



Kielce University  
of Technology

National Technical University  
«Kharkiv Polytechnic Institute»

Kielce University of Technology

# SUSTAINABILITY: Status and problems of transport installations





MicroCAD-2024

## SPEAKERS



Kielce University  
of Technology

**Professor Zbigniew Koruba**

**Professor Andriy Marchenko**

**Sustainable development: state and problems  
of transport energy installations**



**Rector of Kielce University of  
Technology, (Poland, Kielce)**



**Vice-rector of NTU «KhPI», (Ukraine,  
Kharkiv)**



In September 2015, the UN Summit on Sustainable Development was held as part of the 70th session of the UN General Assembly. The 17 components of sustainable development and 169 main tasks were approved.







## EDUCATIONAL AND SCIENTIFIC POTENTIAL OF UNIVERSITIES

**Universities have a powerful scientific and educational potential to solve the UN General Assembly of Sustainable Development Problems.**



**The report is devoted to the problems of transport, without which the efforts of achieving the global goals of sustainable development are unpromising.**



## TRANSPORT STRATEGY DOCUMENTS

In recent years, the world's leading countries have developed and approved strategies and programs for the transition of modern carbon economies to hydrogen economies at the legislative level.

For example, in 2020, the EU approved the Hydrogen Strategy for a Climate Neutral Europe, the US approved the Hydrogen Program Plan, and in 2019, the Japanese government approved a strategic map for hydrogen to create a hydrogen society instead of a carbon society.

Ukraine's involvement in the European Green Deal is particularly important, as emphasized in the joint statement following the 7th meeting of the EU-Ukraine Association Council in 2019.





# DECARBONIZATION OF TRANSPORT POWER UNITS FROM INTERNAL COMBUSTION ENGINES

## STATUS ASSESSMENT – TRENDS

**Diesel engine (car)**



**Electric car**





# DECARBONIZATION OF TRAFFIC POWER PLANTS FROM INTERNAL COMBUSTION ENGINES

## Negative consequences (basic)

The actual lack of methodology for the implementation of strategic tasks for the decarbonization of traffic power plants on the basis of ICE has led to the following negative consequences:

- Populism in the implementation of technical solutions is at the first place now;
- The role of electrical power plants of cars in solving the problem of decarbonization on transport is significantly exceeded;
- CO<sub>2</sub> emissions, which are formed in the production of electricity, are not taken into account;
- In research and forecasts, the main role is given to new power plants on transport;
- Practically there are no decarbonization methodologies used today and to be global performers to ensure humanity life;
- The main tool for solving decarbonization problems is the prohibition system.



## European diesel engines that receive the most negative ratings among internal combustion engines and systemic prohibitions on their use

The results of improving environmental performance through the introduction of innovative technologies and designs, new materials allow us to conclude that the internal combustion engines has gone a long way in improving







## ANALYSIS OF THE LEVEL OF ECONOMIC AND ECOLOGICAL INDICATORS OF DIESEL ENGINES OF FREIGHT VEHICLES

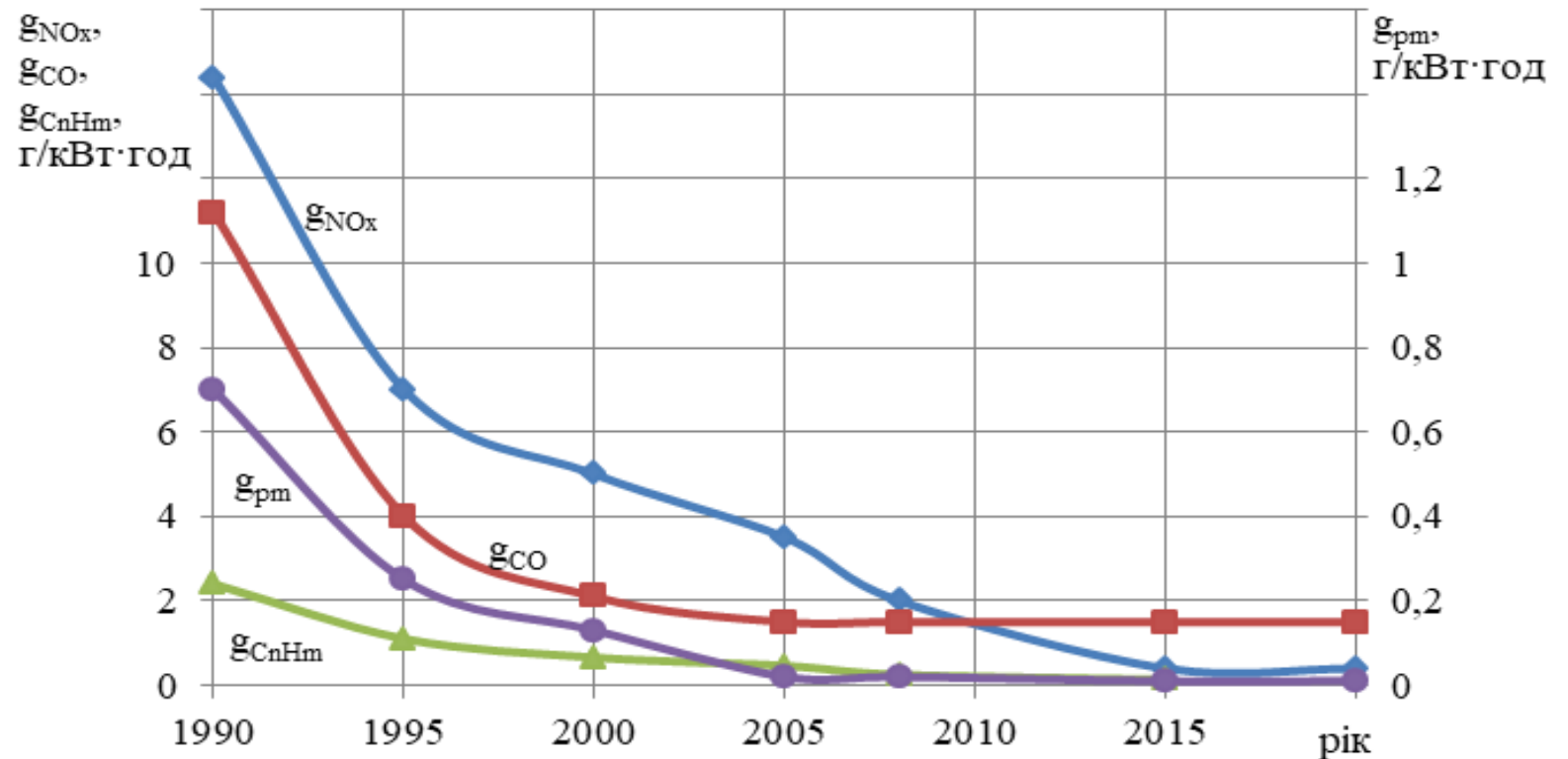
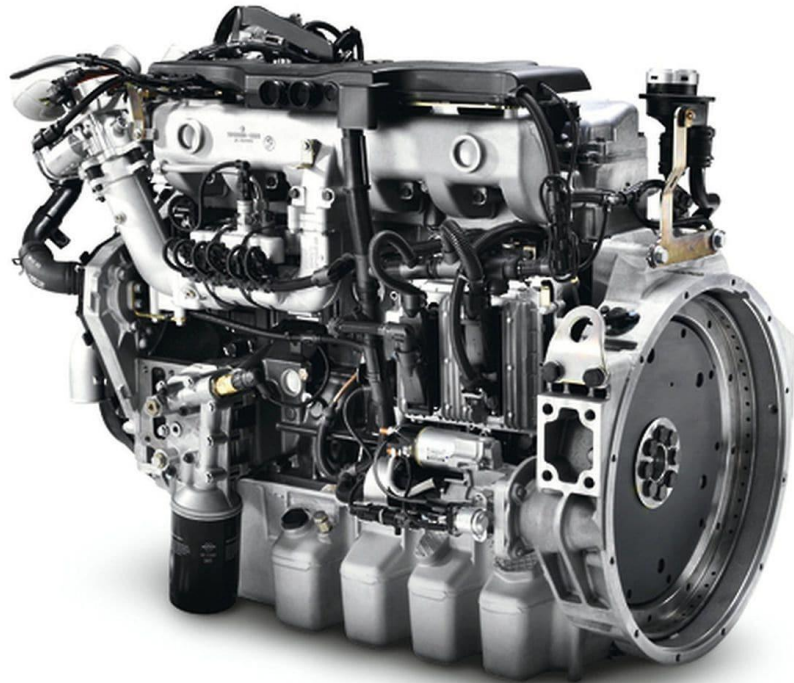
Analysis of the change in the level of environmental performance of diesel engines of freight vehicles over the last 30 years was carried out according to the changes of requirements, and accordingly the level of environmental indicators of diesel engines of freight vehicles, according to the rules of the EUC of the UNC.

Emissions of harmful substances from VG diesel engines of mass production vehicles according to the standards operating in Europe

Standards (ATZ with a full mass of more than 3.5 tones)	Specific emissions of toxides, (g/(kWh))			
	NO <sub>x</sub>	CO	C <sub>n</sub> H <sub>m</sub>	RM (Tch)
Euro-0 (since 1990)	14.4	11.2	2.4	0.7
Euro-I (until 10/01/1995)	8.0	4.9	1.23	0.4
Euro-II (from 10/01/1995)	7.0	4.0	1.10	0.25
Euro-III (from 10/01/2000)	5.0	2.1	0.66	0.13
Euro-IV (since 2005)	3.5	1.5	0.46	0.02
Euro-V (since 2008)	2.0	1.5	0.25	0.02
Euro-VI (since 2015)	0.4	1.5	0.13	0.01
Reducing emissions EURO-0/EURO-VI	36	7,5	18,5	70

# DECARBONIZATION OF TRANSPORT POWER PLANT WITH INTERNAL COMBUSTION ENGINES

According to the data given in the table, a schedule is constructed, which gives a clear dynamics of changes (improvement) of environmental qualities of diesel engines of trucks from 1990 to 2020 according to the standards operating and operating in Europe.





## CONCERNING THE GREENHOUSE EFFECT AND DECARBONIZATION

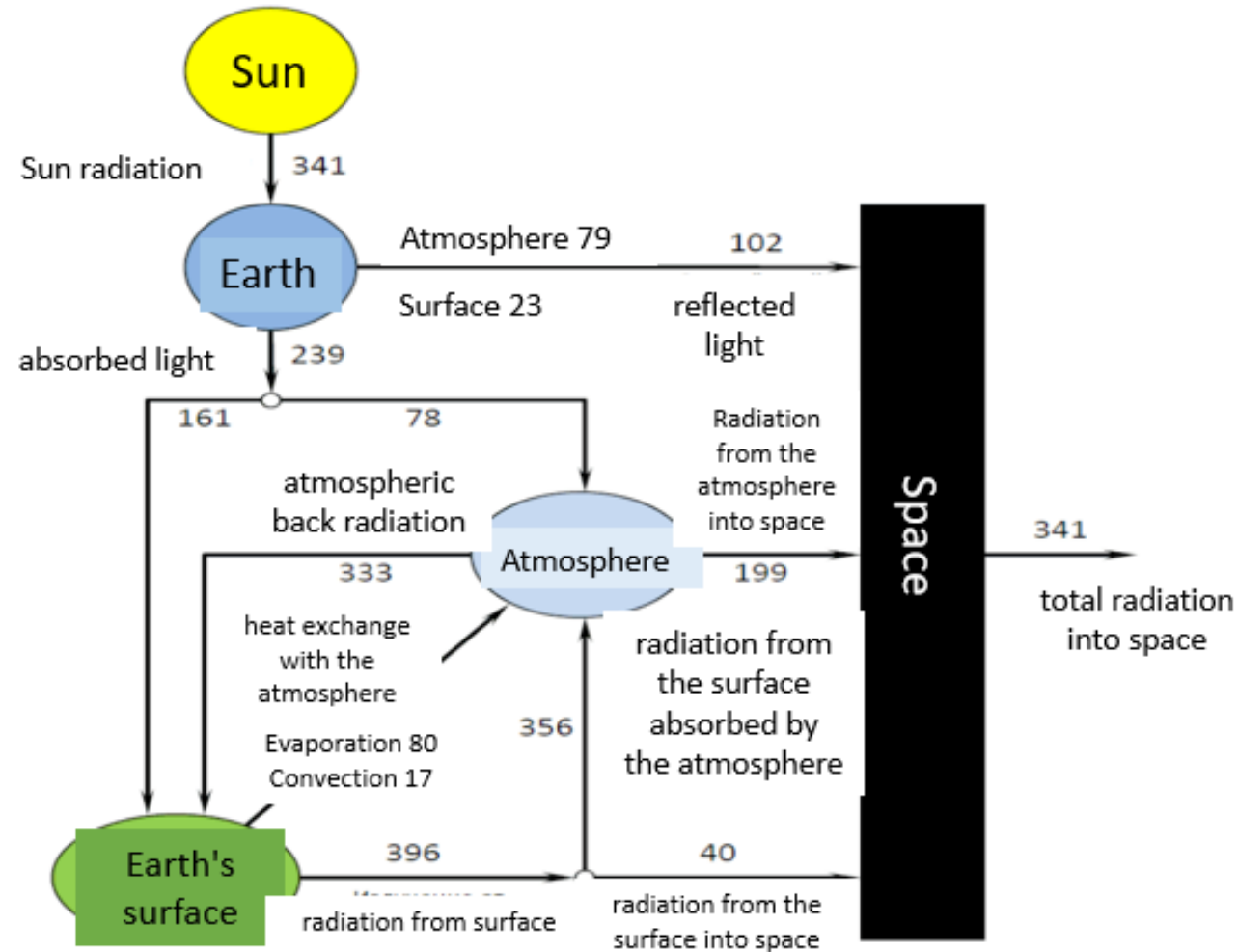
The heat balance of the planet Earth is dynamic, and its parameters depend largely on natural factors and partly on the results of human activity.

Gases  $\text{CO}_2$ ,  $\text{H}_2\text{O}$ ,  $\text{CH}_4$ , freons, etc. are factors that negatively affect the Earth's heat balance.

Thermal pollution is also a factor of negative impact on the Earth's heat balance.

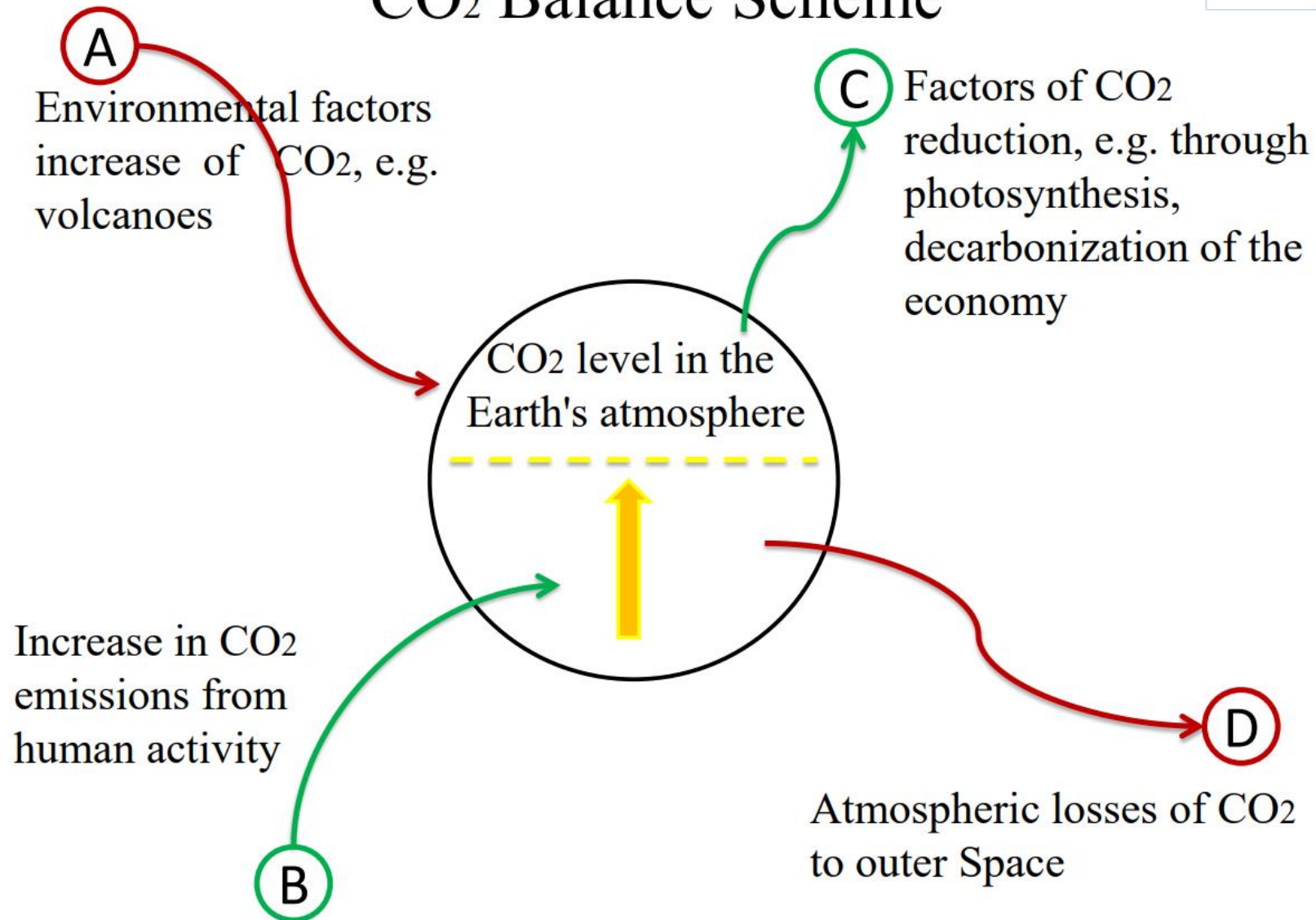


# HEAT BALANCE OF THE EARTH



HEAT BALANCE OF THE EARTH (March 2000 – May 2004)

## CO<sub>2</sub> Balance Scheme





## CONCLUSIONS

**Factors A and D do not depend on human activity**

**Factor B fully and factor C partially depend on human activity.**

**In well-known sustainable development strategies, the focus is on decarbonization, although, as can be seen from the previous 2 slides, this problem is much broader.**

**Due to the legislative negligence of the processes of restoring plant biomass, for example, forests, etc., the possibilities of photosynthesis to reduce CO<sub>2</sub> in the Earth's atmosphere are not fully used, which actually works to destroy civilization.**





**ICE**

**diesel**  
**OR**

**Petrol?**



## DECARBONIZATION OF TRANSPORT POWER PLANT WITH INTERNAL COMBUSTION ENGINES

### NEW PEUGEOT 2008 Specifications (manufacturer)

Type of fuel	Gasoline	Diesel fuel
The maximum capacity of k.s.	130	130
Maximum torque, nm	230	300
Maximum speed, km/h	199	195
Fuel costs City cycle, l/100 km	8,4	4,4
Fuel costs Country cycle, l/100 km	5,4	3,8
Fuel costs Mixed cycle, l/100 km	6,5	4,0
Emissions CO <sub>2</sub> , g/km	148	110

## NEW PEUGEOT 2008

### Technical parameters characterizing thermal pollution

Parameters	ICE petrol	ICE diesel
Average coefficient of efficiency of all internal combustion engines, % and CO <sub>2</sub> emissions, g/km	(30 – 36) 148	(38 -45) 110
Lower heat of fuel combustion, kJ/kg	44 400	42 300
Fuel consumption mixed cycle, l/100 km	6,5	4,0
Thermal pollution, kJ/100 km	210 000	140 000
Difference in thermal pollution, kJ/100 km	70 000	



# GENERAL PRELIMINARY CONCLUSIONS

**When making decisions on global climate issues and ways of decarbonization, reject speculative and unfounded approaches and be guided by scientific evidence**

- To formulate separate strategic measures for:
  - a) for promising energy installations;**
  - b) for power plants in operation.****
- To develop a strategy to promote research on energy transport installations as a key factor in providing the implementation of sustainable development strategies of our civilization.**



# Thank you for your attention!

