Energy contents of various resources – Energy consumption and production of various devices, vehicles and plants

In this table some very important energy concepts are explained	
Watt	1 Watt corresponds to the power which needs to be invested over 1 s to move an object over a path length of 1 m while applying a force of 1 N on this object. 1 Watt corresponds to the power which you need to heat up 1 gram of water by 14.3 K over 60 seconds. Reminder: 1 W = 1 J/s.
Watthour	The watthour (Wh) is the Energy which is supplied as power to a device in one hour. The best example is a 60 Watt bulb which burned during one hour. During this one hour, the bulb used an Energy of 60 Wh. Energy in terms of fuel usage is usually described by the unit: kWh (kilowatt-hour). 1 kWh = 3.6 MJ = 3.6 • 10^6 J = 859.845 kcal 1 hp (horsepower) = 735.498’75 W 1 l Car fuel = 9 kWh
Ampere-hour	One Ampere-hour is the charge amount which flows through a conductor at a constant current of 1 A for over 1 hour.

Important notice

- In the table on the 2nd page you will find the energy contents of various materials which are commonly exploited and combusted in our daily life in order to gain energy.
- On the 3rd page there are values listed which illustrate the power production of various powerplants and other energy generators.
- On the 4th page there are values listed which illustrate the energy and power consumption of commonly used vehicles and devices.
- Keep in mind that all these values serve only for orientation purposes. Thus the values are lay in the range of true values but are NOT precise.
- The values are oriented on sources from Wikipedia, News-Papers and technical data of the corresponding developer or operator.

Sources on which the values were oriented

- http://energieberatung.ibs-hlk.de/plangetrei_dat.htm
- http://www.eon.com/de/ueber-uns/struktur/unternehmenssuche/eon-kernkraft-gmbh.html
- https://de.wikipedia.org/wiki/Brennelement#cite_note-4
- https://de.wikipedia.org/wiki/Kernkraftwerk
- http://gizmodo.com/5850299/americas-largest-coal-power-plant-burns-11-million-tons-of-bituminous-a-year
- https://de.wikipedia.org/wiki/Kohlekraftwerk_Moorburg
- https://en.wikipedia.org/wiki/Energy_efficiency_in_transportation#Trains
- http://shrinkthatfootprint.com/average-household-electricity-consumption
- https://whatisnuclear.com/physics/energy_density_of_nuclear.html

Heat of combustion of various materials		
Solid materials	**MJ/kg**	**kWh/kg**
Bituminous coal (black coal)	23 – 29	6.4 – 8.1
Lignite (brown coal)	19 – 22	5.3 – 6.1
Koks	27 – 29	7.5 – 8.1
Wood (dry)	15 – 19	4.2 – 5.3
Straw (dry)	17	4.7
Paper	15	4.2
Domestic Waste	2.5 – 12	0.14 – 3.3
Liquid materials	**MJ/kg**	**kWh/kg**
Car Fuel	40 – 42	11.1 – 11.7
Aviation Gasoline / Kerosene	44	12.2
Diesel and heating oil	42.6	11.8
Ethanol	26.8	7.4
Petroleum	43	11.9
Paraffin wax	42	11.7
Gaseous materials	**MJ/kg**	**kWh/kg**
Hydrogen gas	120	33.3
Natural gas	32 – 45	8.9 – 12.5
Methan	50.013	13.9
Ethan	47.486	13.2
Ethylen	47.146	13.1
Acetylen	48.222	13.4
Propan	46.354	12.9
n-Butan	45.715	12.7
i-Butan	45.571	12.7
Nature Uranium (~0.7 % ^{235}U)	650'000	$1.8 \cdot 10^5$
Weakly enriched Uranium, used in Nuclear Power plants (~5% ^{235}U)	4'600'000	$1.3 \cdot 10^5$
Enriched Uranium (100% ^{235}U)	80'000'000	$2.2 \cdot 10^7$
Enriched Thorium (100% ^{232}Th)	80'000'000	$2.2 \cdot 10^7$
Biological materials	**MJ/kg**	**kWh/kg**
Fat (animal and vegetable)	37	10.3
Protein	17	4.7
Carbohydrates	17	4.7

Power Plants		
Kind of power plant	**Generated Power**	**Additional Information**
One nuclear reactor unit	1000 MW	One nuclear reactor core of a nuclear power plant holds approximately 100 tons of Uranium. Of these 100 tons, ~4 % are ^{235}U. Every year 20 tons of these nuclear fuel elements are replaced by new ones. Thus the nuclear fuel elements can stay up to 3 or 5 years inside the nuclear reactor core without replacement. 1 kg of natural Uranium (containing ~0.7 % of ^{235}U) has more or less the same energy as ~13'000 l of petroleum or ~20'000 kg of black coal.
One fossil-fuel power station unit	1000 MW	The black coal consumption of a fossil-fuel power station unit is somewhat around 12'000 tons/day.
Solar panels	200 W/m^2	at 1'000 W/m² sun irradiation
Wind turbines	2 – 8 MW	Max. power limit is dependent on the size of the wind turbine
Hydropower	heavily dependent on the river size	
Batterie (Li-Ion)	0.6 MJ/kg	

Energy and power consumption of various devices and vehicles

Device/Vehicle	MJ	kWh	W	Important information
Car	194 per 100 km	54 per 100 km		A new average car burns ca. 6 l (ca. 194 MJ) car fuel per 100 km on a freeway.
Plane (holding 240 people, per 100 km travel)	29'000 per 100 km	8'000 per 100 km		A plane burns ca. 850 l kerosene per 100 km, while being able to transport ~240 people. This makes ca. 3.5 l per 100 km per person
Helicopter	4300 per hour	1200 per hour		A helicopter uses ~ 150 l kerosene per 100 km when flying 250 km/h. Yet fuel usage is very dependent on size and the movement of the helicopter. A Eurocopter HH-65 Dolphin fits into this scale
Train	6'840 – 11'880	1'900 – 3'300 per 100 km		A German ICE Train needs an energy of ca 1900 – 3300 kWh to drive a length of 100 km
Truck/Bus	990 per 100 km	275 per 100 km		An LKW uses on average 30 l diesel when driving 100 km at a speed of 80 km/h.
City Busses				City Buses use up to 60 l fuel per 100 km
Computer		0.07 – 0.5	70 – 500	Depending on the hard ware of the computer and the kind of work the computer performs
LCD TV			100	32" – 40" screen
Laptop			10	
Average Household		3500 per year		
Backoven				
Microwave			2000	
Cooking Plate			2000 / plate	
Heater			2000	

Comparison of Atomic Bombs

The strength of Atomic Bombs is usually described by tons of TNT equivalents. Thus, if an Atomic Bomb hast a blast yield of 1 kilotons, this means that 1000 tons of TNT have the same blast yield. Atomic bombs usually contain enriched Uranium or Plutonium containing at least 80 % ^{235}U or ^{239}P respectively.
1 kiloton of TNT equals to 4.184 terajoules (TJ).

Bomb	Blast Yield in TNT equivalents	TJ (Terajoule)	Radius (km / mi)
Nuclear Bomb dropped on Hiroshima by the USA	15 kilotons	63	1.75 / 1.1
Today's nuclear bombs range:	3 kilotons up to 50 megatons	$13 – 2 \bullet 10^5$	–
https://en.wikipedia.org/wiki/List_of_states_with_nuclear_weapons			