

**Seminar za privrni sektor
„Izračunavanje ugljikovog otiska poslovnih subjekata!”**

**Izračun ugljikovog otiska s Bilan Carbone® modelom -
Metodološki principi izračuna ugljičnog otiska**



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Energetski institut Hrvoje Požar

Zagreb, 29.-30.11.2016.



Pregled

- Usporedba i zbrajanje stakleničkih plinova (GHG)
- Faktori emisija
- Karakteristike Bilan Carbone® modela



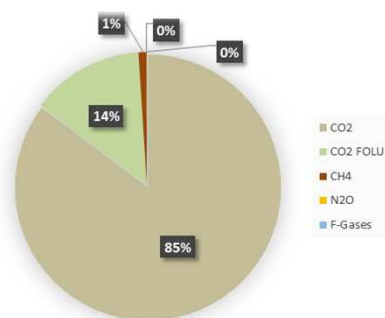
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Globalne GHG emisije – apsolutna vrijednost

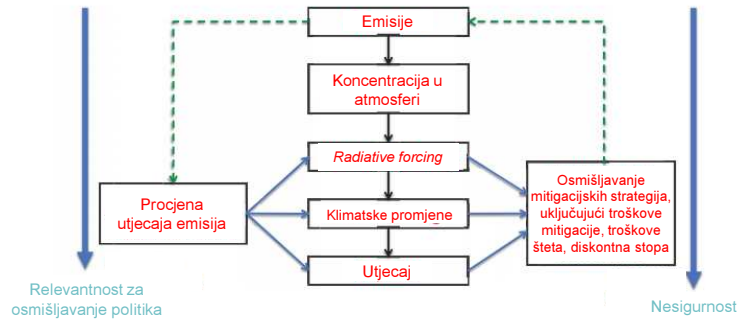


Raspodjela globalnih GHG emisija, u 2010 (IPCC, 2013)





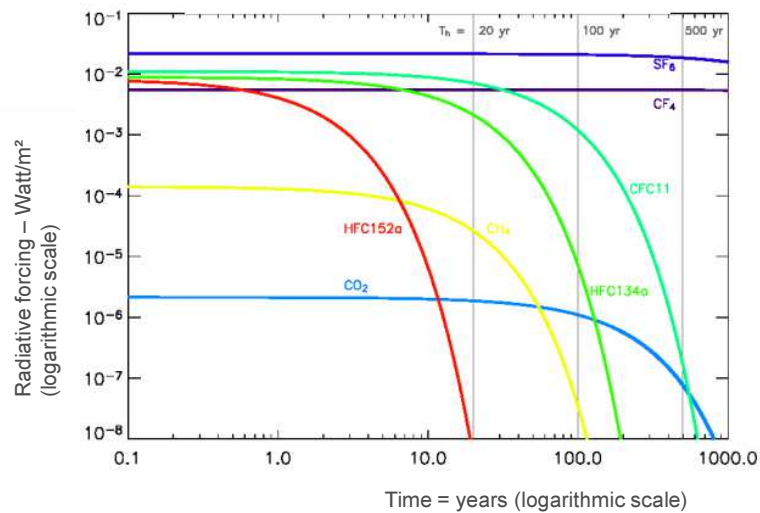
Kvantificiranje utjecaja emisija



Izvor: IPCC, 2013



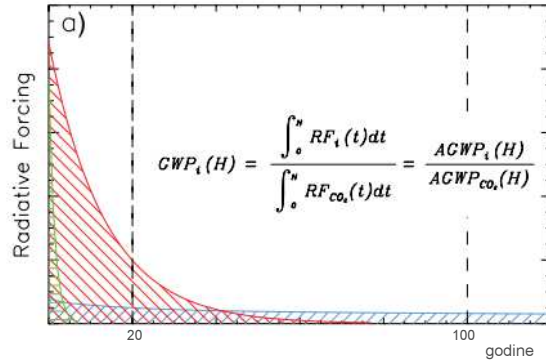
The physical characteristics of GHGs



6



Definiranje zajedničke jedinice: Potencijal globalnog zagrijavanja (GWP)

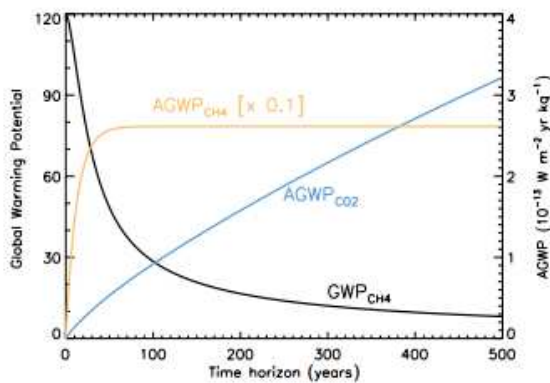


GWP = utjecaj u odnosu na CO₂

Izvor: IPCC, 2013



Definiranje zajedničke jedinice: Potencijal globalnog zagrijavanja (GWP)



$$GWP_i(H) = \frac{AGWP_i(H)}{AGWP_{CO_2}(H)} = \frac{\int_0^H RF_i(t) dt}{\int_0^H RF_{CO_2}(t) dt}$$

Izvor: IPCC, 2013



GWP – CO₂e



Gas	Formula	GWP 100 years
Carbon dioxide	CO ₂	1
Methane	CH ₄	28 to 30
Nitrous Oxide	N ₂ O	265
HydroFluoroCarbon (HFC)	CnHmFp	167 to 13.900
PerFluoroCarbon (PFC)	CnF2n+2	7.350 to 12.300
Sulfur Hexafluoride	SF ₆	26.100

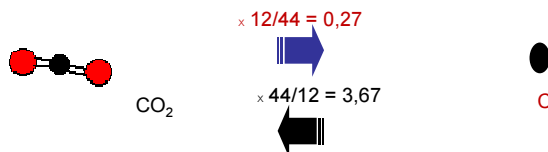
$$\text{GWP} = \text{CO}_2\text{e}$$



Ekvivalent ugljika - Ce



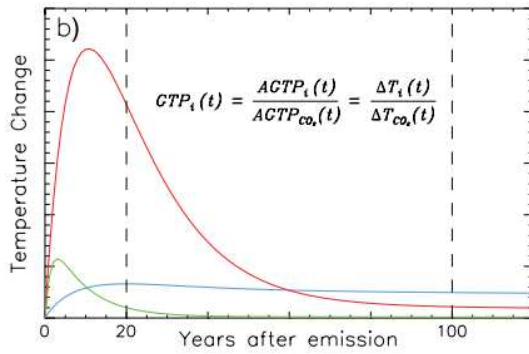
Uglavnom se koristi u znanosti: Ekvivalent ugljika - Ce



Gas	Formula	GWP 100 years
Carbon dioxide	CO ₂	0,27
Methane	CH ₄	7.56 to 8.10
Nitrous Oxide	N ₂ O	71.5
HydroFluoroCarbon (HFC)	CnHmFp	45 to 3753
PerFluoroCarbon (PFC)	CnF2n+2	1985 to 3321
Sulfur Hexafluoride	SF ₆	7047



Potencijal promjene globalne temperature (Global Temperature change Potential - GTP)



$$AGTP_i(H) = \int_0^H RF_i(t) \cdot R_i(H-t) dt$$

Izvor: IPCC, 2013



Različite jedinice



Plin	GWP ₂₀	GWP ₁₀₀	GTP ₂₀	GTP ₁₀₀
CO ₂	1	1	1	1
CH ₄	84-85	28-30	67-68	4-6
N ₂ O	264	265	277	234

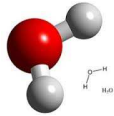
Izvor: IPCC, 2013



Inventar antropogenih GHG emisija



GWP 100



H₂O ✗

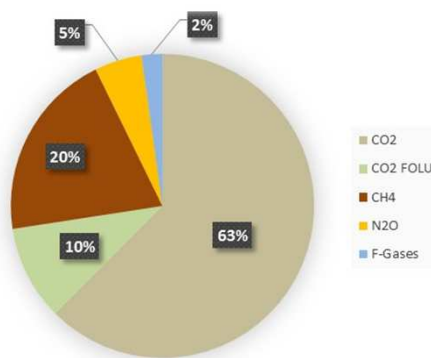


O₃ ✗

Ozone, O₃



Globalne GHG emisije (CO₂e)



Raspodjela globalnih GHG emisija (tCO₂) (IPCC 2013)





Pregled




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GHG emisije – Kako ih izračunati?



- Nemoguće mjeriti 
- Koristimo faktore za izračun GHG emisija za pojedine aktivnosti - faktori emisija (EF)
- Faktori emisija - prosječni iznos emisije stakleničkog plina iz određenog izvora, sveden na jedinicu aktivnosti
 - Jednostavne aktivnosti
 - Aktivnosti koje se sastoje od više procesa



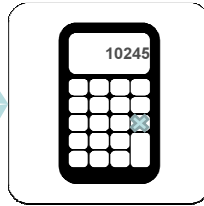
Faktori emisija – metoda



Aktivnosti:
- litre
- tone
- km
- kWh
- ...



Baza faktora emisija



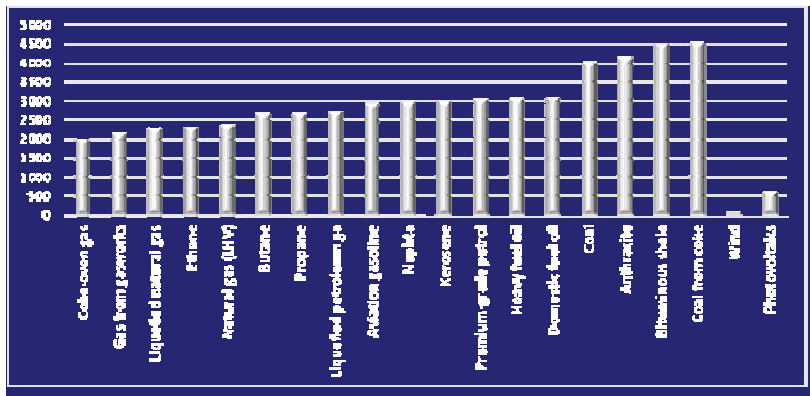
CO₂e



Faktori emisija – Energetski izvori



Emisije koje se odnose na primarne izvore energije



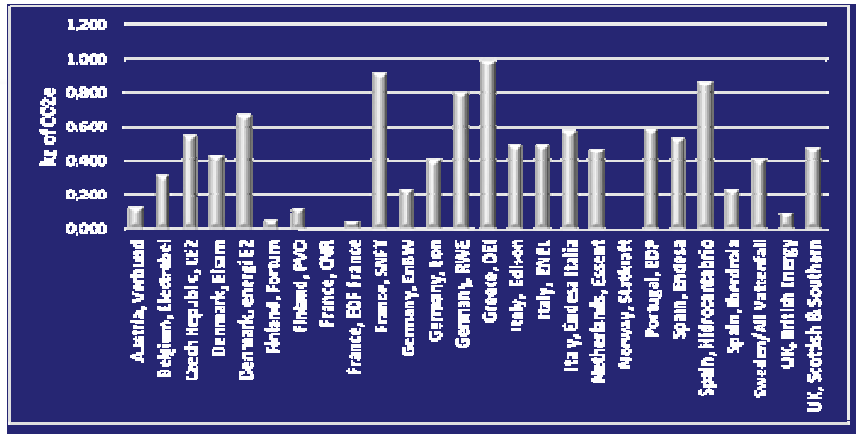
kg CO₂e po toe; **Life Cycle Assessment (LCA)** metodologija



Faktori emisija – Električna energija



kg CO₂e po kWh za odabrane europske proizvođače



Samo emisije vezane uz korištenje goriva (**ne uključuje upstream emisije**)

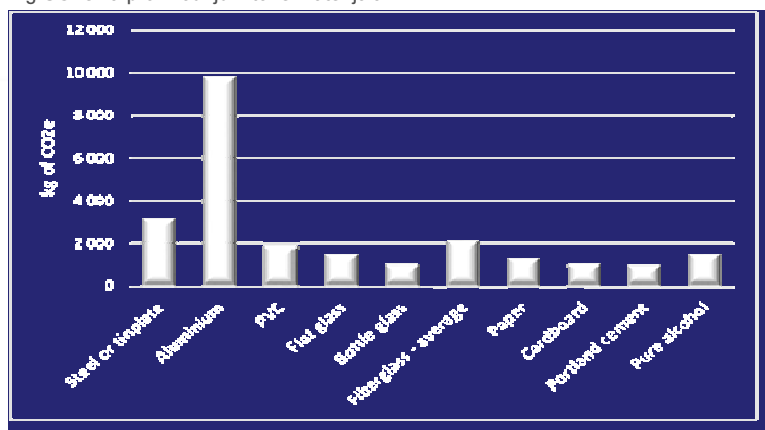
Izvor: European Carbon Factor - 2007



Faktori emisija – Materijali



kg CO₂e za proizvodnju 1 tone materijala



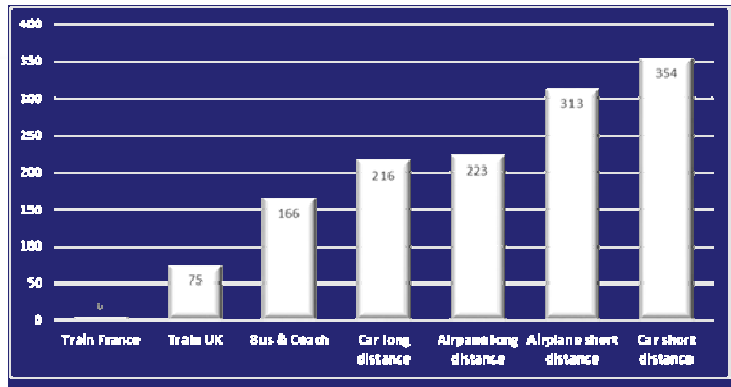
Evropski prosjek. Izvor: Base Carbone ADEME



Faktori emisija – Transport



g CO₂e za 1 putnik.km



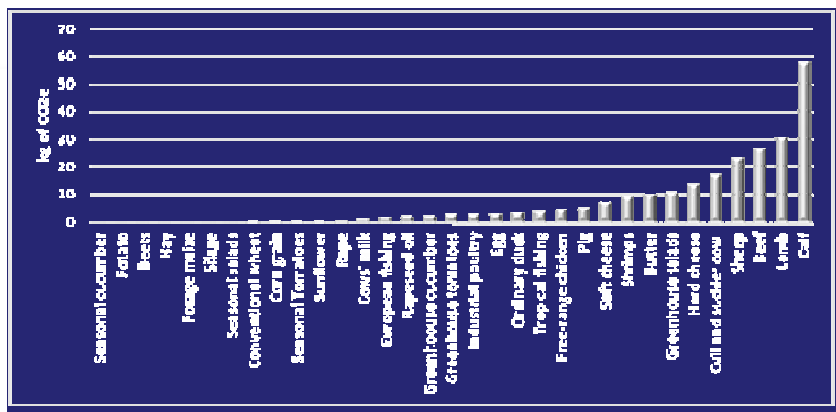
Izvor: Base Carbone ADEME



Faktori emisija – Prehrambeni proizvodi



kg CO₂e za proizvodnju 1 kg hrane



Izvor: Base Carbone ADEME



Sažetak



- Usporedba i zbrajanje stakleničkih plinova (GHG)
- Faktori emisija
- Karakteristike Bilan Carbone® modela



Bilan Carbone® služi za izračun antropogenih GHG emisija



- Uključene emisije: sve prethodno definirane
- Emisije koje nisu uključene:
 - Vodena para
 - CO₂ organskog porijekla (izuzev deforestacije, aforestacije, reforestacije)
 - Ozon
- Koristi se GWP100 za izračun emisija, rezultati prezentirani kao CO₂e i Ce



Specifičnosti Bilan Carbone®



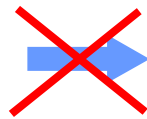
- GHG koji su uključeni:
 - 6 plinova obuhvaćeni Kyoto protokolom + NF3
 - Plinovi koji nisu obuhvaćeni Kyoto protokolom: freoni, haloni i dr.

- Kriterij: Utjecaj na globalno zagrijavanje

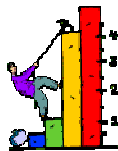
- Uključene emisije:
 - Direktna: na lokaciji analizirane organizacije
 - Indirektna: upstream i downstream emisije



Rješenja nisu u modelu



- Model daje prikaze emisija u određenom trenutku
- Sljedeći korak je definiranje potencijalnih aktivnosti za smanjenje emisija



Suradnja
Strateško razmišljanje

Savjetovanje





Hvala na pozornosti!



Energy Institute Hrvoje Požar
Savska cesta 163, Zagreb, Croatia

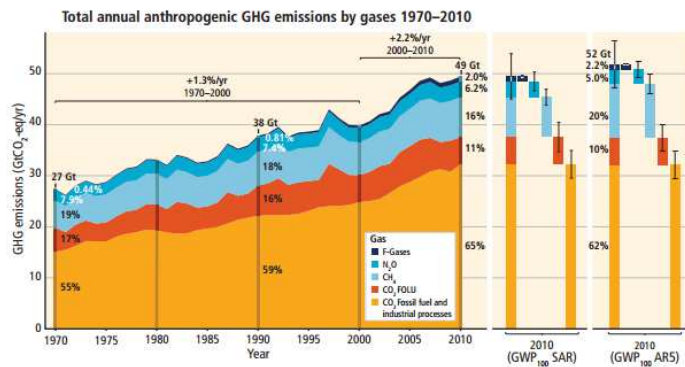


Figure SPM.2 | Total annual anthropogenic greenhouse gas (GHG) emissions (gigatonne of CO₂-equivalent per year, GtCO₂-eq/yr) for the period 1970 to 2010 by gases: CO₂ from fossil fuel combustion and industrial processes; CO₂ from Forestry and Other Land Use (FOLU); methane (CH₄); nitrous oxide (N₂O); fluorinated gases covered under the Kyoto Protocol (F-gases). Right hand side shows 2010 emissions, using alternatively CO₂-equivalent emission weightings based on IPCC Second Assessment Report (SAR) and AR5 values. Unless otherwise stated, CO₂-equivalent emissions in this report include the basket of Kyoto gases (CO₂, CH₄, N₂O as well as F-gases) calculated based on 100-year Global Warming Potential (GWP₁₀₀) values from the SAR (see Glossary). Using the most recent GWP₁₀₀ values from the AR5 (right-hand bars) would result in higher total annual GHG emissions (52 GtCO₂-eq/yr) from an increased contribution of methane, but does not change the long-term trend significantly. (Figure 1.6, Box 3.2)