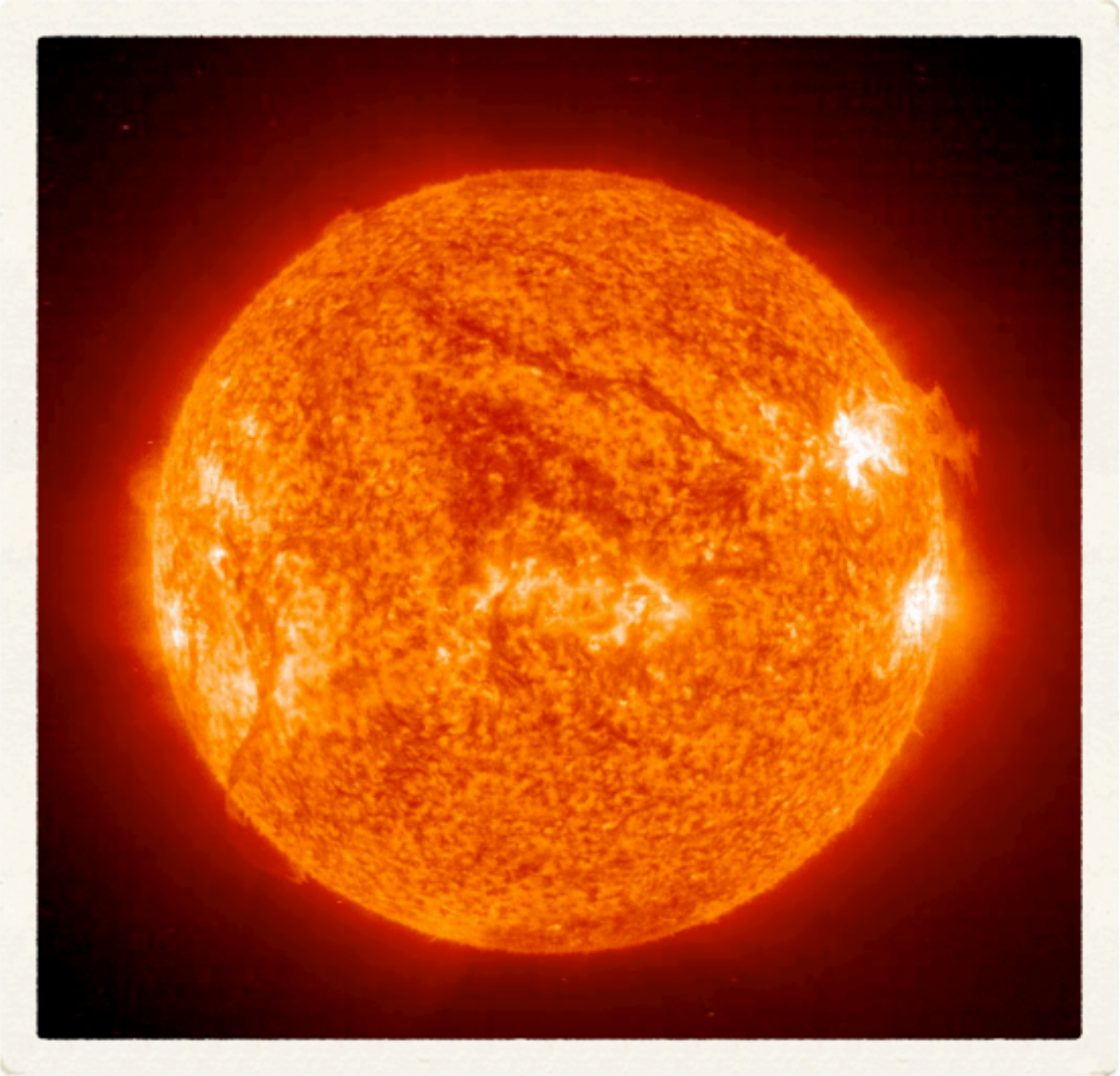
- *"To serve as a catalyst for sustainable energy innovation, transformation and technology diffusion in support of South Africa's sustainable development that benefits our nation."*
- **SANEDI** therefore has to play a critical role to ensure that South Africa will have the necessary **information** and **planning support** (regarding, amongst others, emerging technologies, innovative practices, alternate energy solutions, advanced infrastructure, energy data) to **plan** for a sustainable and secure energy future that will also satisfy the country's economic, social and environmental needs.
- SANEDI also has **to influence/facilitate** an immediate and critical change in the energy culture towards more considered and **sustainable energy practices**.

Energy

Stuff we use to do work

- Per day - **12** MJ/day (3000 kCal)
- To walk - **25** MJ/100km
- To cycle - **11** MJ/100km or <11 MJ/100km
- To drive - **320** MJ/100km or **54** MJ/100km
- To ride - **40** to **100** MJ/100km

Where do energy come from?



Solar

Wind

Biomass

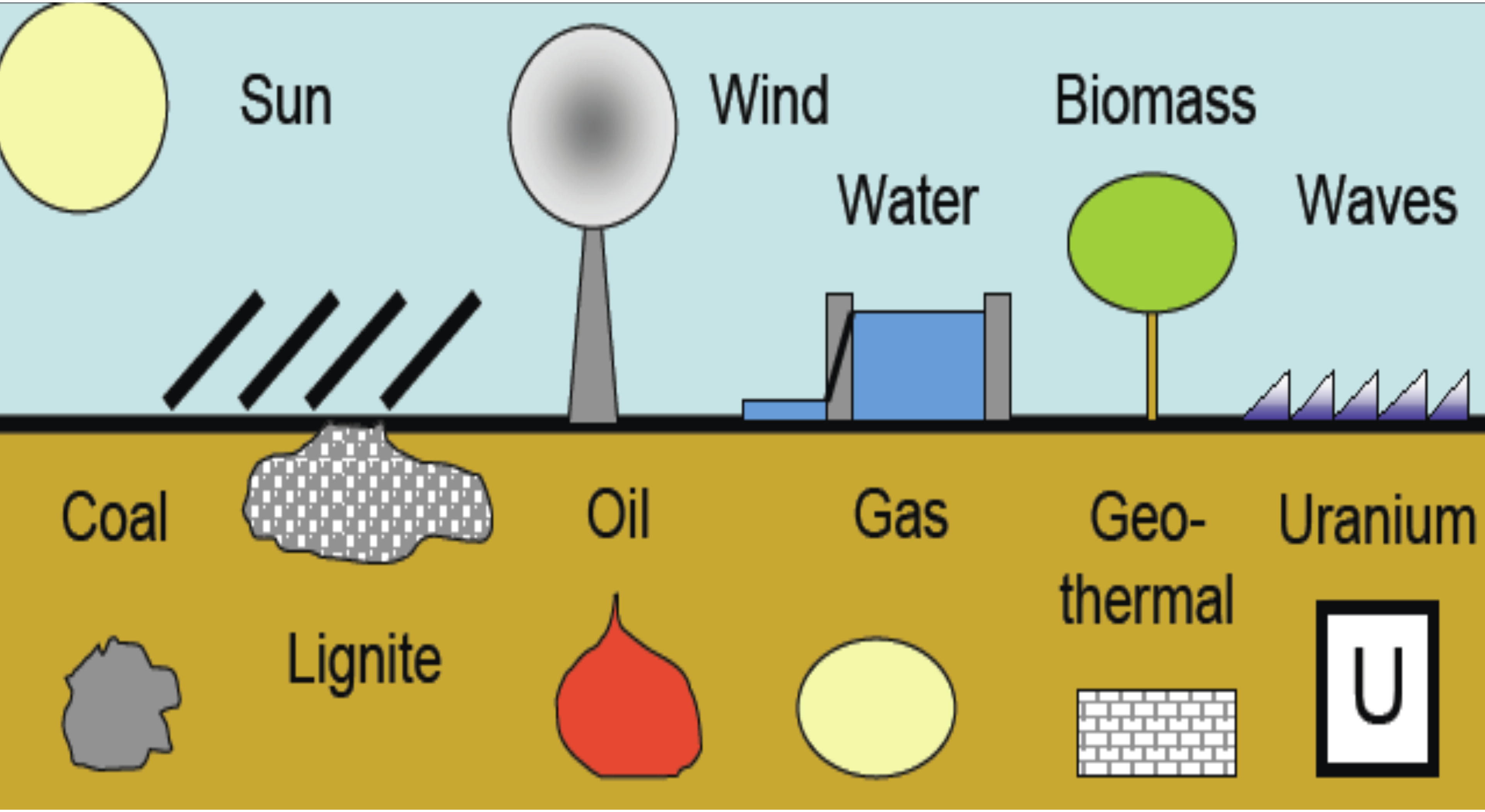
Tides

Gas

Oil

Coal

Where do we find energy?



What are we doing?!

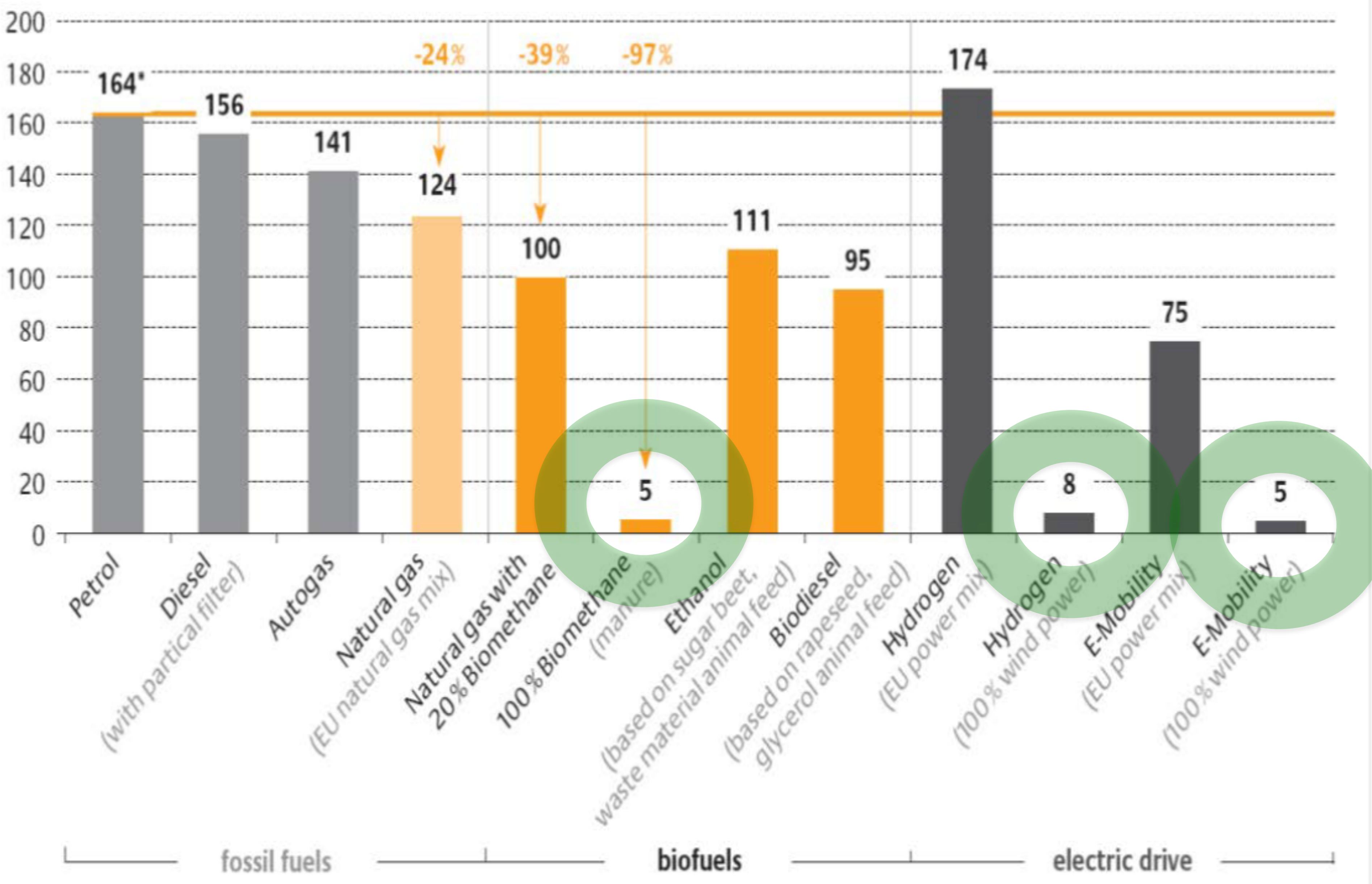
Wasting

Polluting

Suicide

World – 3,7million | China – 1,6million | London – 9’000 people

Well to Wheel GHG emissions in $gCO_{2eq.}$/km



* reference vehicle: gasoline engine (induction enginge), consumption 7 l per 100 km

How much energy/hectare/year?

Photosynthesis: 2% of 20'000GJ/ha and cultivation period 400GJ/ha/yr

Processing:
50-135GJ BioFuels/ha/yr (BioEtOH, BioDiesel, BTL)

Distribution & Combustion: 35% (Fuel to Wheel)

18-47GJ/ha/year

Solar beats Biomass 40-100 times!

PV Cell to grid: 10% efficient 3600GJ/ha/yr

Inverter {dc to ac} 90% efficient 3050GJ available for car battery

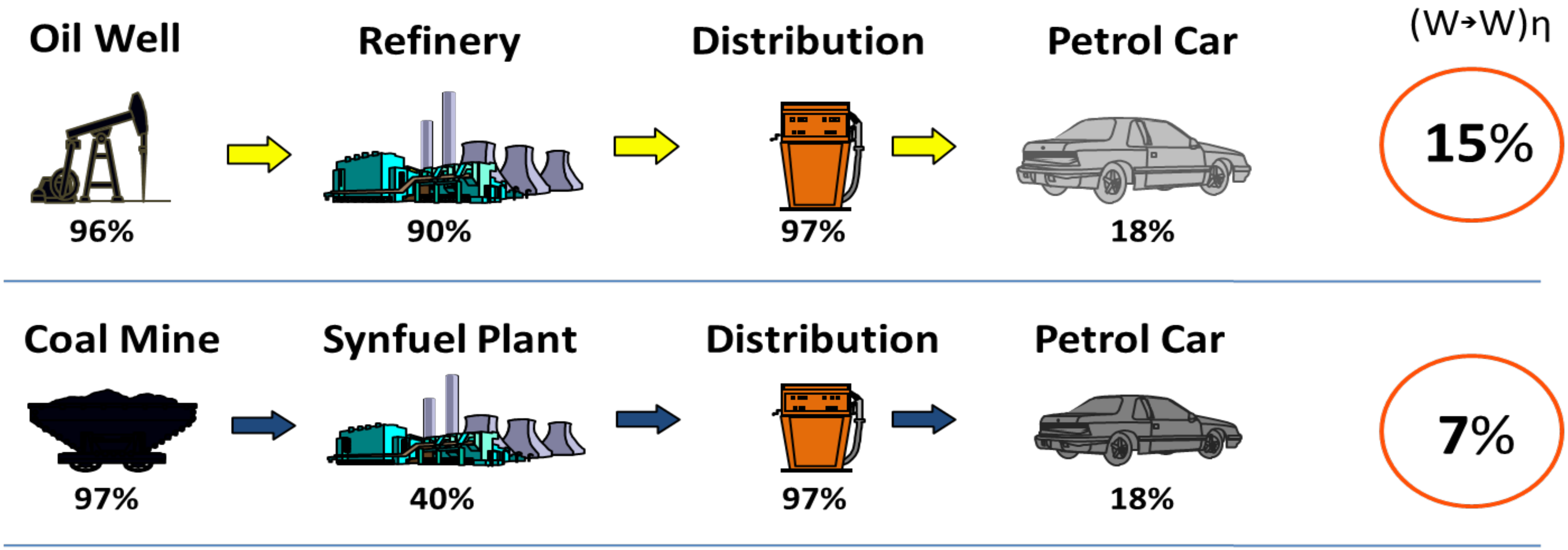
From battery to wheel: 60% efficient

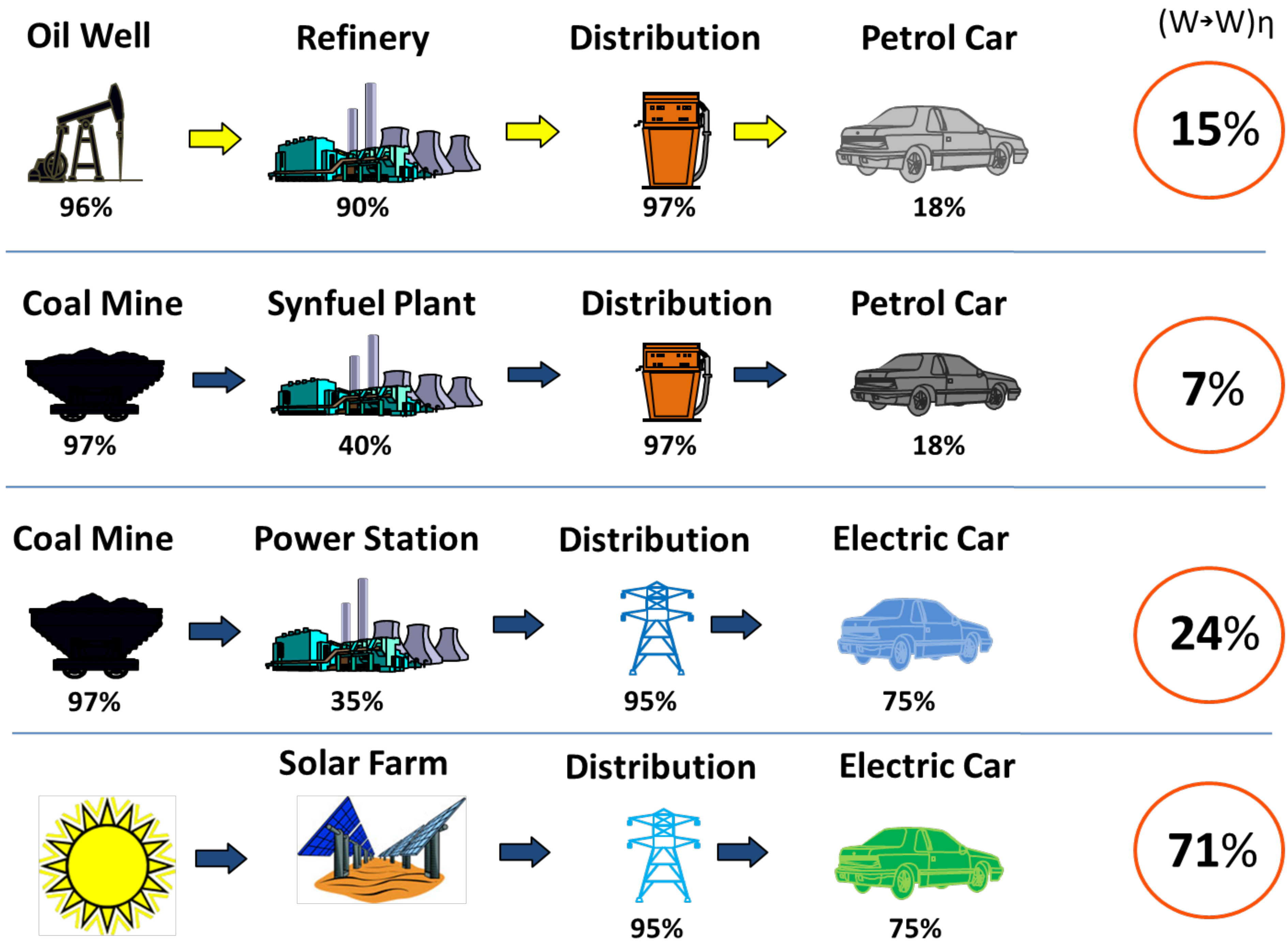
1800GJ/ha/year

Mobility

Road: Modes & energy performance

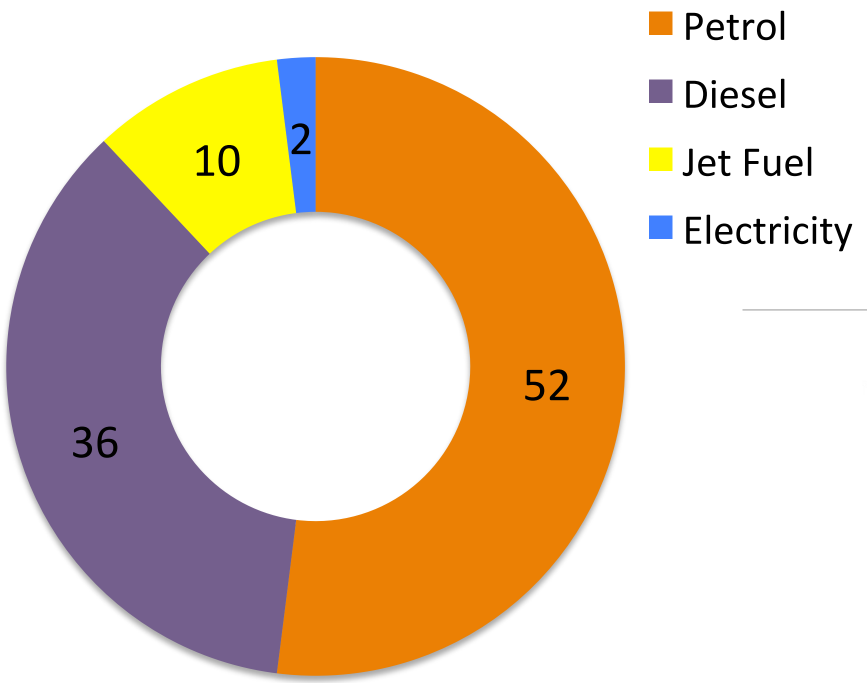
Mode	Energy	Number	%	Load Capacity	Unit / 100km	MJ/P.km MJ/T.km	gCO_2/P.km gCO_2/T.km
Car	Petrol	4'455'038	57%	1.4	9.0	2.19	153.77
	Diesel	184'407	2%	1.4	7.0	1.90	119.60
SUV	Petrol	442'621	6%	1.4	14.0	3.40	239.20
	Diesel	279'222	4%	1.4	11.0	2.99	187.94
LCV	Petrol	1'103'608	14%	0.5	13.0	8.84	621.92
	Diesel	700'265	9%	0.5	10.0	7.60	478.40
MCV	Petrol	5'991	0.1%	2.5	33.0	4.49	315.74
	Diesel	131'425	2%	2.5	25.7	3.90	245.58
HCV	Diesel	198'134	3%	15	38.0	0.96	60.60
MBTaxi	Petrol	260'577	3%	14	15.0	0.36	25.63
	Diesel	13'976	0.2%	14	11.7	0.32	19.93
Bus	Diesel	30'033	0.4%	25	33.0	0.50	31.57

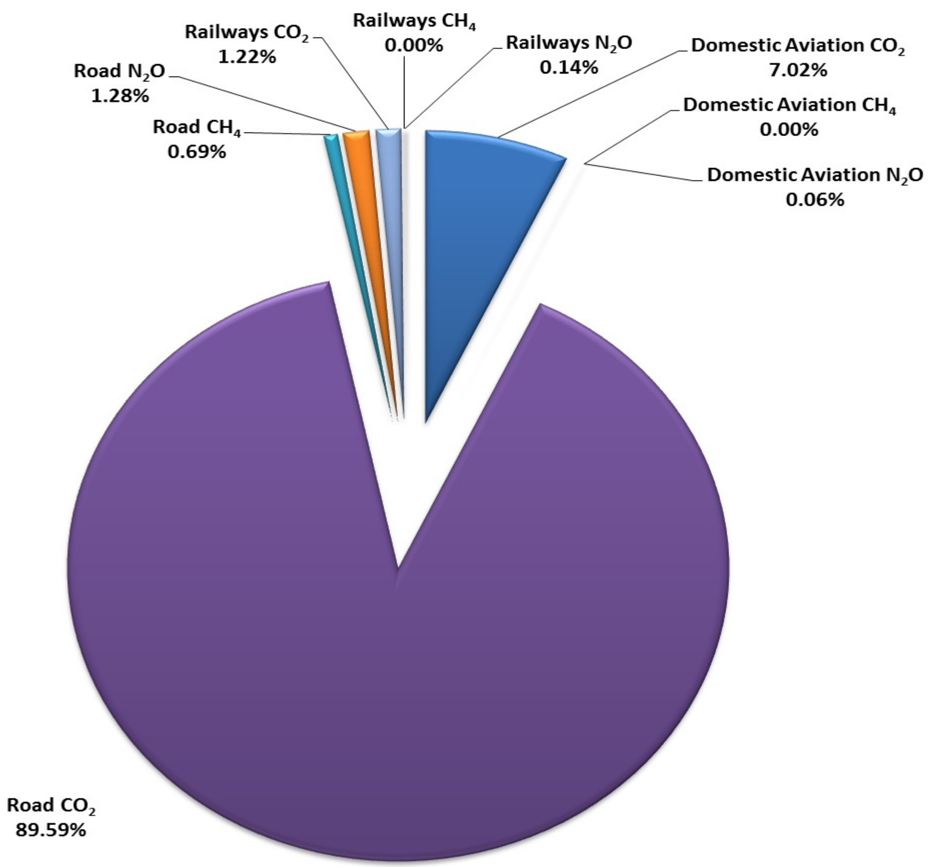

(W→W)η
Oil Well
Refinery
Distribution
Petrol Car
96%
90%
97%
18%
15%
Coal Mine
Synfuel Plant
Distribution
Petrol Car
97%
40%
97%
18%
7%



(W→W)η
Oil Well
96%
Refinery
90%
Distribution
97%
Petrol Car
18%
15%
Coal Mine
97%
Synfuel Plant
40%
Distribution
97%
Petrol Car
18%
7%
Coal Mine
97%
Power Station
35%
Distribution
95%
Electric Car
75%
24%
Solar Farm
Distribution
95%
Electric Car
75%
71%

Transport energy use & impact





Technology for mobility

Limit = 60km/h

Need only 14s

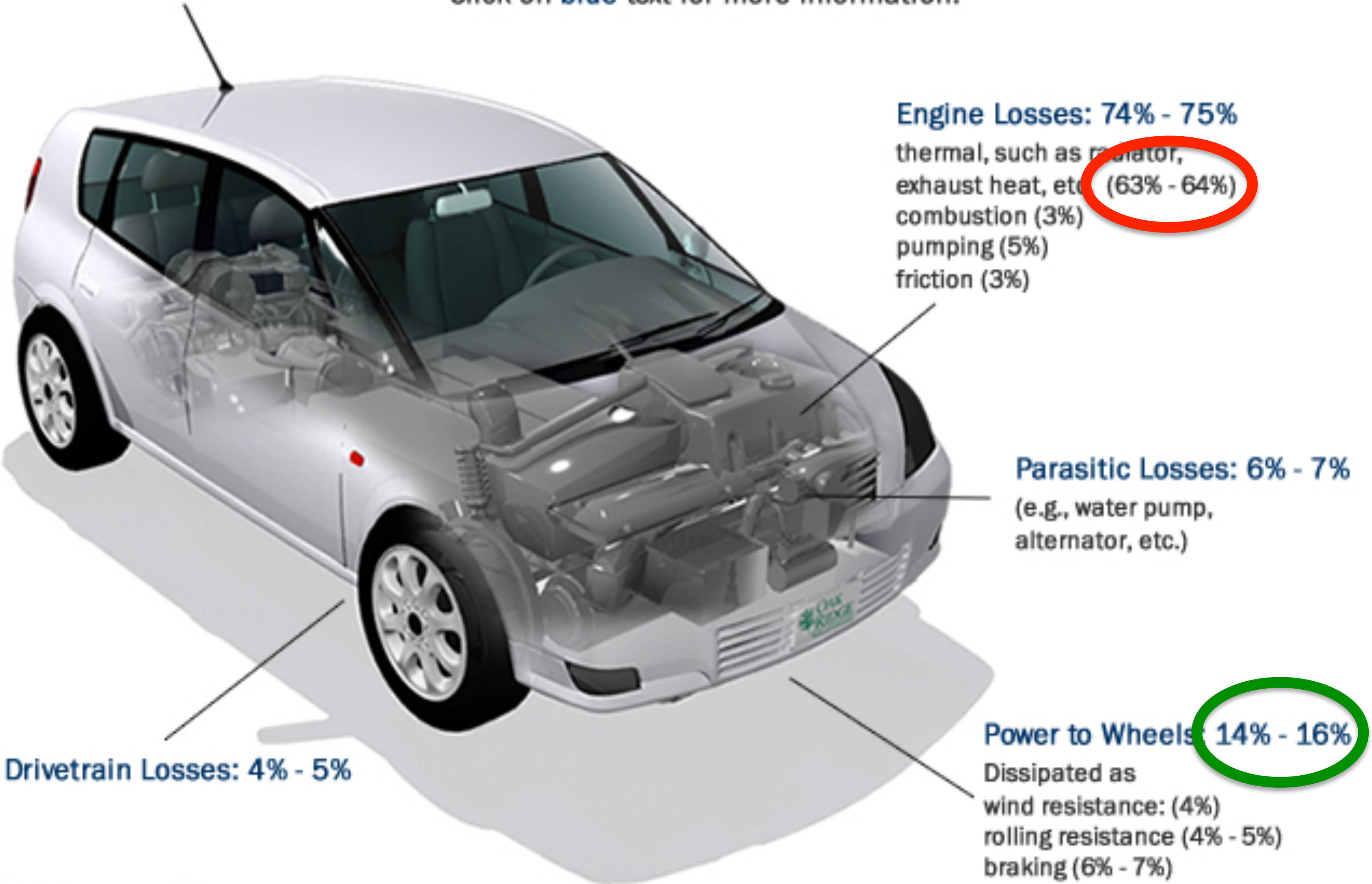
Need only 150km

40kgCO_2/100km

400kg can do

Energy Requirements for City (Stop and Go) Driving

Click on blue text for more information.



Idle Losses: 6%

In this figure, they are accounted for as part of the engine and parasitic losses.


It is not about cars
It is about people!

And our focus is:

Automakers’ Electric Bikes

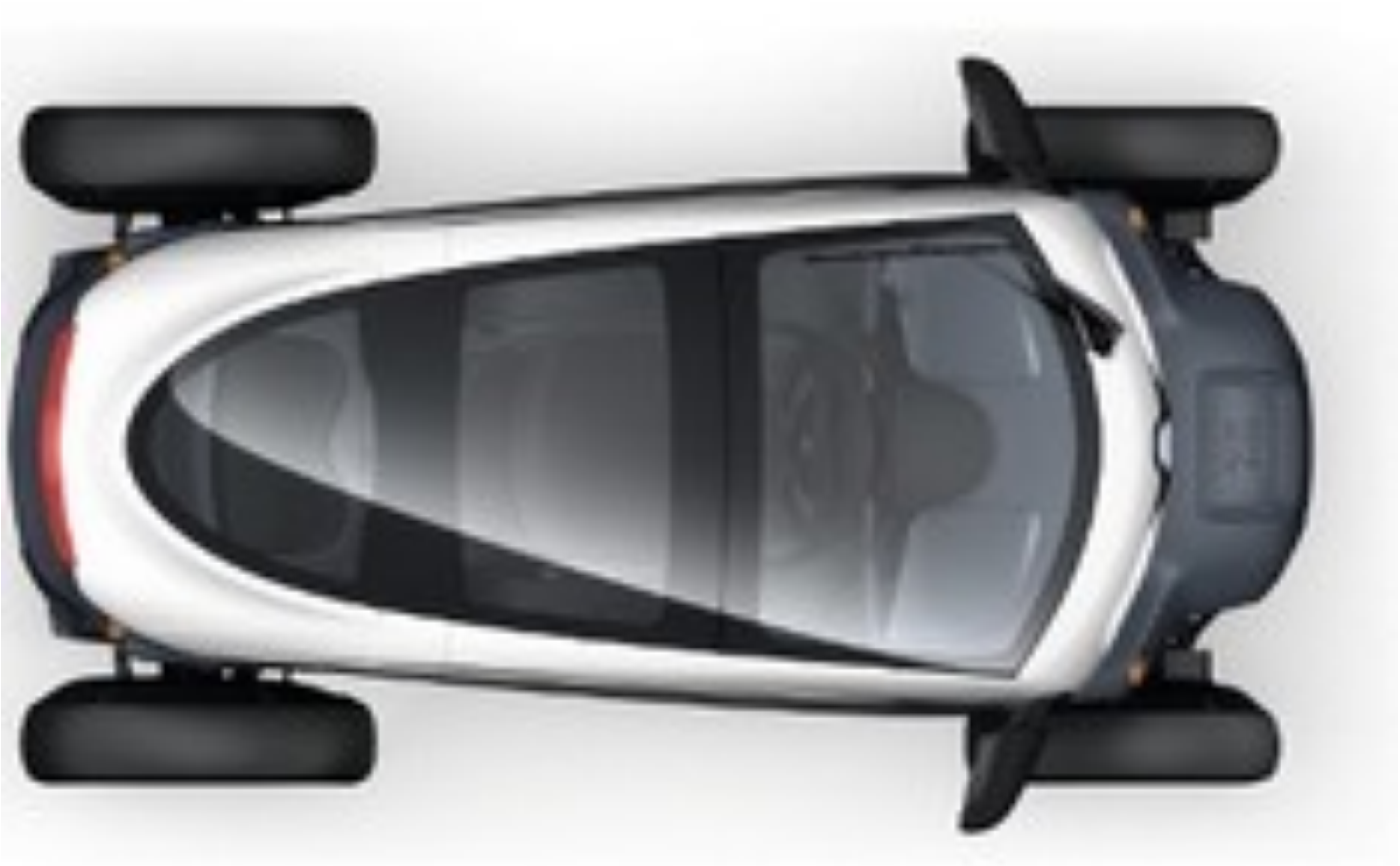









INTRODUCING THE ELF

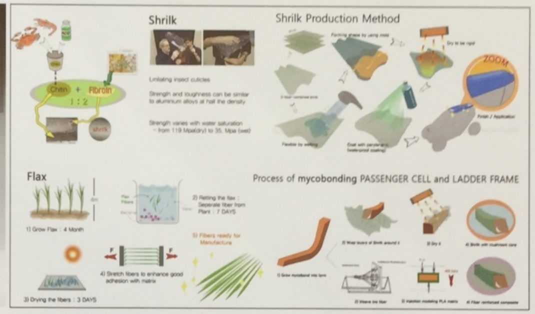



NISSAN
zero Emission

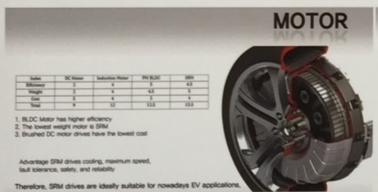
Cost, Energy and Pollution

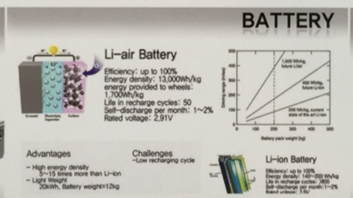
For 100km:	Petrol Car	Electric Car Normal	Electric Car Off-peak & Small Car
Price/Unit	R 12,00	R 1,33	60c
Units	10 litres	15 kWh	5 kWh
Energy	320 MJ	54 MJ	27 MJ
Cost	R 120,00	R 20,00	R3,00
GWP	45kg	39kg	13kg

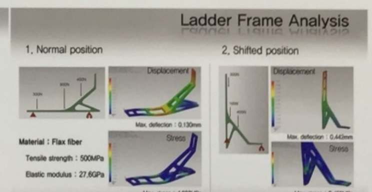
Materials

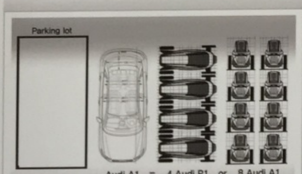


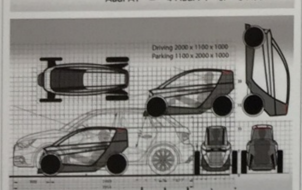
Engineering

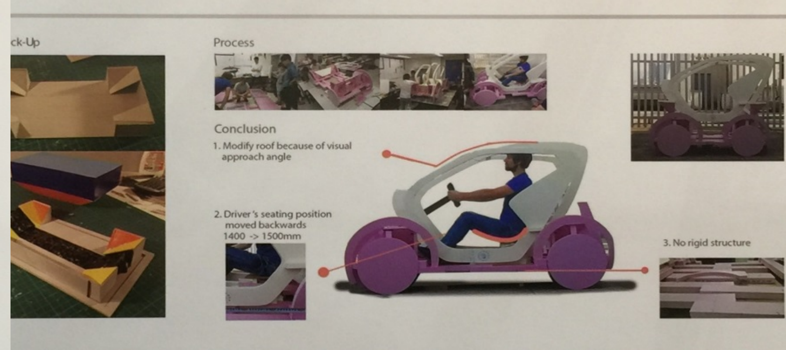


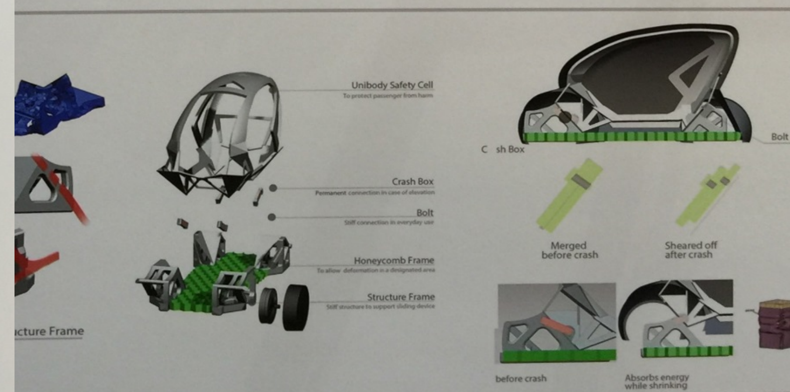












RWTHAACHEN UNIVERSITY

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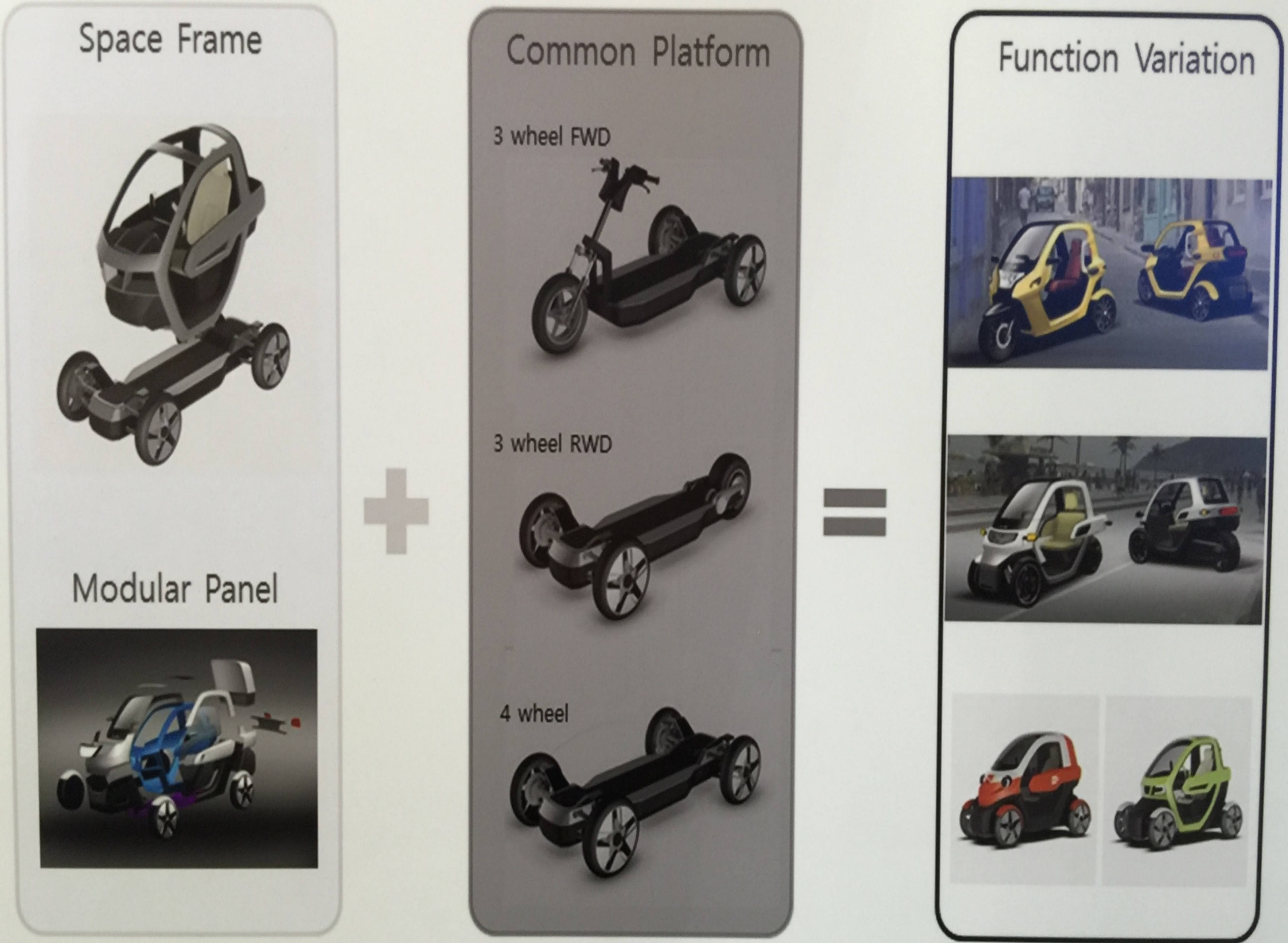
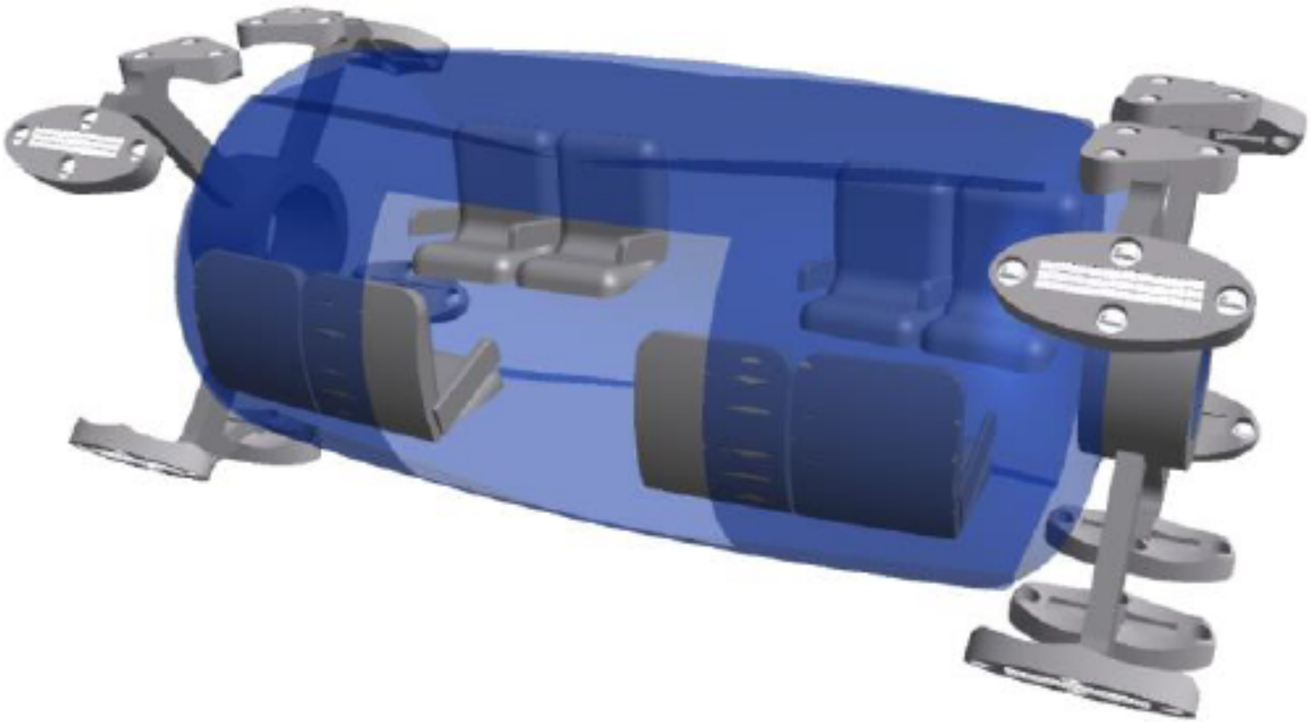

Space Frame
Modular Panel
Common Platform
3 wheel FWD
3 wheel RWD
4 wheel
Function Variation

In South Africa, Milotek is working on the creation of the Futran multi purpose people transportation system

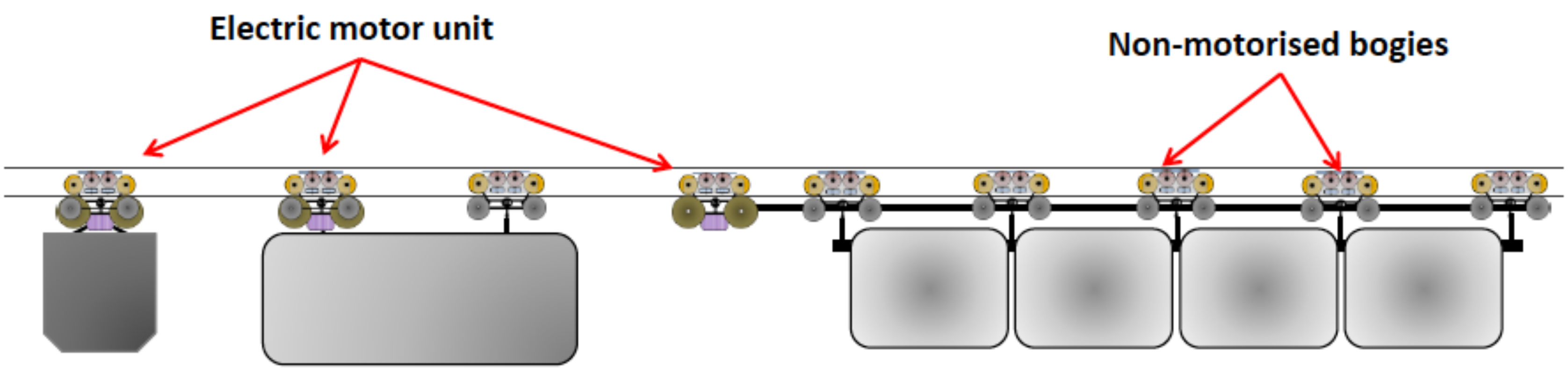


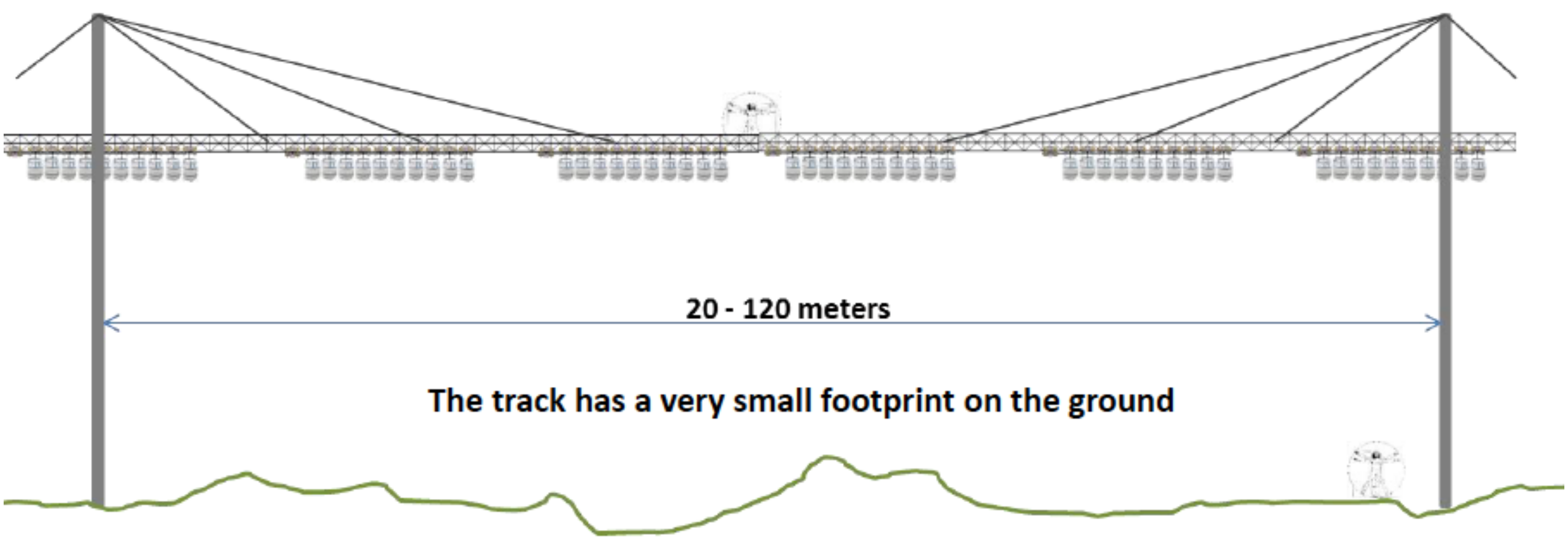
<u>Taxi trip</u>: Up to 8 people per trip, up to 2 stops in between

<u>Limo trip</u>: Whole pod for yourself

<u>Goods trip</u>: Up to 4 tons bulk, packaged or solid freight per trip

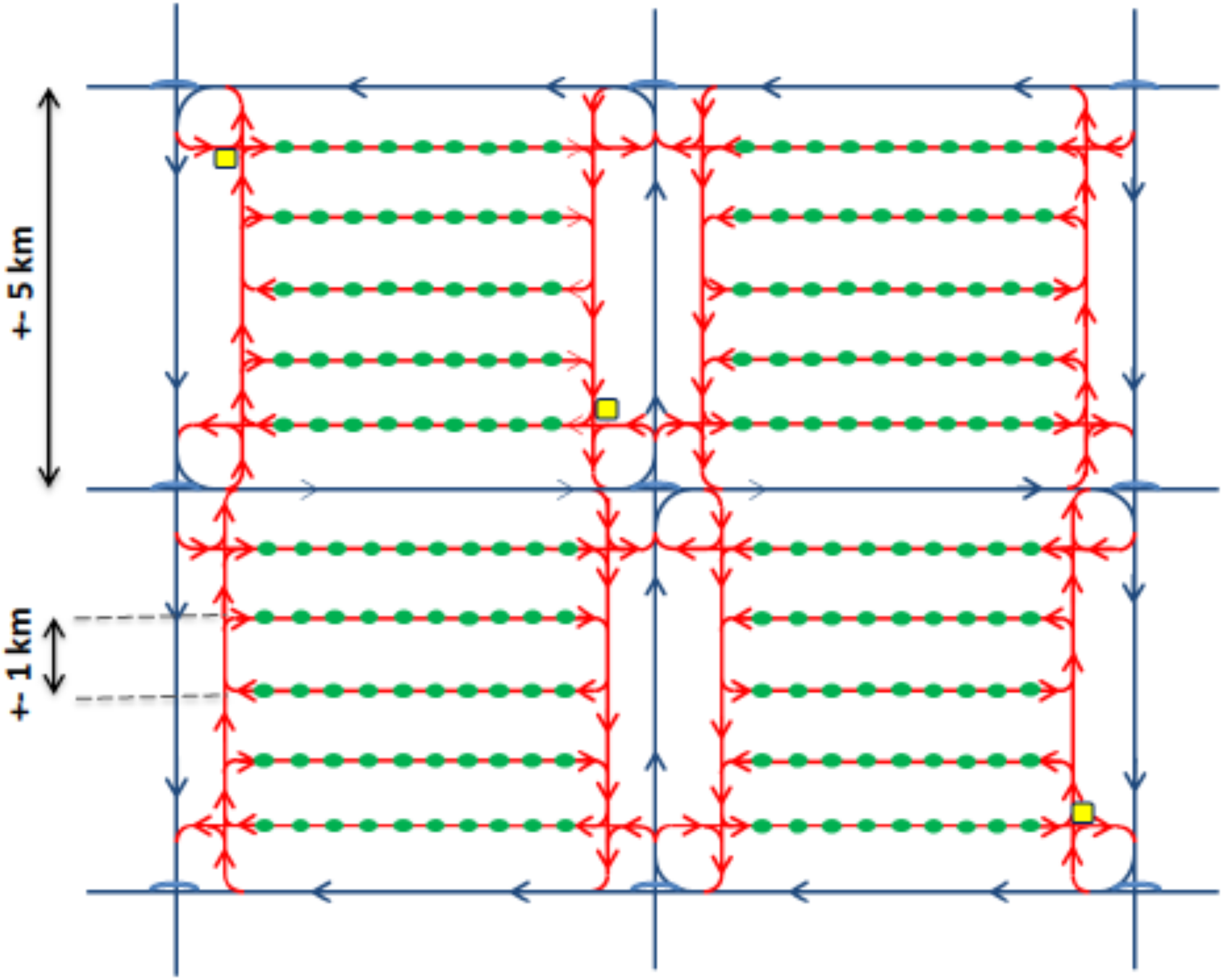
Futran System



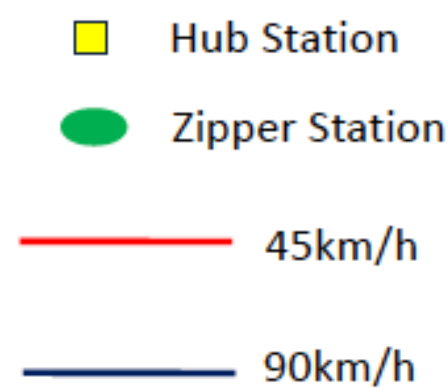


The unidirectional, block-based Futran designed FRT track network is the ideal design to cover wide urban areas

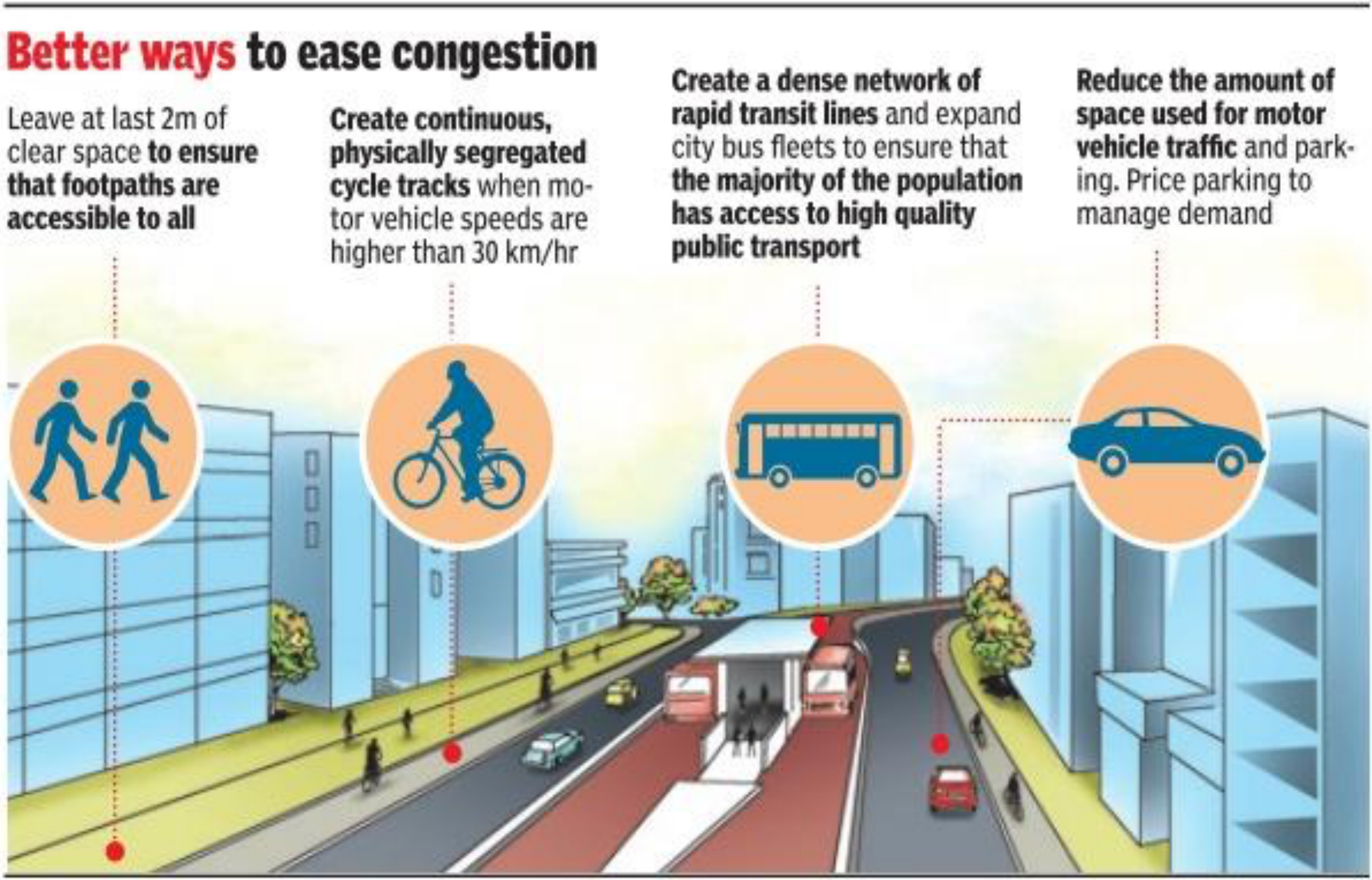
A typical FRT track block will be 5km x 5km with stations less than 500m from any point in the city. The bigger the city, the more FRT track blocks there will be.



Pods can move from any station to any other station without the need to stop at interim stations first



Mobility pathways

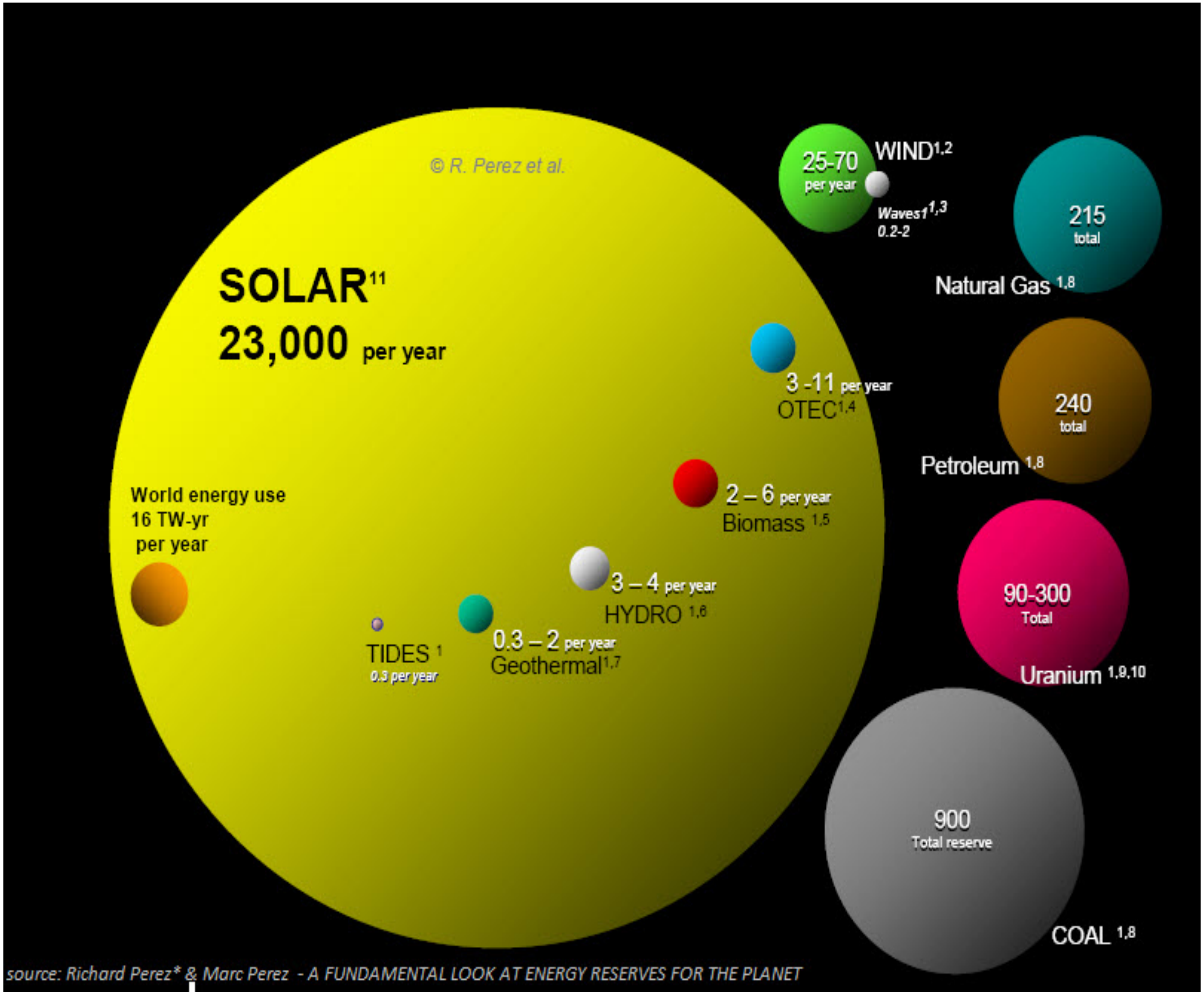


Mobility for life

Need to move: Energy & Mode combination

- Efficient (least energy per P.km)
- Right sized (fit for purpose)
- Zero emissions (clean)
- Available and accessible
- Integrated, interconnected mix of options

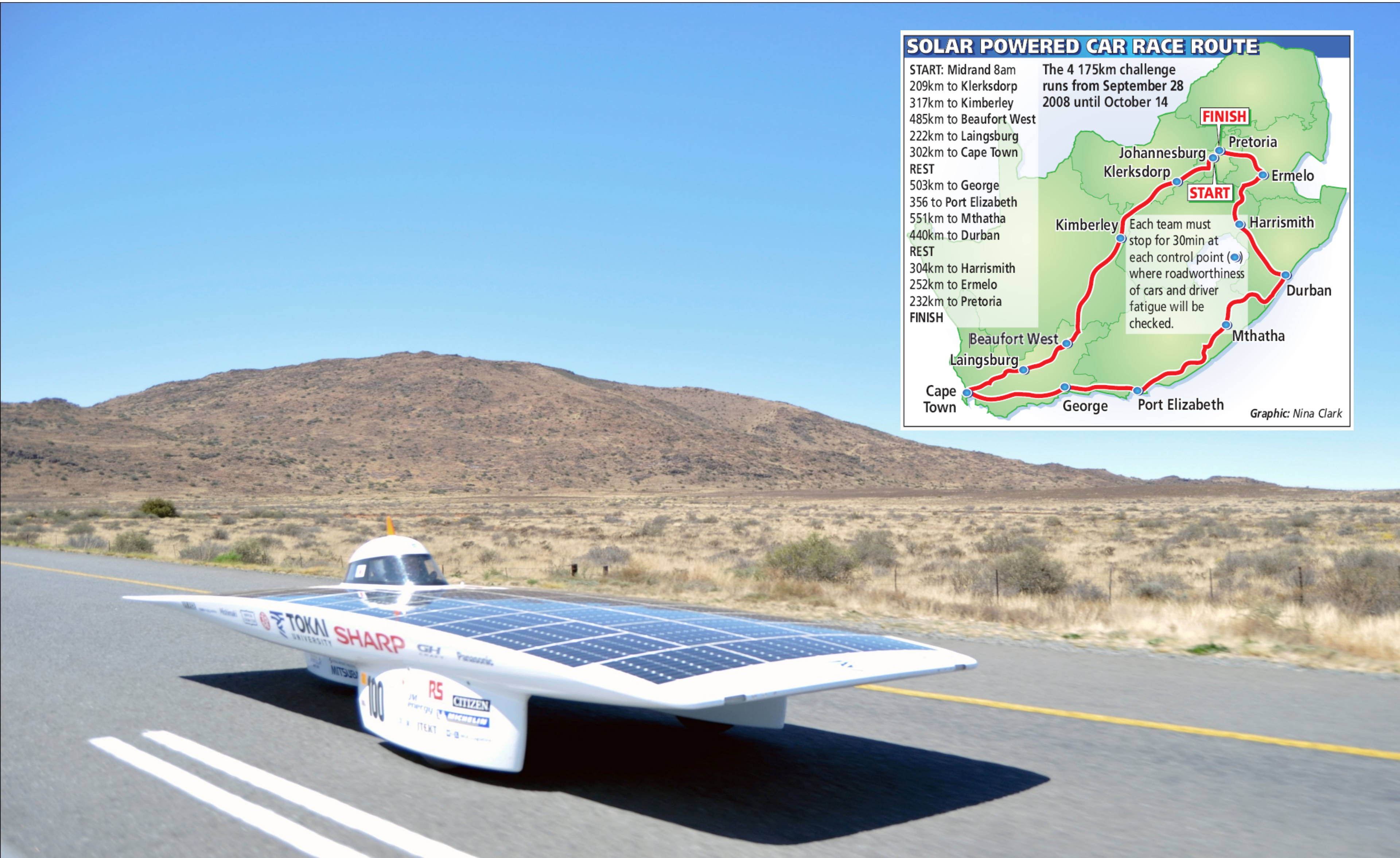
Energy alternatives to onsider



Comparing finite and renewale planetary energy reserves)Terawatt-years).
Total recoverable reserves are shown for the finate resources.

TW.yrs

SA Solar Challenge



Solar powered electric bus

- Adelaide Australia – “Tindo” after the Aboriginal word for "sun”
- World's first 100% solar-recharged electric transit bus
- Seats 27
- 35kW electric motor
- 262kWh ZEBRA sodium nickel chloride batteries

11,480kg vehicle, top speed of 75km/hr and an estimated operation range between fast charges is 200km

Nissan LEAF can be used as an electricity storage device for houses in preparation for power outages and/or shortages.

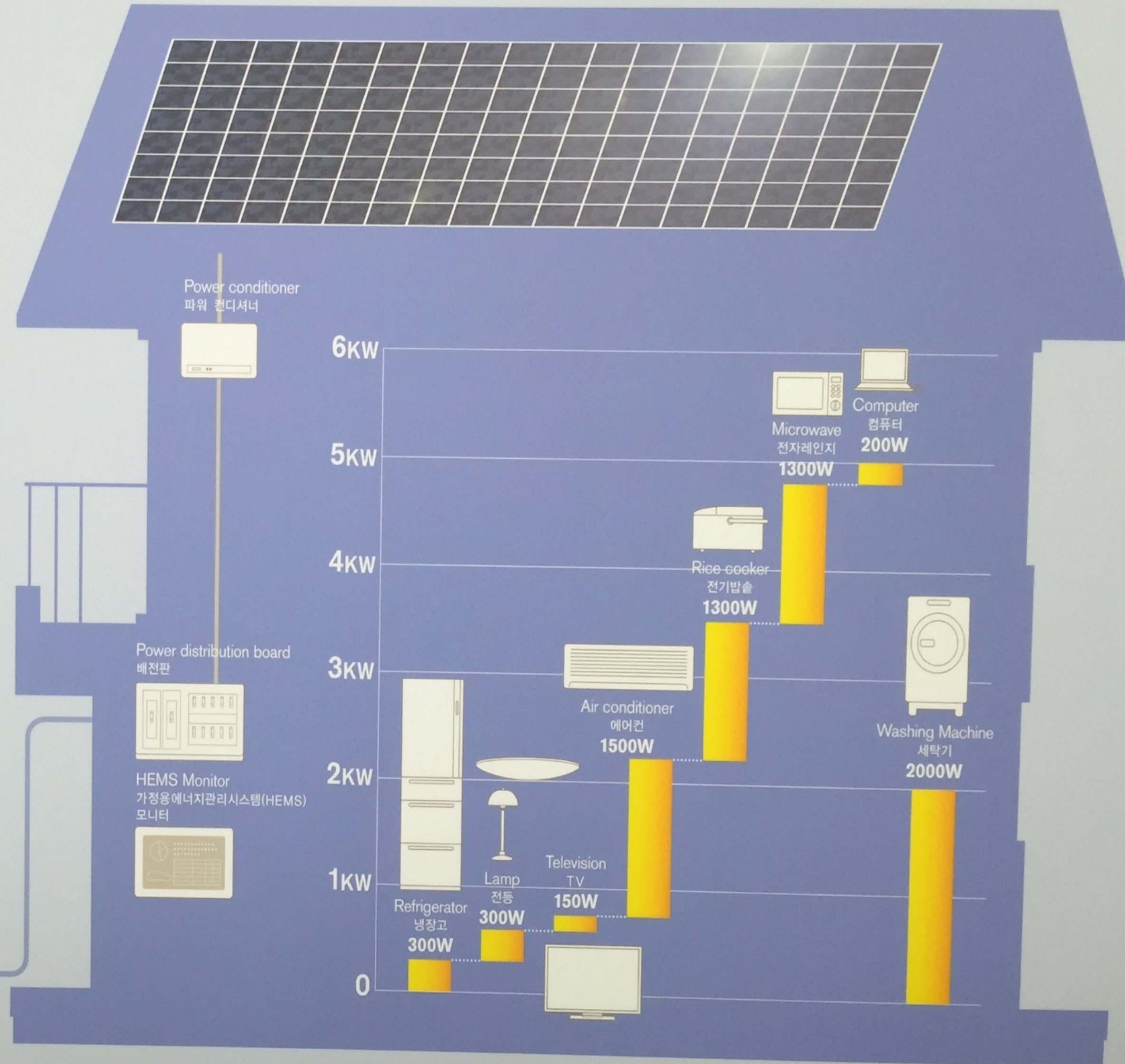
닛산 리프는 정전이나 전력부족 사태를 대비하여 가정에서 전력저장장치로 사용될 수 있습니다.

The lithium-ion batteries in a fully-charged Nissan LEAF, store up to 24kWh of electricity, which is sufficient to supply an average Japanese household for about two days*. Electricity can be supplied to a house through the power control system (PCS) by connecting the car to the house's electricity distribution panel using a connector linked to the LEAF's quick charging port.

*Average electricity usage of a standard home in Japan: 10~12 kWh/day

완전히 충전된 닛산 리프의 리튬-이온 베터리는 일반적인 일본 가정내에서 약 이틀동안 사용하기에 충분한 24kWh의 전기를 저장합니다. 리프의 급속 충전구에 연결된 커넥터를 사용하여 가정의 배전판에 연결시키면 파워컨트롤 시스템 (PCS)을 통해 가정에 전기를 공급할 수 있습니다.

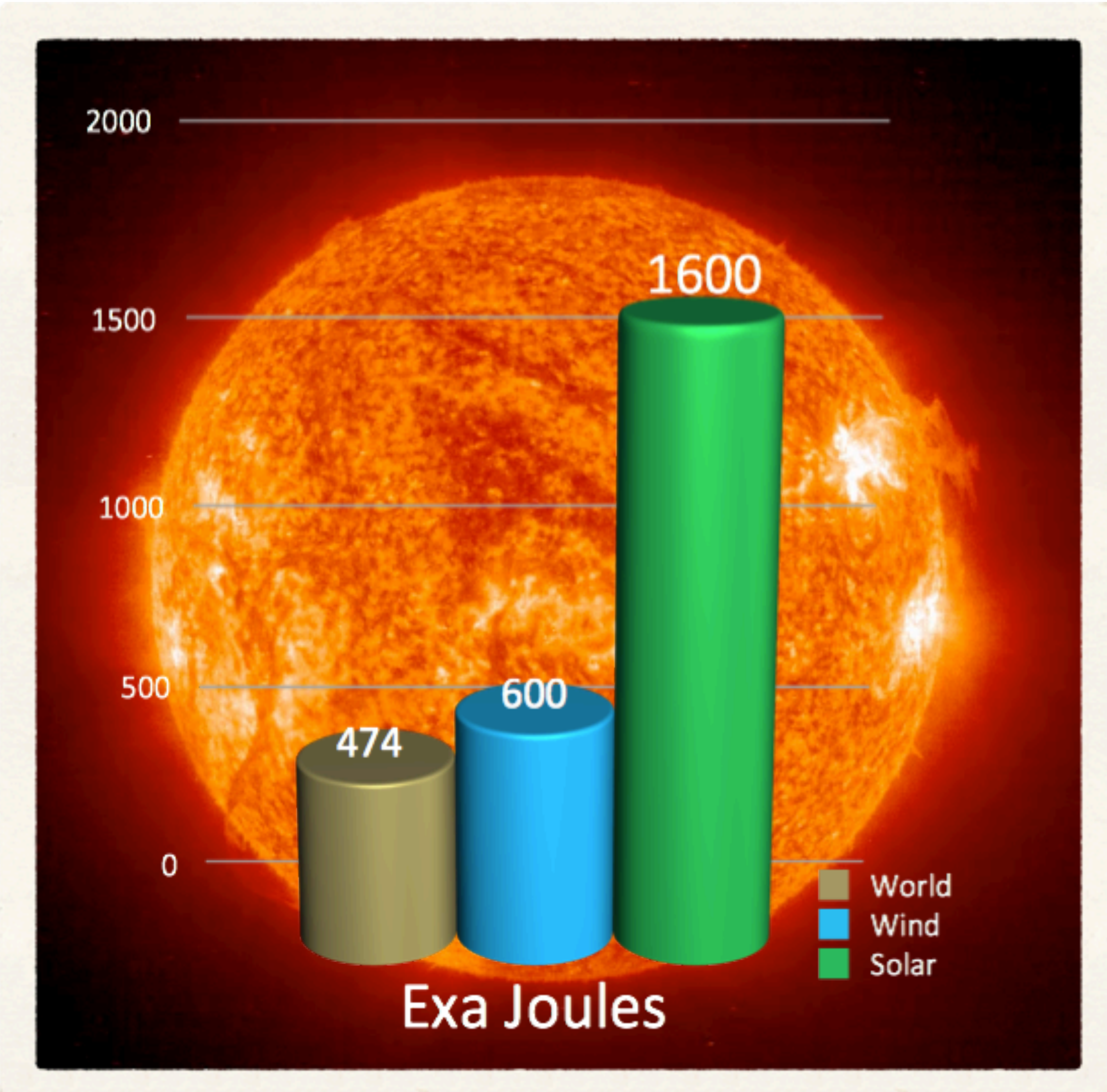
* 일본의 일반가정의 평균전기사용량: 일 10-12kWh



Home & *e*Commuter Car

Appliance	For Every Day Wh/d	MJ/d	Cost
Kitchen	8'577	31	R 8,58
Rest	7'720	28	R 7,72
Outside	2'780	10	R 2,78
Total	**19kWh**	69	R 25
	Use of petrol or electricity	MJ/d	Cost
*p*Car 9L/100km	7,2 L 80km/day	205	R 100 R14/L
*e*Car 15kWh/100km	**12 kWh** 80km/day	43	**R 16** R1,33/kWh
*e*Com 5kWh/100km	**4 kWh** 80km/day	14	**R 5** R1,33/kWh

Energy from the SUN



- Average = 80km per day
- Small electric commuter

5kWh/100km = 4kWh/day

- PV electrical energy

  5kWh per day

  1kW array = 5 x 200W panels

  $7m^2$ (= 3,5m x 2m carport)

- PV installation cost
- R30000, once-off, for 25 years

PV life = 500000km

6c/km (no increase!)

Passenger.km per energy unit

Urban Commutes

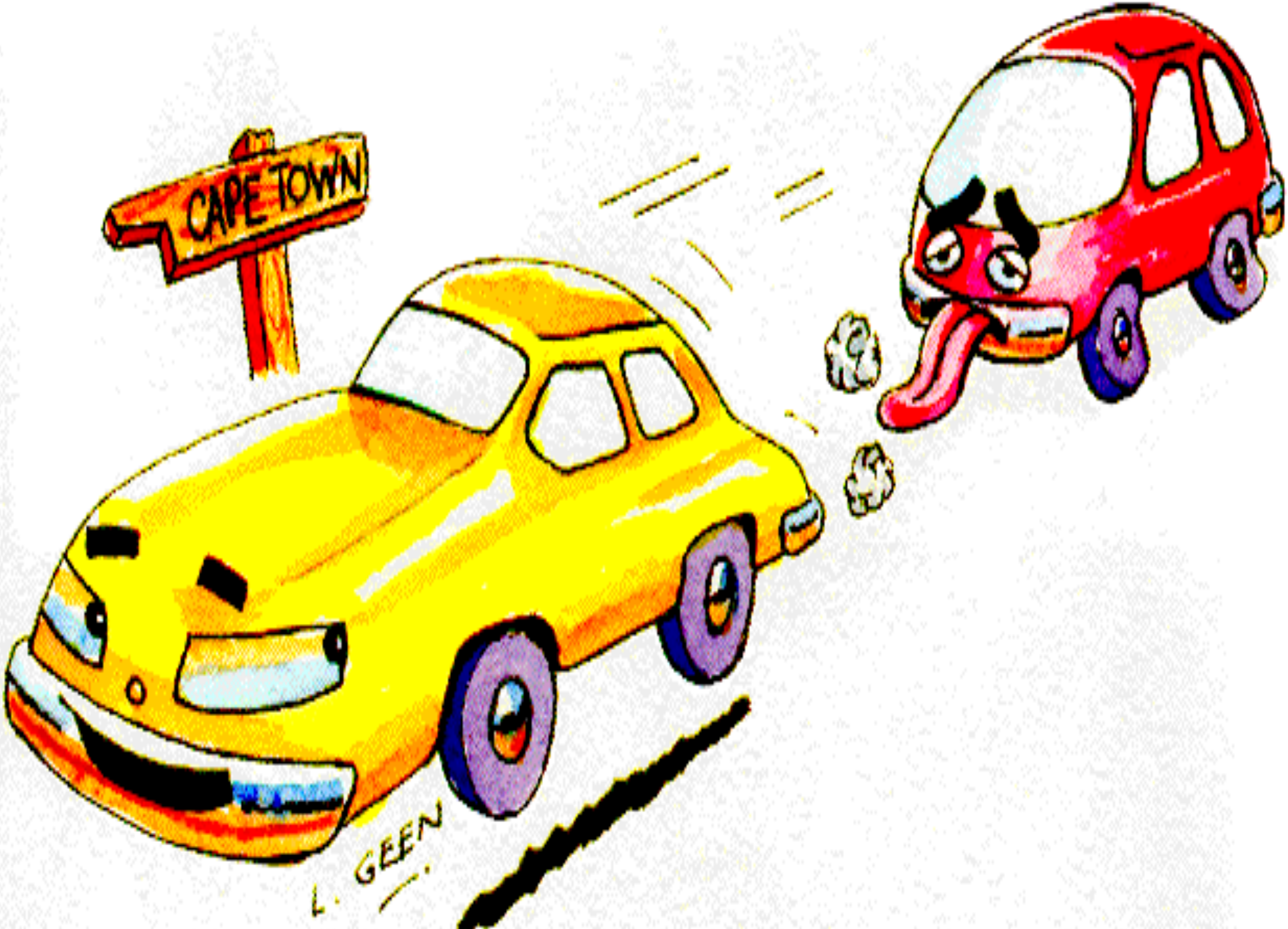
Electric Rail	255
Trolleybus	123
Diesel bus	33
Light motorcycle	25
Smart For 2 cdi	20
Prius	20
*e*Commuter	60

Individual

Public

Transport!


Cafeteria BOBA
기술!
THE 28th
ELECTRIC
SYMPOSIUM AND
학술대회
EVS28


CAPE TOWN
L. GREEN

SANEDI: Green Transport

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