Primary Energy
- and how to count it

IEA-seminar January 24, 2018

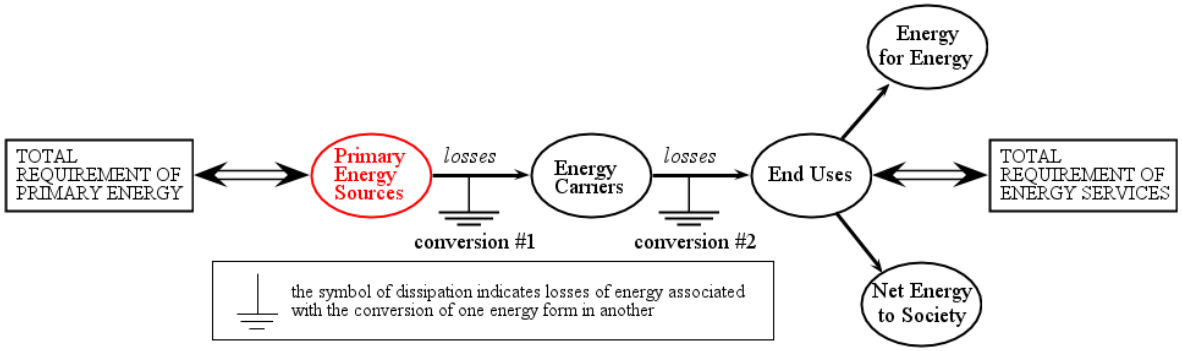
By Erik Sauar

DIFFER

Definition of Primary Energy is clear and agreed - and inherent in the term

UN / OECD / IEA:

Primary energy consumption refers to the direct use at the source, or supply to users without transformation, of crude energy, that is, energy that has not been subjected to any conversion or transformation process.



Wikipedia:

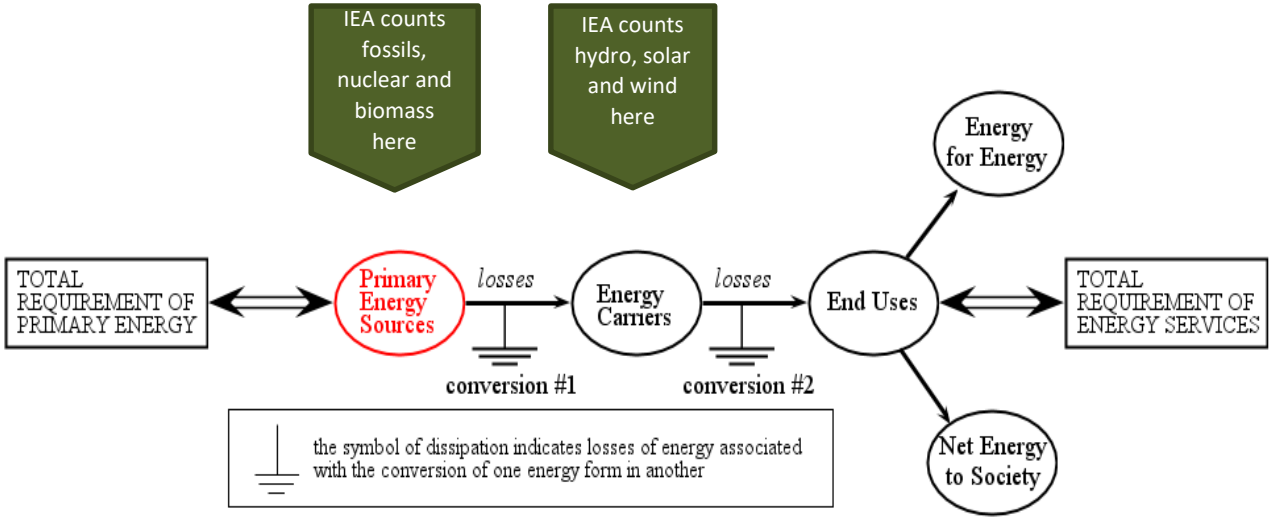
Primary energy (PE) is an energy form found in nature that has not been subjected to any human engineered conversion or transformation process.

How does IEA and UN count primary energy ?

IEA and UN has chosen to count primary energy as "the first energy form downstream in the production process for which multiple energy uses are practical"
……. BUT THIS IS OBVIOUSLY NO LONGER PRIMARY ENERGY

How does IEA and UN count primary energy ?

IEA and UN has chosen to count primary energy as "the first energy form downstream in the production process for which multiple energy uses are practical"
……. BUT THIS IS OBVIOUSLY NO LONGER PRIMARY ENERGY



Is it acceptable that IEA and UN does not adhere to their own definition of primary energy ?

IEA Primary Energy definition

…»crude energy that has not been subject to any conversion process»

> *This is a clear physical term*

> This is before conversion

IEA Counting Method

"the first energy form downstream in the production process for which multiple energy uses are practical"

> This is an unclear, practical term. Which waste heat is practical ? Hot water in desert ? Warm air on PV panel?

> This is sometimes after conversion

It is quite clear that IEA counts «Tradable energy produced».

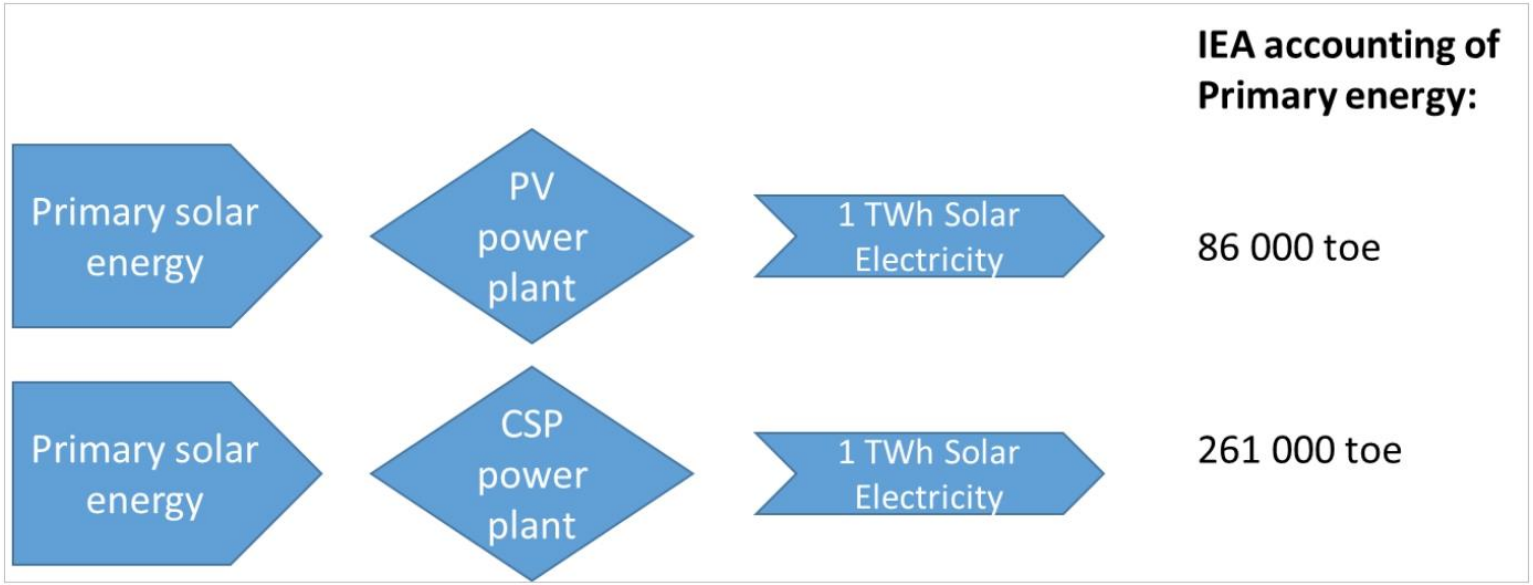
It is not scientifically acceptable for IEA and UN to have a counting method that is not consistent with the physical term they claim to count. If anyone wants to count in this way, they can not name it «primary energy».
Most likely historical reasons.

IEA already «back calculates» for nuclear and biomass. The same should of course be done for wind and PV.

DIFFER

Primary energy source	IEA conversion factor from secondary electricity made to primary energy source		Conversion factor based on scientific definition of primary energy
Nuclear energy	3.03	=	~3
Bio mass energy	3.0	=	~3
Solar energy	1.0	X	~5.0
Wind energy	1.0	X	~2.5 ?
40/60 mix of solar and wind	1.0	X	~3-3.3

Two solar technologies deliver the same power – counted hugely differently



Basically all energy losses of primary energy end up as heat !

To make heat from solar energy immediately removes 40 % of potential power.

Meaningless to «count» interim heat production.

Energy efficiency of electric cars based on renewables very similar to gazoline cars

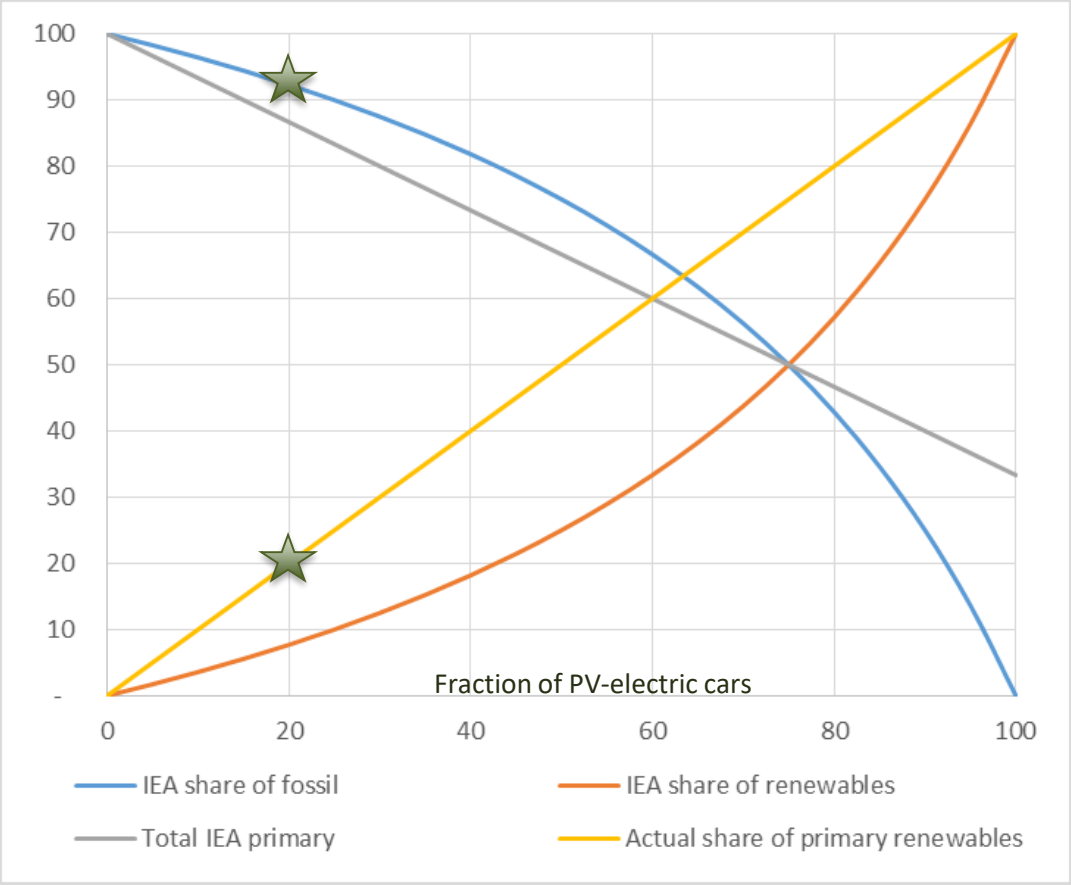
Vehicle	Fuel	Energy efficiency at extraction	Energy efficiency in vehicle	Primary energy consumption per 15 000 km (scientific definition)	Primary energy consumption per year (Today's IEA terminology)
Gasoline car	Gasoline	~ 80 % (Keesom et al., 2012)	~ 27 % (Thomas, 2014)	17 MWh (EPA, 2017 and Keesom, 2012))	17 MWh
Electric car	Wind/Sun electricty	~ 28 % (Mix of sun and wind)	~ 75 % (Tesla)	15 MWh	4 MWh

The energy efficiency of gasoline cars and electric cars is very similar.

It is normally always the conversion from primary to secondary energy that has the largest efficiency loss. It just takes place at different places in the value chains.

The irrational consequences for transport: Cars on PV electricity vs traditional gazoline cars

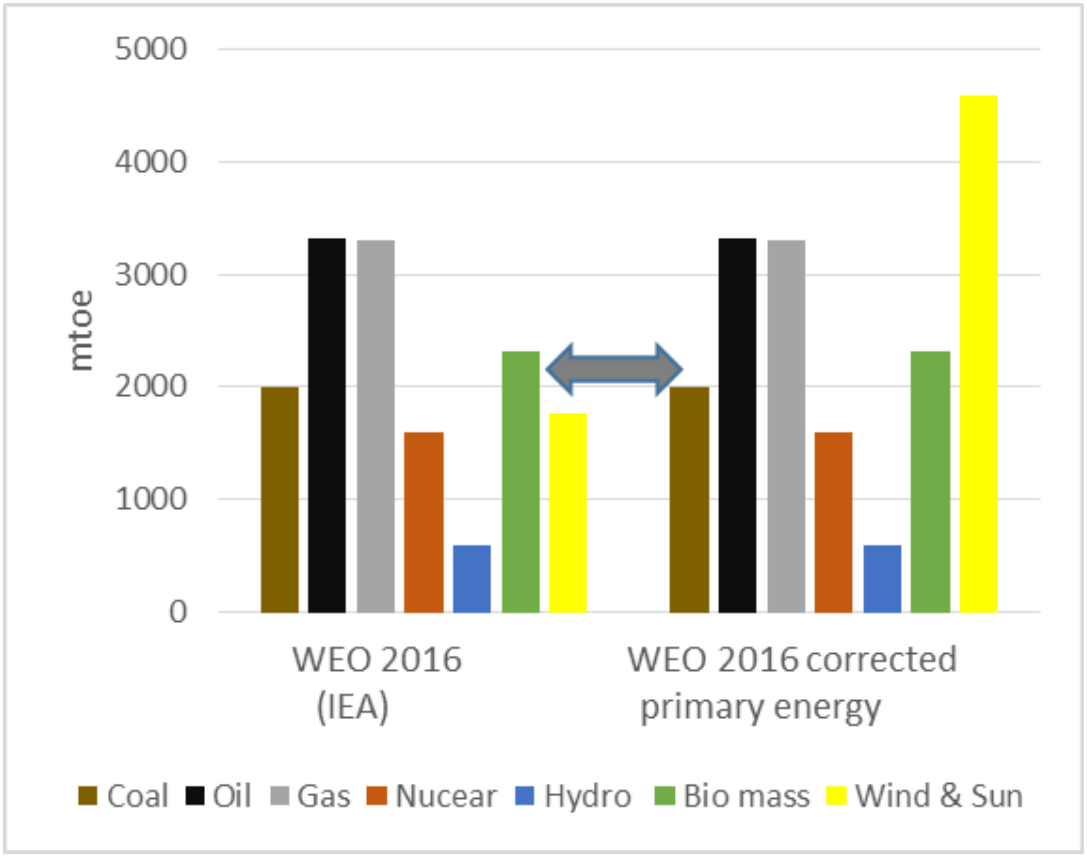
IEA's reporting of «primary» energy vs actual primary energy
As a function of percentage of electric cars on PV power vs ICE cars.



When 20 % of cars are on PV electricity, IEA will still report 93% fossil primary energy used by the car fleet !

When renewables grow, IEA reports that energy efficiency goes up, but this is just due to counting secondary energy.

World Energy Outlook's 2040 Scenarios.
- Decision makers are deceived by current counting method.



Fossil investors today believe market share will stay much stronger than it will.

The visible price pressure from renewables comes much earlier on the right side.

Politicans and public opinion believe shift to renewables is too far away.

Other decision makers…..

Way forward

- Important to state whenever today's primary energy is presented, that this is actually a mix of primary and secondary energy, and that wind and PV are strongly under reported.

- Important to start dual reporting and graphs:
  - «Traditional» energy mix reporting
  - Consistent primary energy reporting

- EUs PV platform is preparing an official request for correct counting of PV energy.

- The road is open for an independent party to take «pole position».
  It is not good for IEA to be the last to change practise.

  => IEA should drive this change.

BACK UP - Slides

Is lost wind and solar energy relevant ?
Yes, lost opportunity cost very similar for PV (wind) and oil

DIFFER

> Let us assume a simple system with PV and oil as the only energy sources and EVs and ICE cars as the only consumers. The conversion to secondary energy occurs in the PV panel and in the ICE.

> If the energy efficiency of the ICE car increases (at no extra cost), the cars will use less oil, and can tolerate a higher oil price. This means more oil fields become profitable and valuable.

=> «Free oil in nature becomes valuable oil.»

> If the energy efficiency of the PV panel increases (at no extra cost), new PV power plants become more competitive. This means that more sunny sites become profitable and valuable.

=> «Free sun in nature becomes valuable sun.»

Three methods, two of which converge

- IEA mix of primary and secondary as today
  - continues strong underreporting PV+Wind
  - Deceives investors in oil, coal and gas.

- Fossil fuel equivalency (how much is replaced)
  - Implies a 3 x upgrade of PV + Wind

- Physical energy content (as according to definition)
  - Implies a 3 x upgrade of PV + Wind