



State Education
Development Agency
Republic of Latvia



EUROPEAN UNION



Erasmus+ TCA thematic seminar
**Green Practices for Increasing
Environmental Sustainability**

Green Daily Practices

Professor Andra Blumberga

WORKSHOP

GREEN DAILY PRACTICES

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Riga Technical university

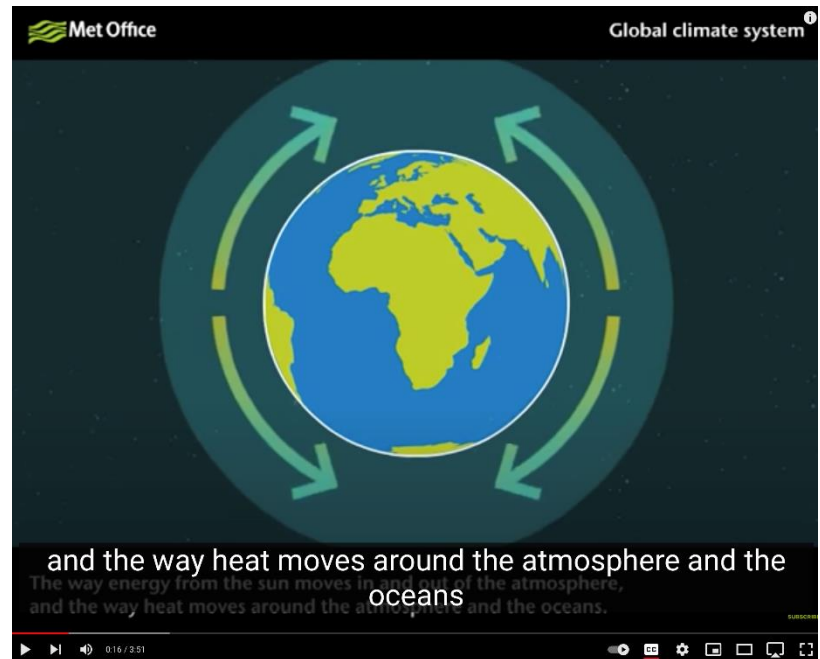
21.03.2024

ERASMUS+ TCA Thematic seminar

What is greenhouse effect?

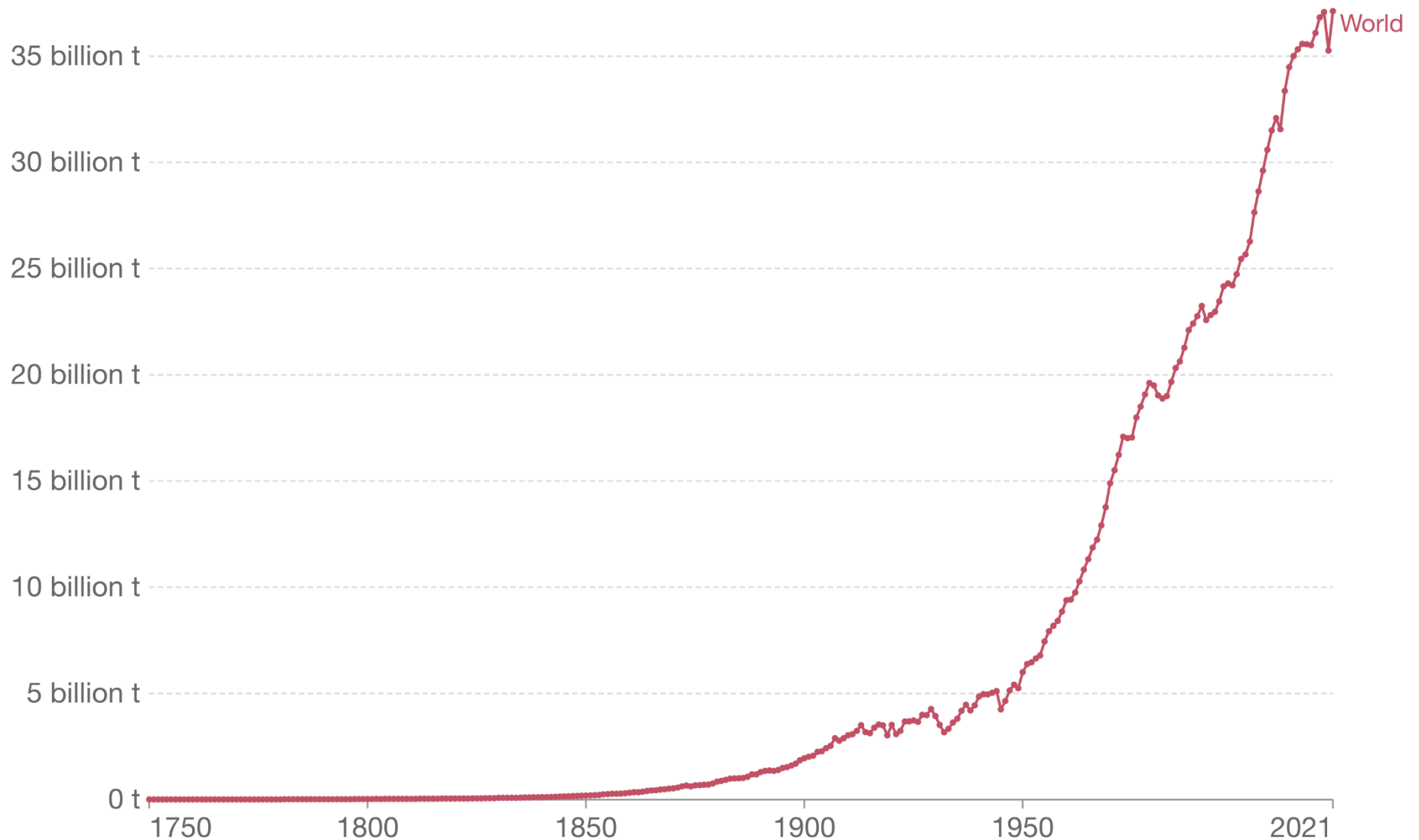


How does global climate system work?



Annual CO₂ emissions

Carbon dioxide (CO₂) emissions from fossil fuels and industry¹. Land use change is not included.



Source: Our World in Data based on the Global Carbon Project (2022)

OurWorldInData.org/co2-and-greenhouse-gas-emissions • CC BY

1. Fossil emissions: Fossil emissions measure the quantity of carbon dioxide (CO₂) emitted from the burning of fossil fuels, and directly from industrial processes such as cement and steel production. Fossil CO₂ includes emissions from coal, oil, gas, flaring, cement, steel, and other industrial processes. Fossil emissions do not include land use change, deforestation, soils, or vegetation.



CO₂ SOURCES



Greenhouse gases

- Carbon dioxide CO₂
- Methan CH₄: CO₂ equivalent = 84 x CO₂
- Nitrogen oxide (N₂O): CO₂ equivalent = 298 x CO₂
- hydrofluorocarbons (HFCs)
- perfluorocarbons (PFCs)
- sulfur hexafluoride (SF₆)

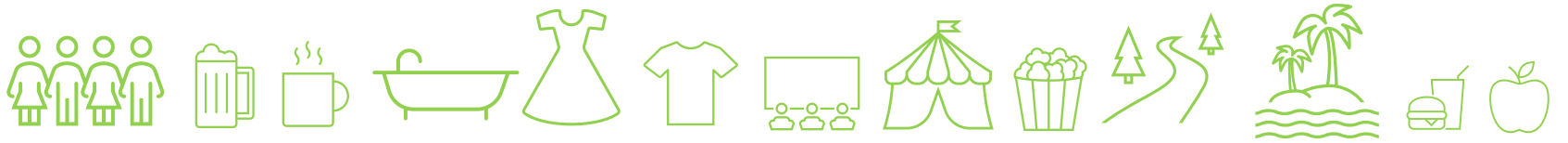
SERVICES



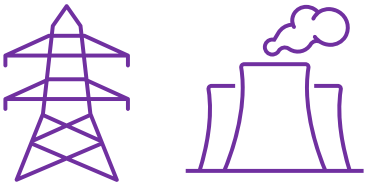
TECHNOLOGIES PROVIDING SERVICES:
ENERGY CONSUMPTION



SERVICES



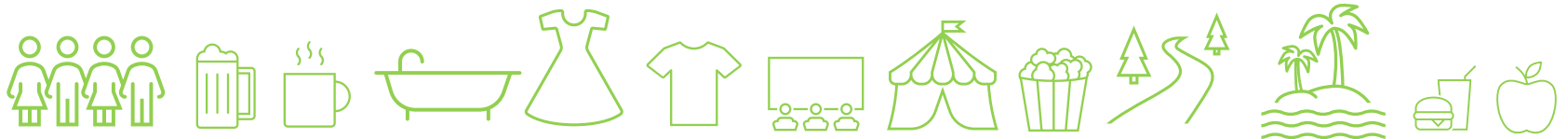
ENERGY PRODUCTION

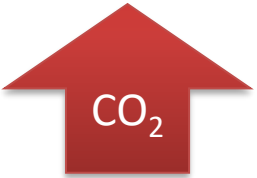


TECHNOLOGIES PROVIDING SERVICES: ENERGY CONSUMPTION

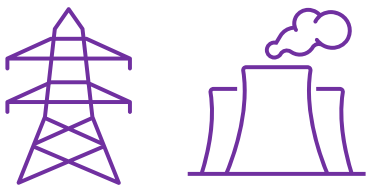


SERVICES





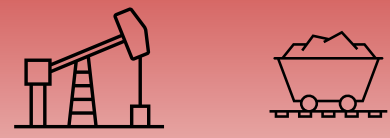
ENERGY PRODUCTION



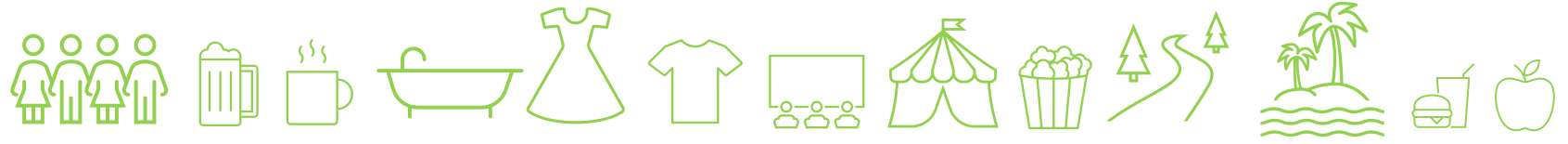
TECHNOLOGIES PROVIDING SERVICES:
ENERGY CONSUMPTION

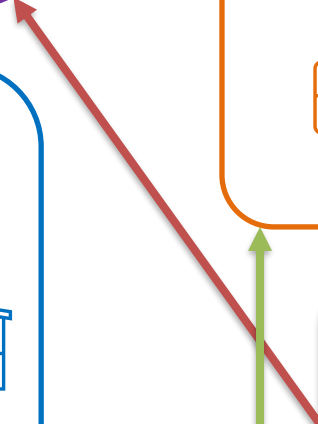
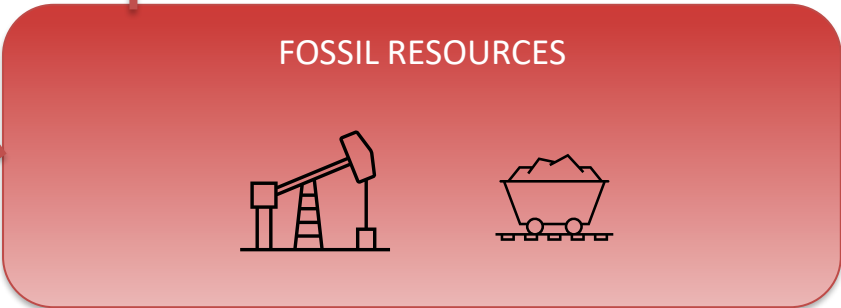
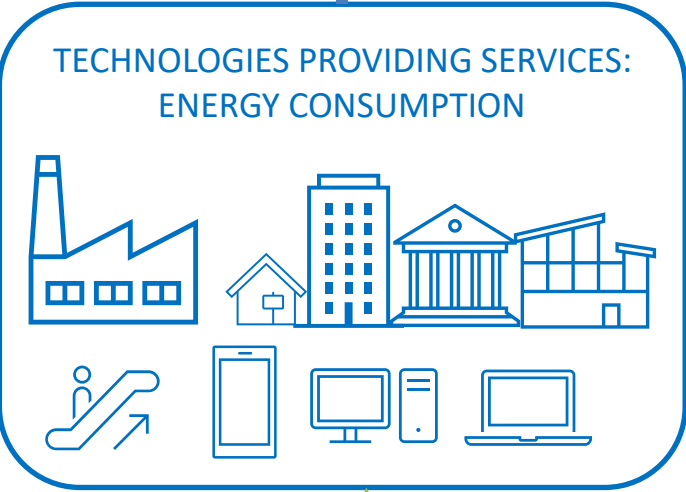
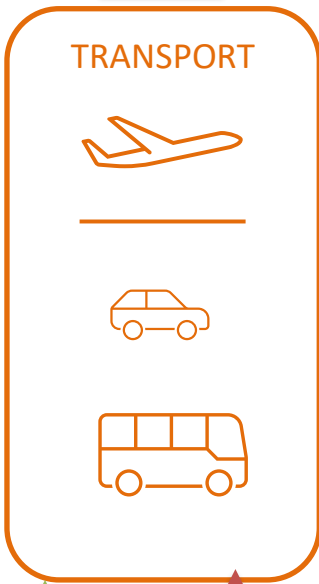
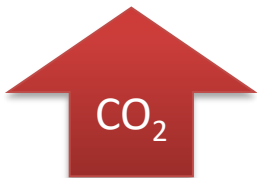
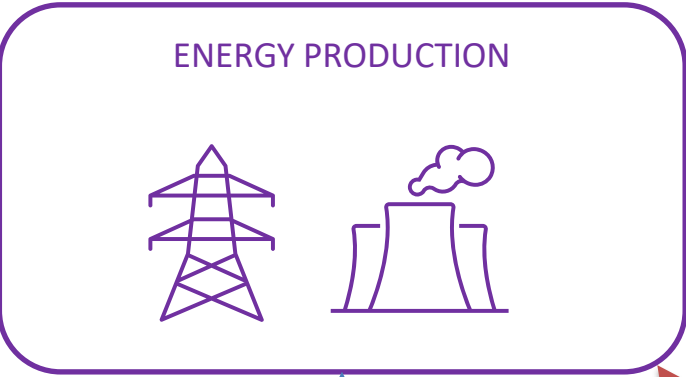
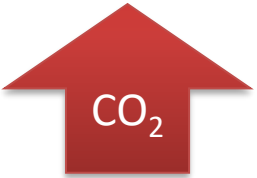


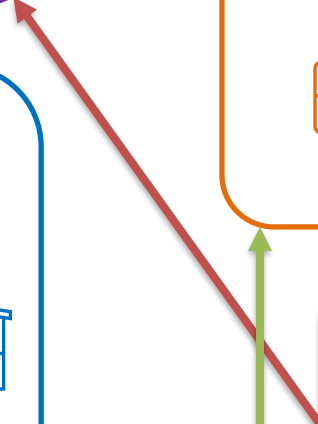
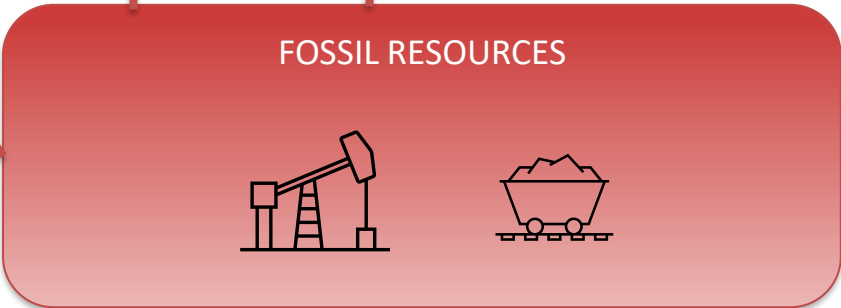
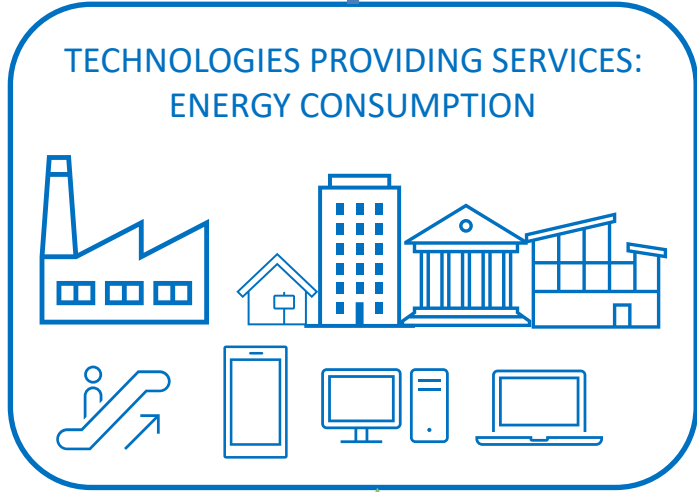
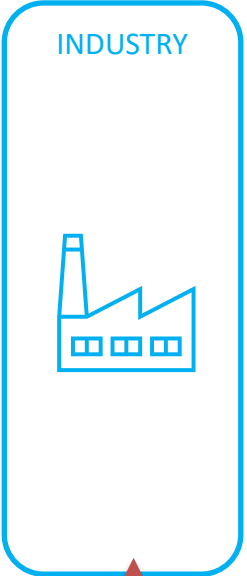
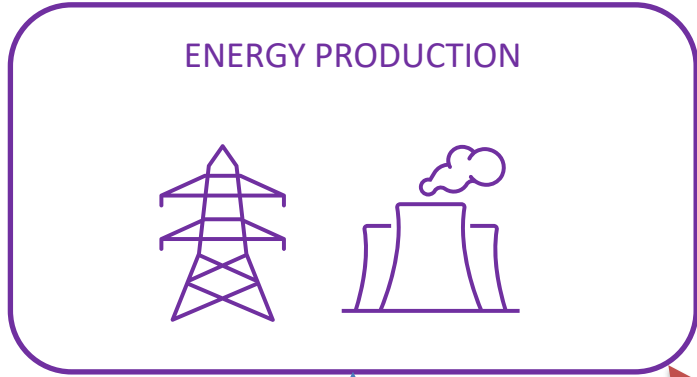
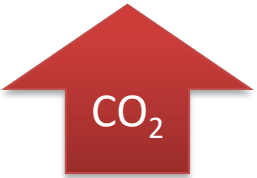
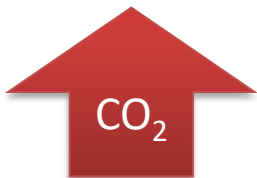
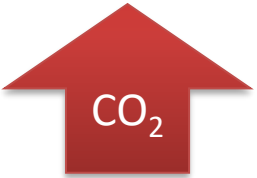
FOSSIL RESOURCES

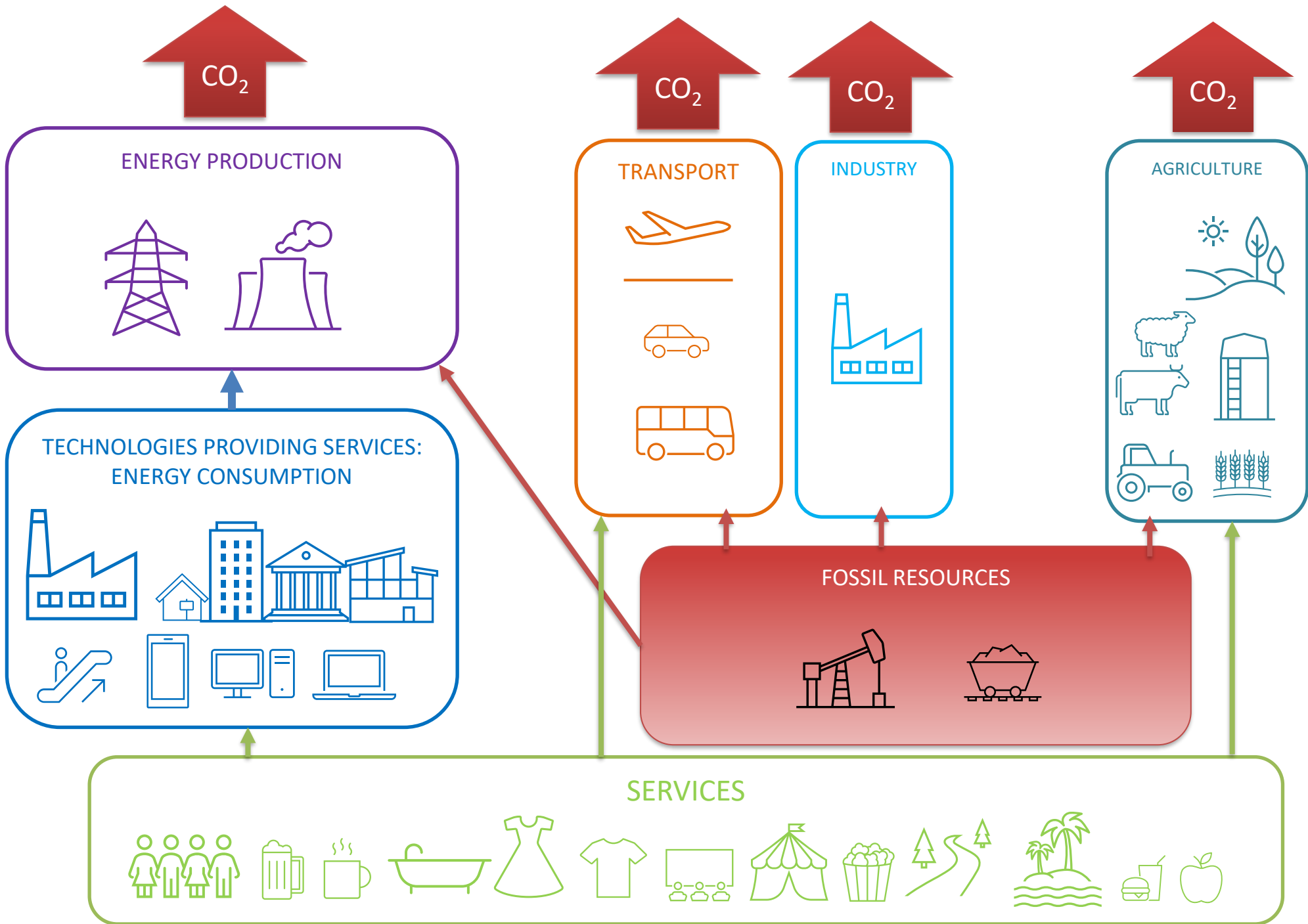


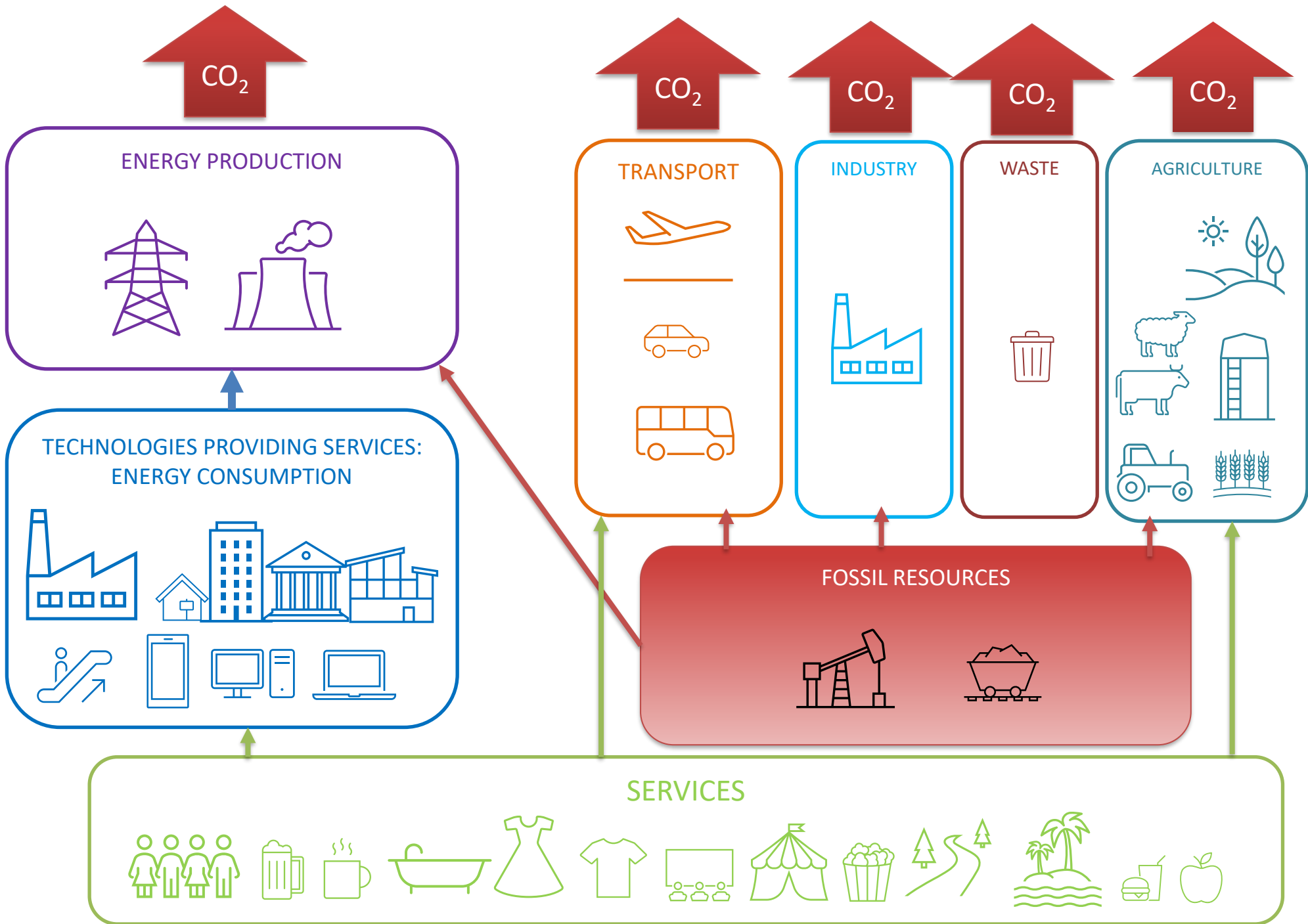
SERVICES

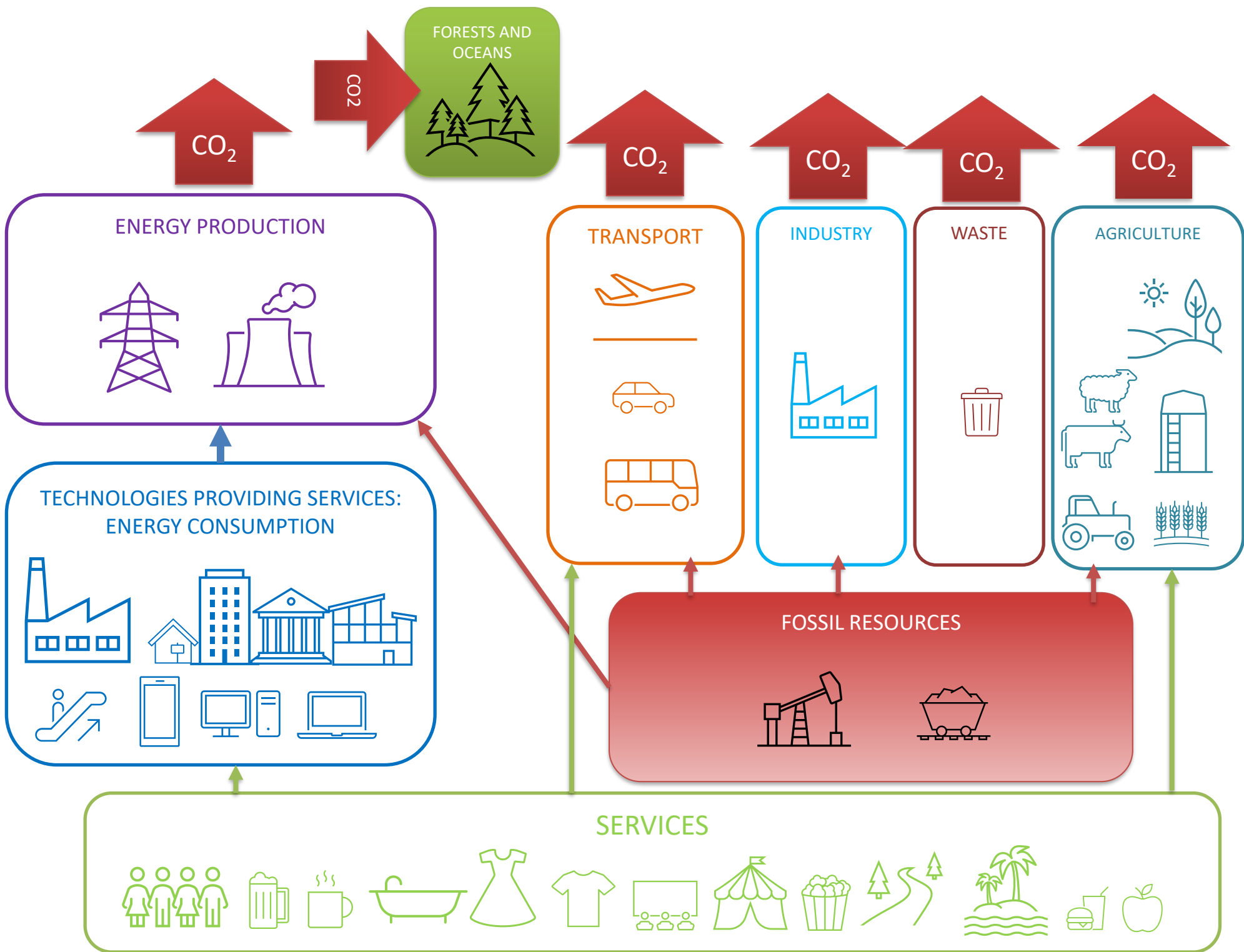






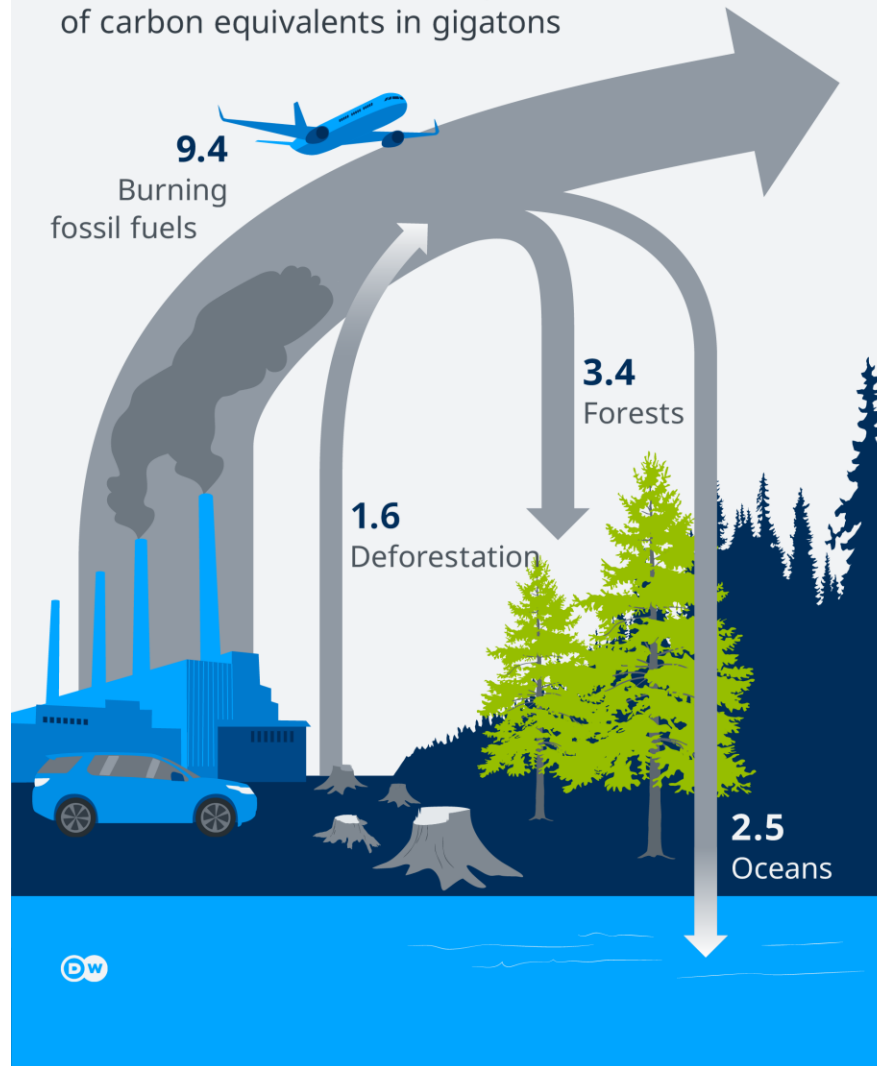


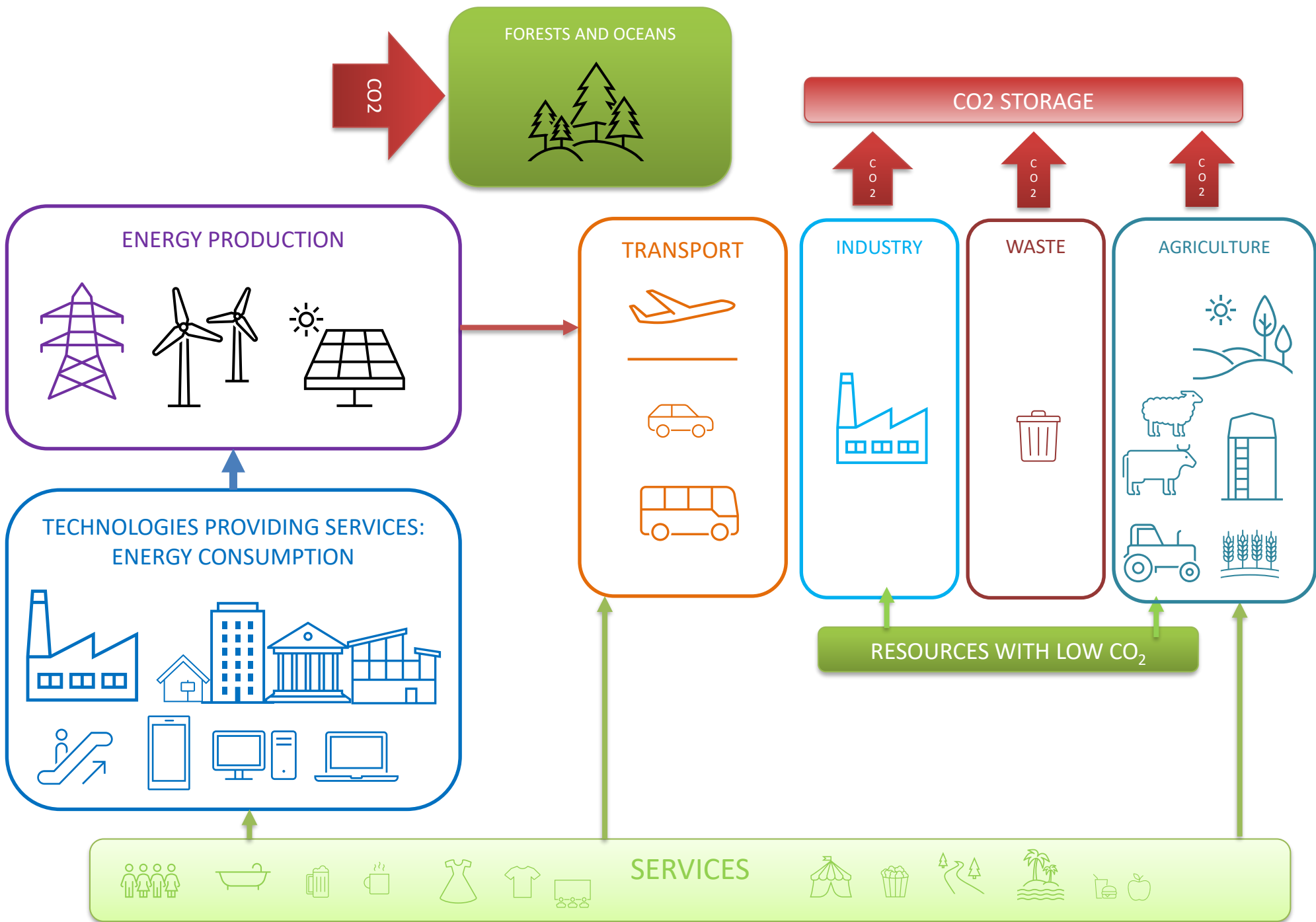




The carbon cycle

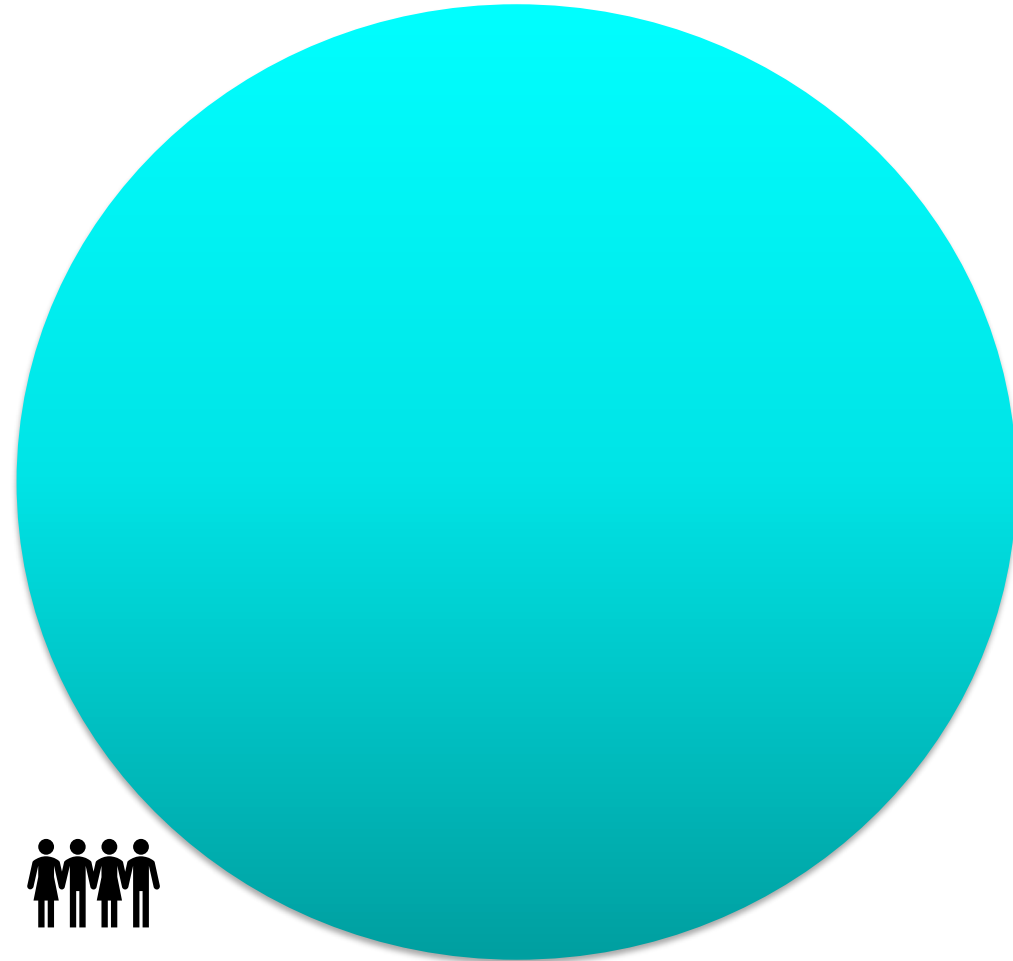
Emissions and natural absorption of carbon equivalents in gigatons





1 TONN OF CO₂?

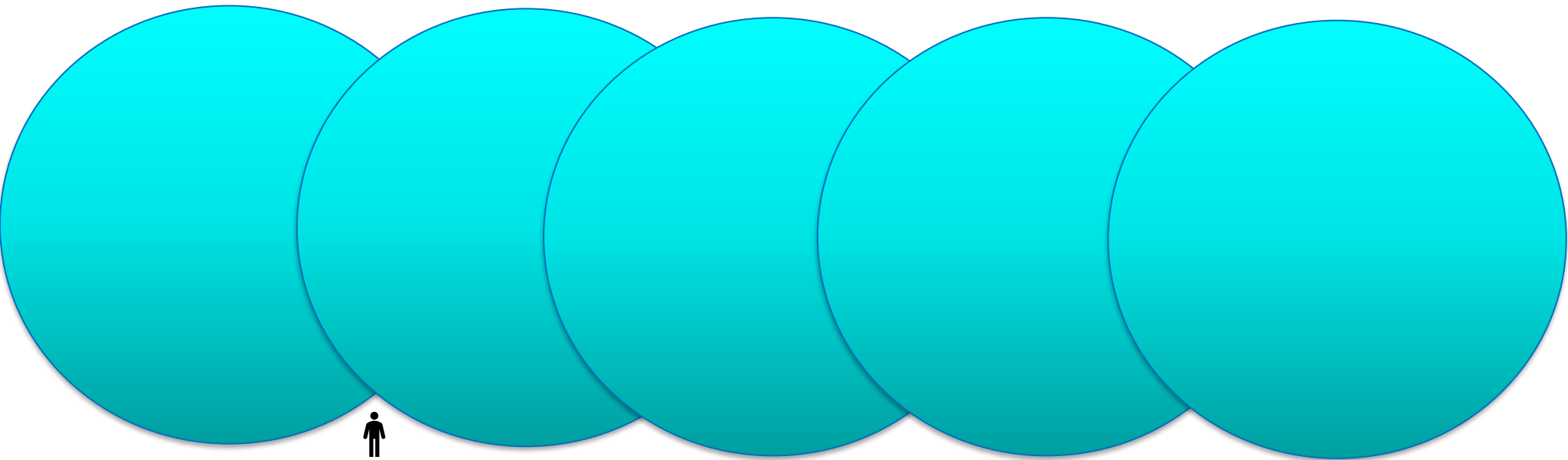
1 tonn CO₂



10 meters



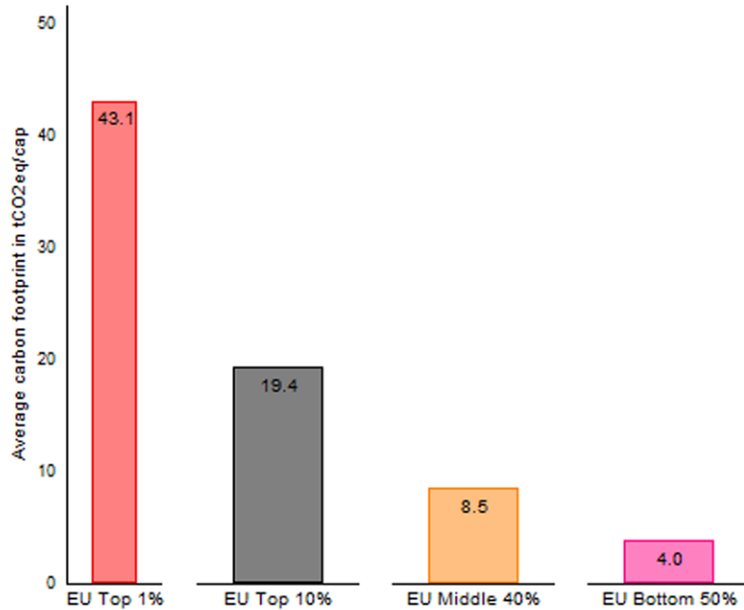
ANNUAL CO₂ EMISSIONS PER PERSON IN LATVIA



Annual CO₂ emissions in Europe

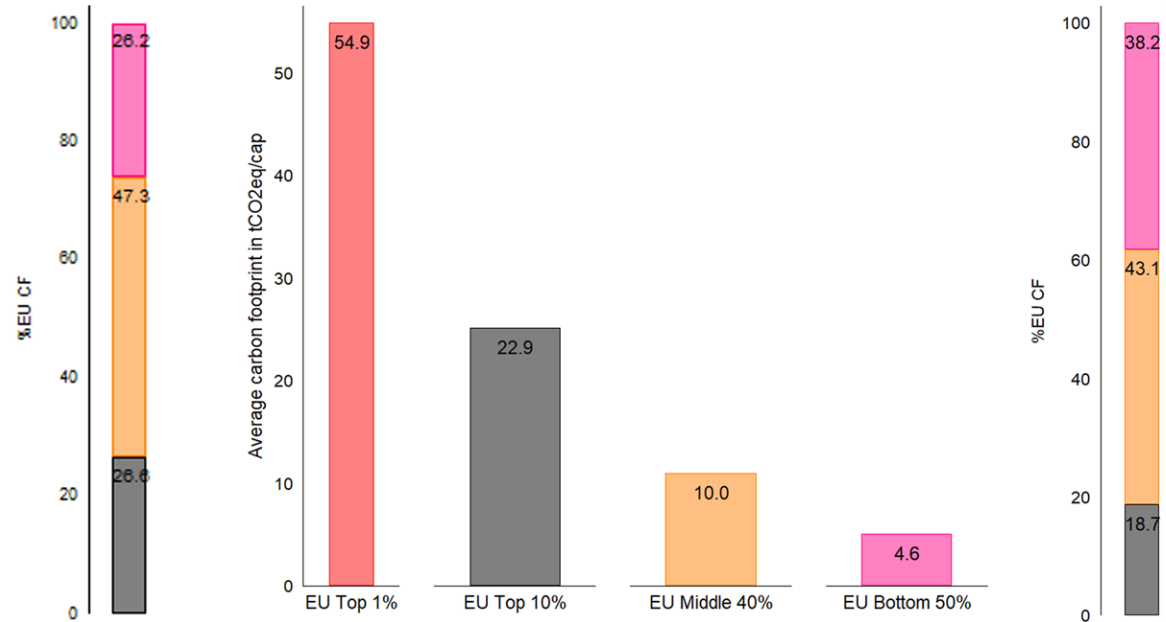
(a)

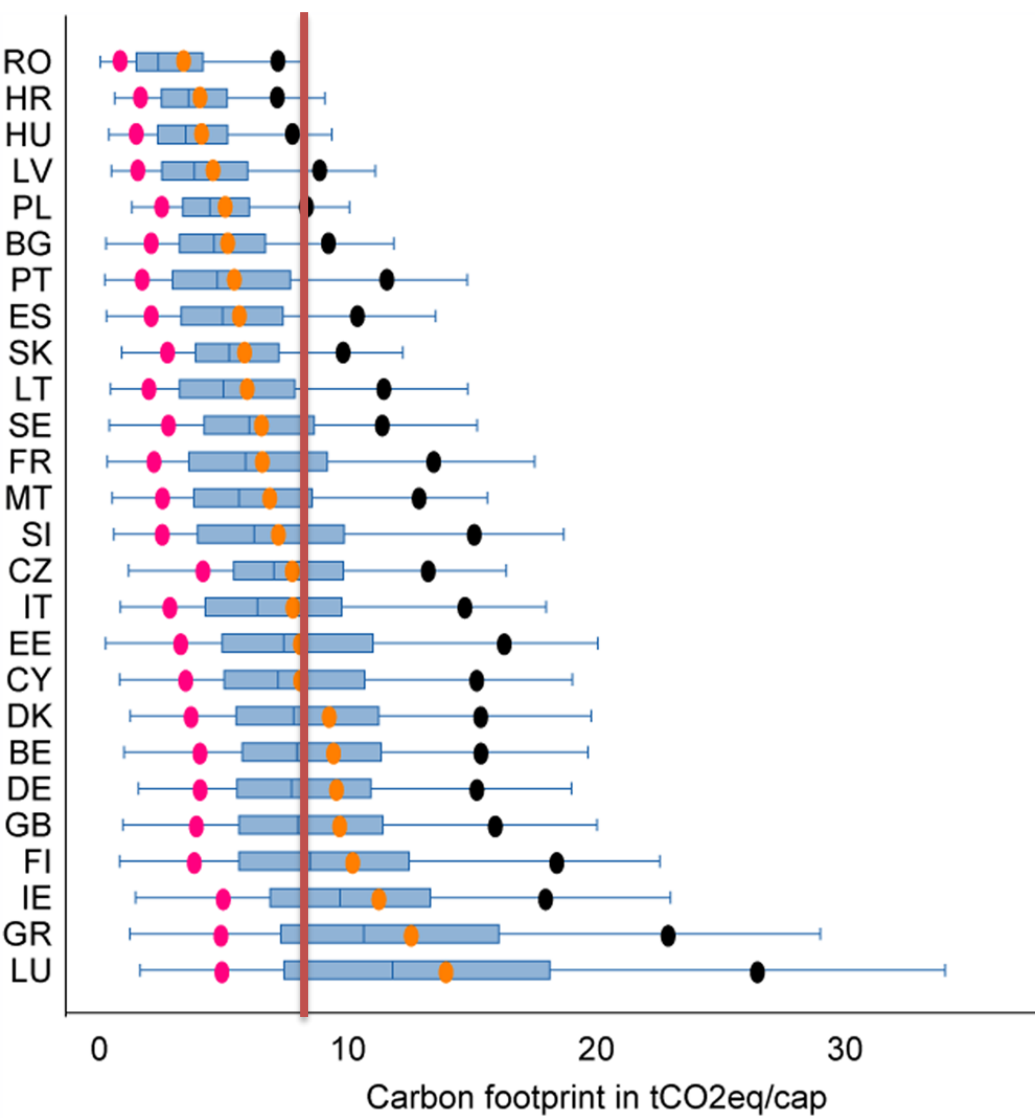
EU individuals (adjusted by household size)



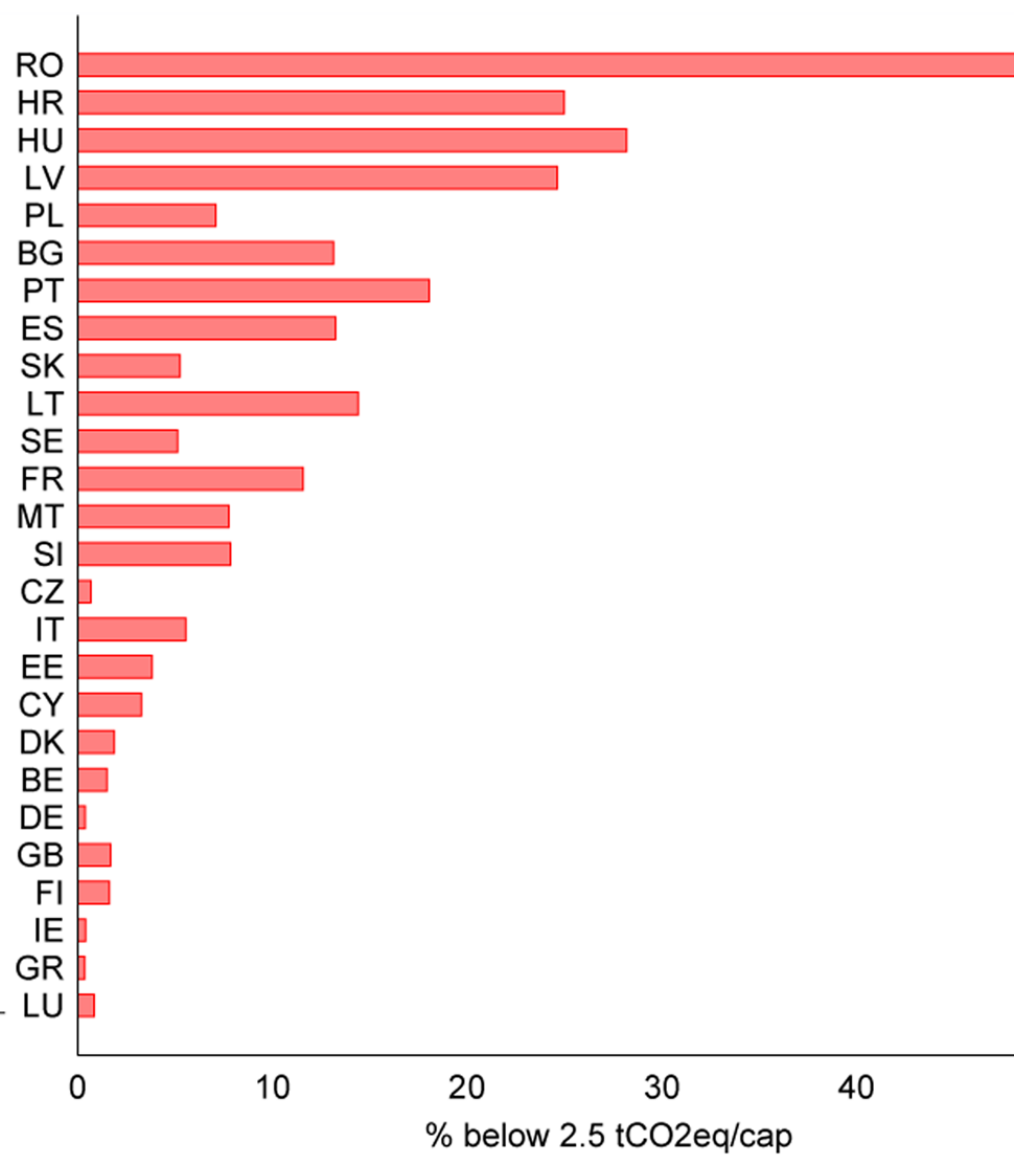
(b)

EU households

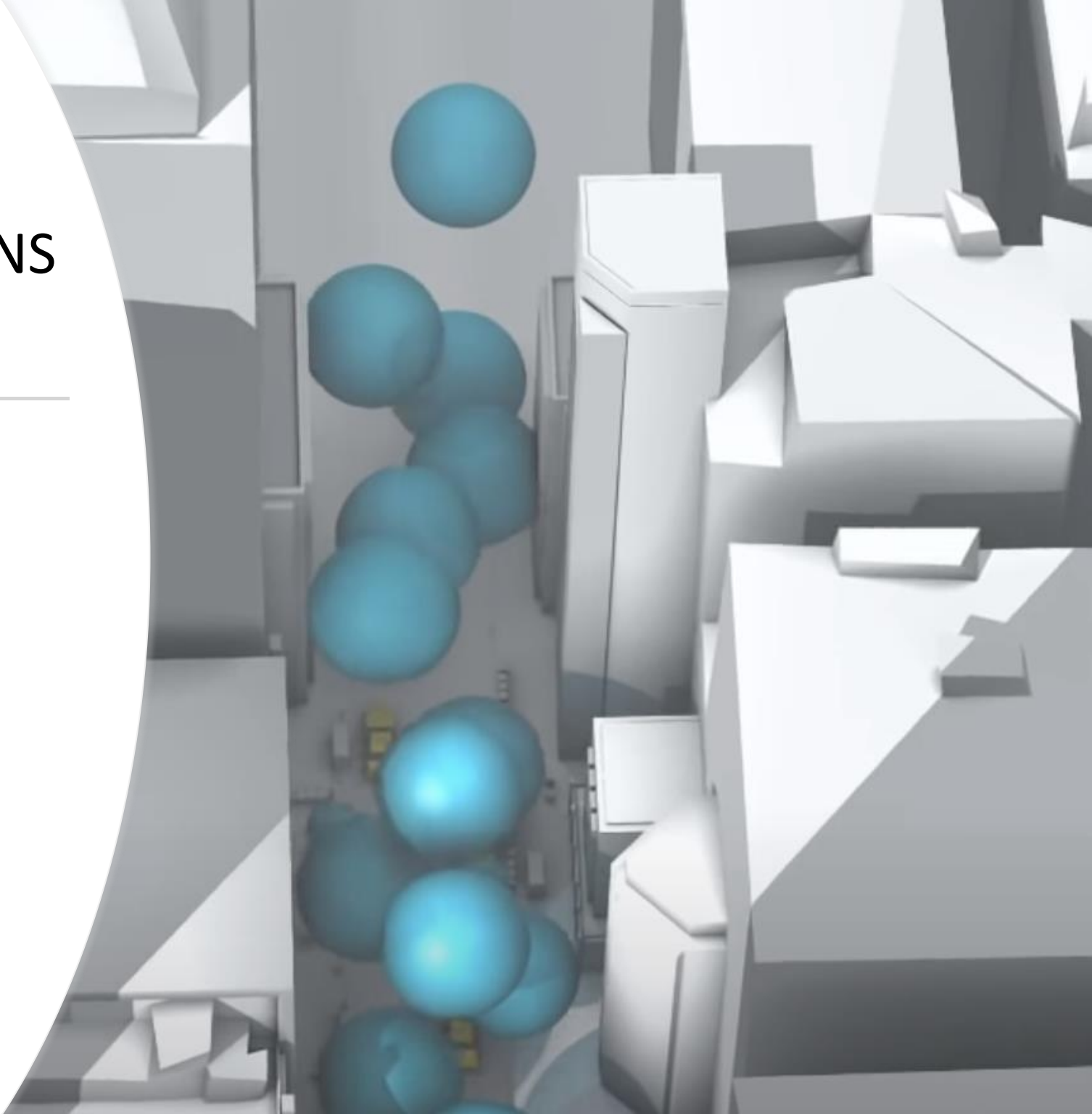


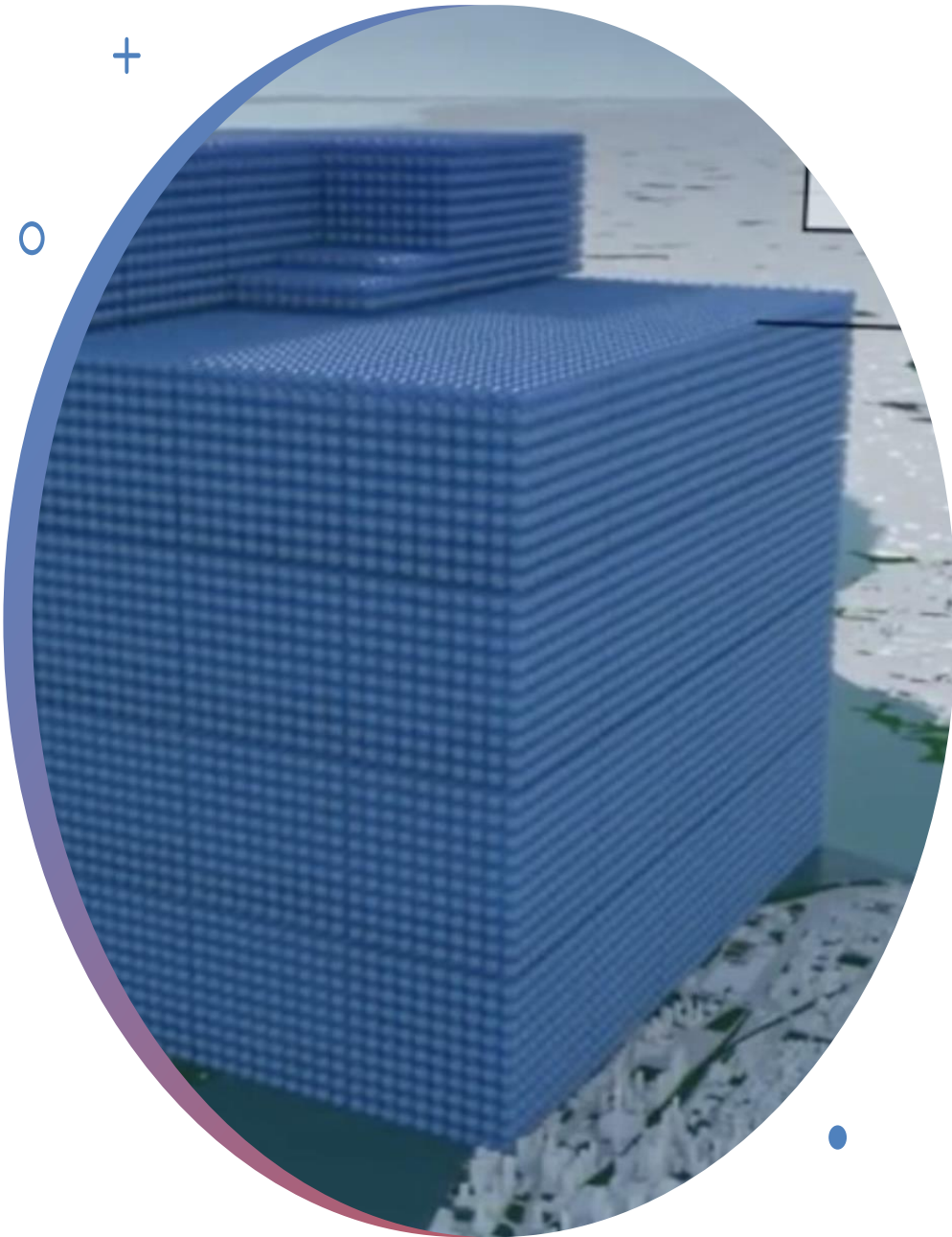


excludes outside values



CO₂ EMISSIONS IN NY CITY





GLOBAL CO₂ EMISSIONS

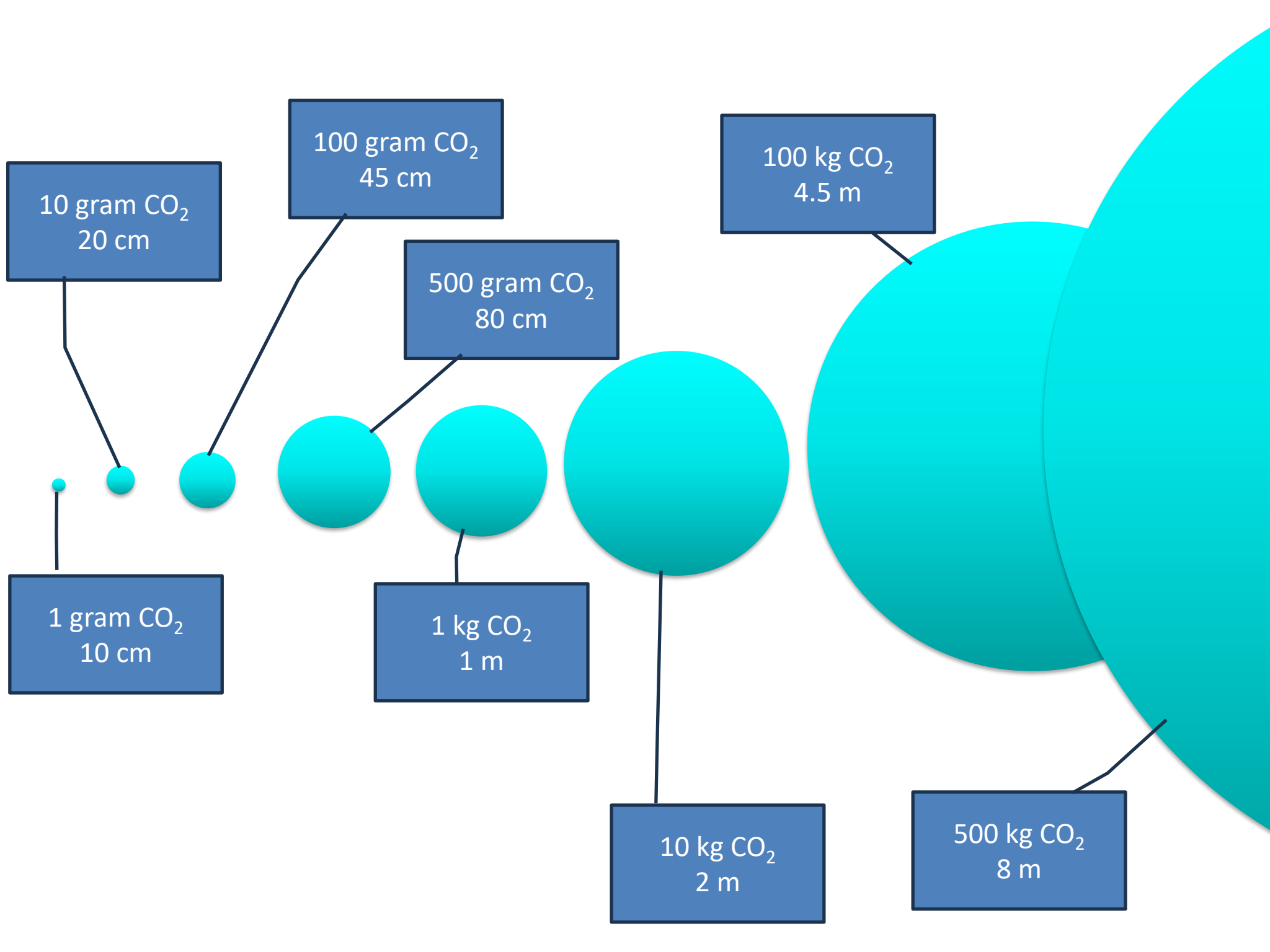
- **1000 tonn/sec**
- **112 milj. tonn/day**

CO₂ FOOTPRINT

Based on:

- Berners-Lee M., How Bad are Bananas?, 2020
- Other scientific literature sources





1 liter tap water

1 liter bottled water

grams CO₂/liter

1 liter tap water

0.4

1 liter bottled water

Locally produced + transportation	320
Average	400
Transported on road 600 km	480

1 km by mechanical bicycle

1 km by electric bicycle

grams CO₂/km

1 km by mechanical bicycle

with banana	25
porridge with cow milk	44
with bacon	119
with cheeseburger	194
asparagus transported with the airplane	2938
carbon embedded in bicycle	6...60

1 km by electric bicycle

fully electric, driving speed 7.5 km/h, without hills and stops	1,9
the same, but with 5 stops per 1.5 km and a 20 meter climb	3,1
carbon embedded in bicycle	6...60

1 km by bus

1 km by car

1 km by train

grams CO₂/km/person

(*km/person –passenger kilometer)

1 km by bus

90 seater full electric bus in UK	4
A crowded minibus in La Paz, Bolivia	16
A partially loaded diesel hybrid bus in London	29
A double-decker bus in the UK countryside with only a driver + 1 passenger	1563

1 km by car

Mid-size 5-door electric car	113
a smart car traveling at a constant speed of 45 km/h	181
an average car with an average consumption of 0.425 l/km	331
a relatively new Range Rover Sport that has not been technically maintained and drives at 55 km/h	788

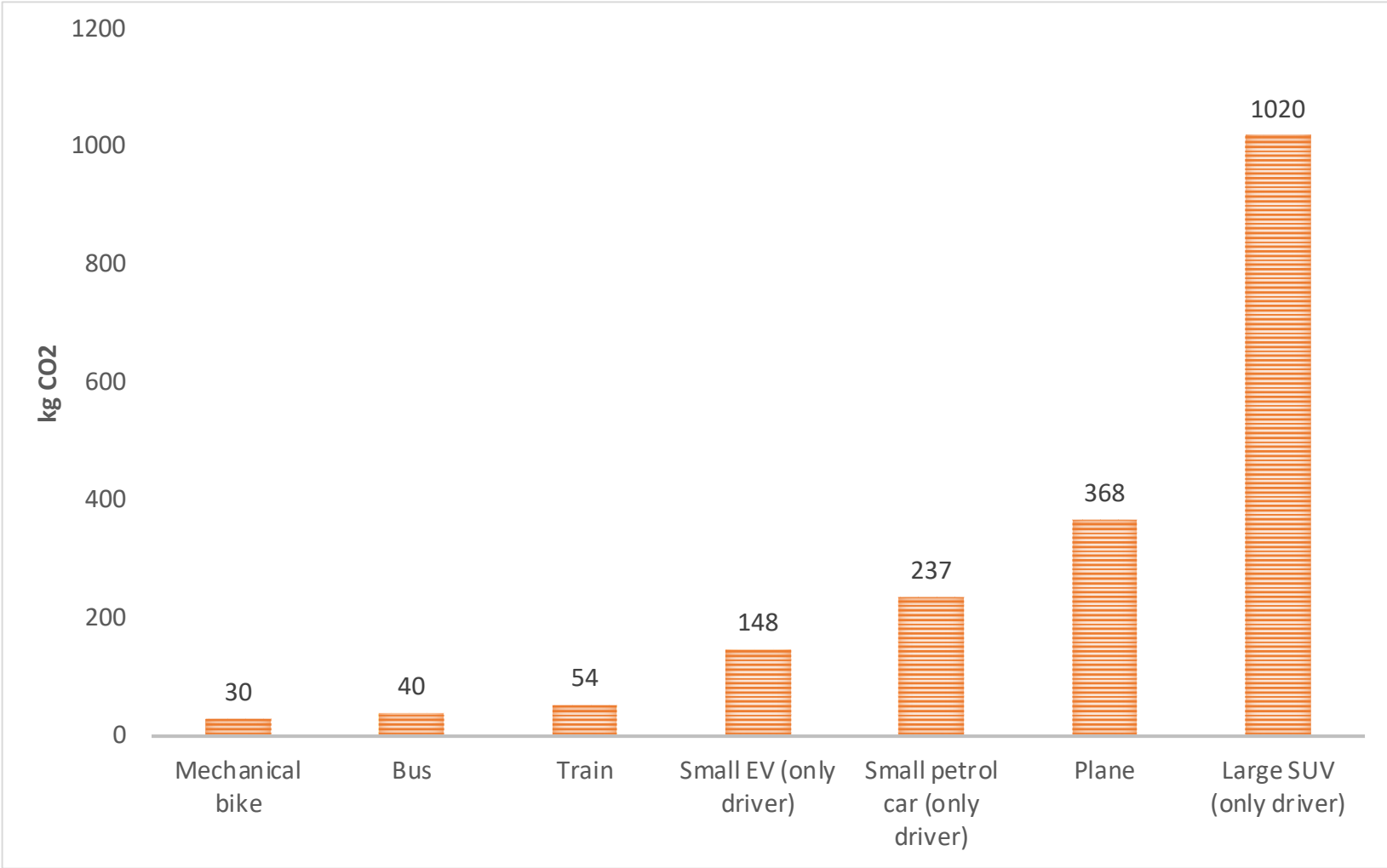
1 km by train

French train with nuclear power	14
London underground	43
Tram	45
Intercity standard class	50
Intercity first class	100

Round trip from Riga to Warsaw (1320 km)

- Mechanical bicycle
- Bus
- Train
- Small electric car (driver only)
- Small efficient petrol car (driver only)
- Airplane
- Large SUV (driver only)

Round trip from Riga to Warsaw (1320 km)



Transport CO₂ emissions per passenger kilometer depend on:

- Food if riding a mechanical bicycle
- Occupation rate
- Driving speed
- Congestions drive
- Car sharing

Smart phone

- 3 hours every day throughout the year

Computer and it's use

- 8 hours every working day for 11 months

kg CO₂

Using a smart phone

	kgCO2 year
1 h/day	63
195 minutes per day	69
10 h/day	86

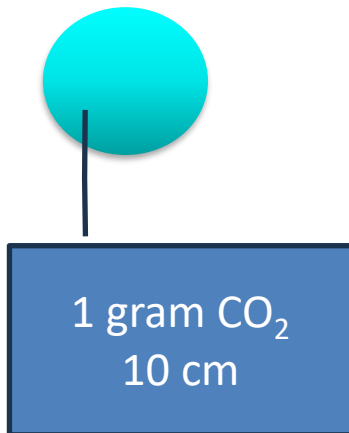
A computer

Computer:	kgCO2
13" MacBook Pro , 128Gb memory	326
Low price 14" HP Chromebook 14g5	329
15" Dell Precision 5539, 256GB memory	475
16" MacBook Pro, 1 TB memory	620

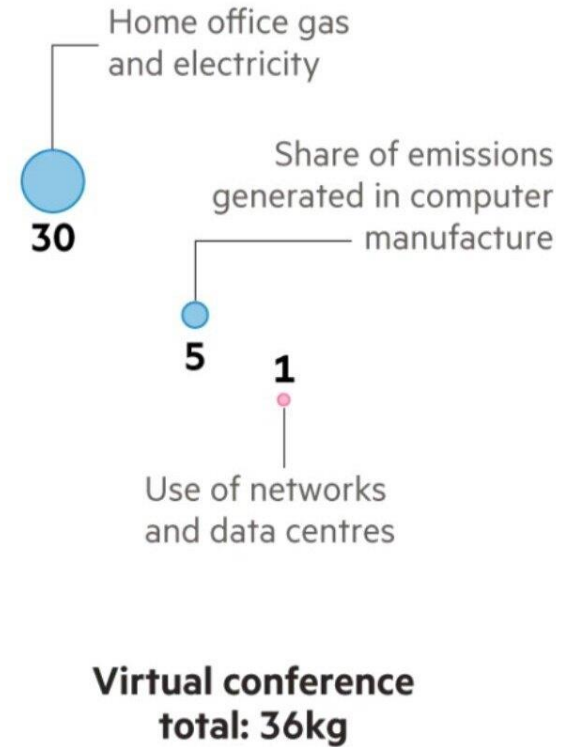
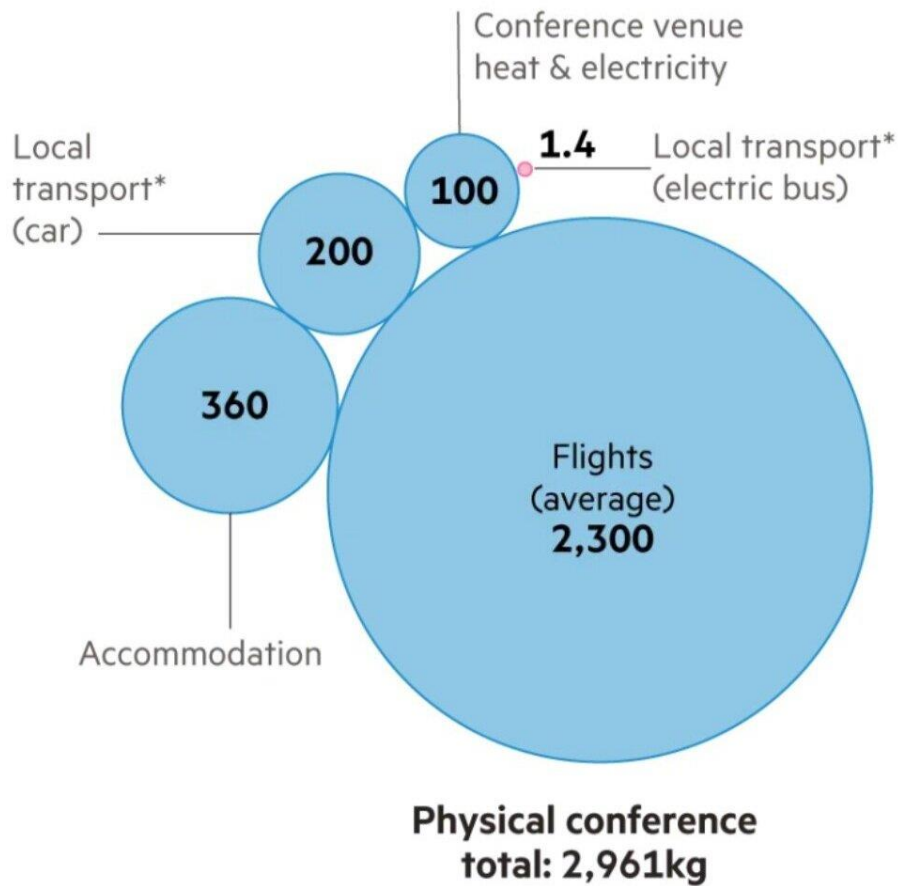
Using a computer

Computer use:	kgCO2/year, if used 8h/workdays 11 month/year	Total with server and network use
13" MacBook Pro	4	68
16" MacBook Pro	5	70
Low price 14" HP Chromebook 14g5	11	75
Laptop with average efficiency	18	82
Desktop with screen	88	152
Gaming computer with screen	120	184
plus additionaly for server and network use	64	

1 gram CO₂/min



Emissions per head generated by a 12-day conference/kg of CO2



*assumes hotel is 10 miles from transport centre

Source: National Centre for Emissions Management in Poland, How Bad Are Bananas? by Mike Berners-Lee, WSP © FT

<https://www.greenwoodarbitration.com/greenwood-energy-arbitration-blog/2021/5/11/the-value-and-cost-of-in-person-networking>

A plastic bag

A paper bag

grams CO₂/bag

A plastic bag

Very light	3
Heavier supermarket bag	10
Heavy bag “for the rest of the life”	50

A paper bag

Recycled and light	12
Fashion bag from new paper	80

25 cm pizza

A boiled potatoes portion (200 g)

grams CO₂

25 cm pizza

Vegan (without cheese)	1000
Margherita	1400
Pepperoni	2200
Quattro Formaggi	2200
Meat Feast	2800
Takeaway box	130
Delivery with scooter	340

A boiled potatoes portion (200 g)

Local and unboiled	56
Local, boiled on low flame in a pot with a lid	106
Imported from Cyprus, boiled on low flame in a pot with a lid	240
Imported from Cyprus, boiled on high flame in a pot without a lid	340

A bowl of porridge

A portion of fish (200 g)

Grams CO2

A bowl of porridge

Made with water	110
Made with soya milk	450
Made with 50/50 cow's milk and water	450
Made with cow's milk	800

A portion of fish (200 g)

Fresh mackerel caught and sold locally	480
Fresh cod caught and sold locally	880
Fresh trout caught and sold locally	1700
Canned tuna	1900
Fresh lobster transported by road	4500

Taking a bath

A cup of tea or coffee

grams CO₂

Taking a bath

Modest bath heated by solar energy	200
Modest bath heated by efficient gas boiler	500
Generous bath heated by efficient gas boiler	100
Generous bath heated by electricity	160

A cup of tea or coffee

Black tea	22
Tea with soya milk	47
Instant coffee	49
Tea with cow's milk	71
Black coffee (drip, Americano or filtered)	87
Large oat milk latte	288
Large soya milk latte	308
Large cow's milk latte	552
A typical disposable cup	110

220 grams raw steak

A pair of jeans

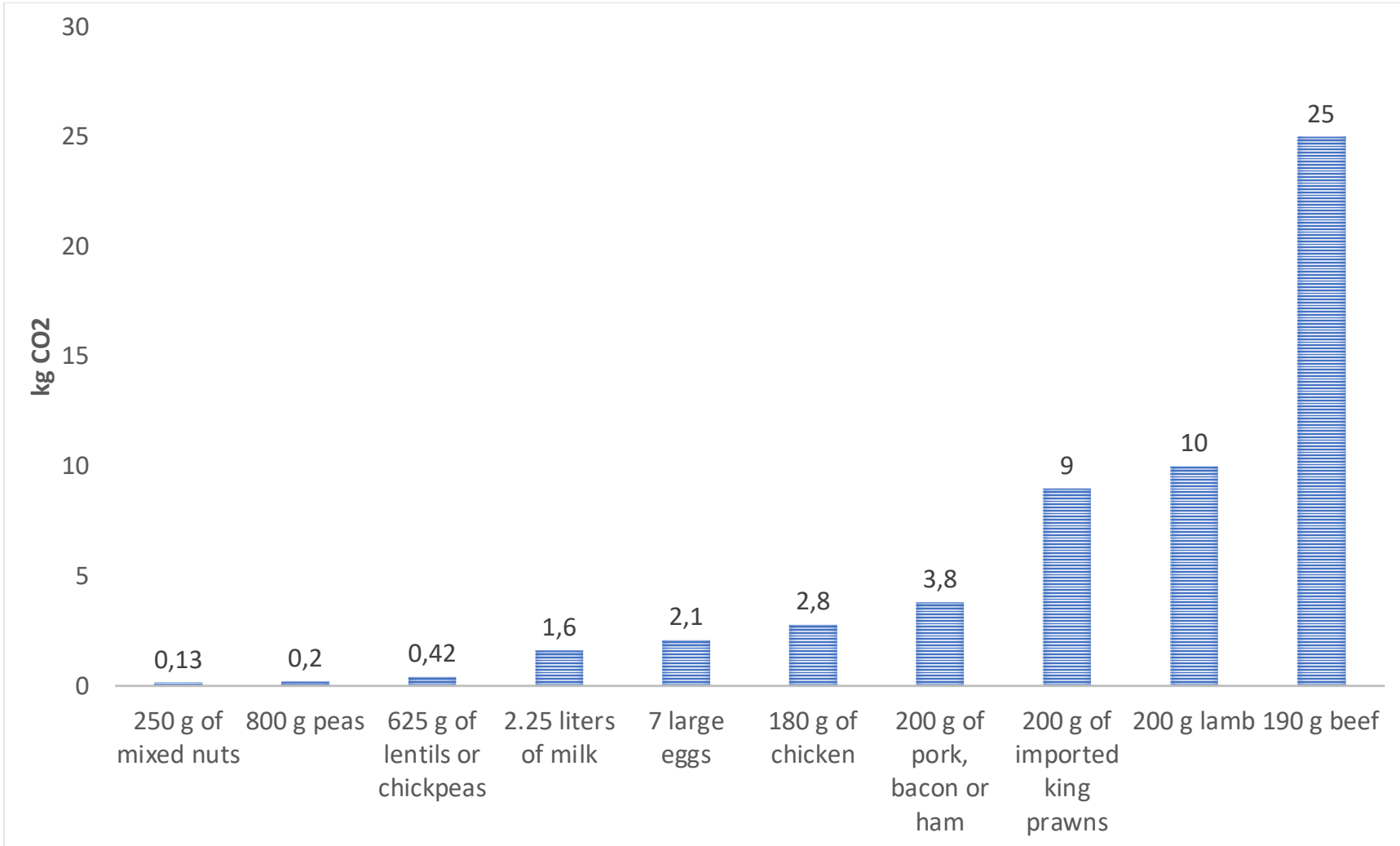
kg CO₂

220 grams raw steak

Local raw steak	6
Raw steak from deforested land in Brasil	18

A pair of jeans

Polyester (300g)	8
Acryl (300 g)	11
Male cotton jeans (600 g)	19



A day's protein (50 g)

A bottle of wine

A bouquet of flowers

kg CO₂

A bottle of wine

By ship from Australia and 300 km by road	1.4
2400 km by road from Italy	1.6
	5

A bouquet of flowers

From your garden without mineral fertilizers	0.0
Snapdragon, grown locally outdoors and sold locally	0.1
15 flowers grown locally outdoors and sold locally	1.7
A rose grown in a greenhouse in the Netherlands or outdoors in Kenya and airfreighted to Europe	2.4
Bouquet of 5 Kenyan or Dutch roses, 5 Dutch lilies and three Kenyan assorted flowers	32

**A heart bypass or hip
replacement operation**

A funeral

4 kW solar PV panel

tonns CO₂

A heart bypass or hip replacement operation

Hip replacement or knee operation	1
Heart bypass operation	2.3

A funeral

Cremation	0.4
Pyre	0.6
Field burial	0.9

4 kW solar PV panel

4 kW panel	5
Reduced CO ₂ in 20 years from 4 kW panel	-24

3 MW wind generator

Car crash

New single family building

tonns CO₂

3 MW wind generator

3 MW installed	1046
3 MW CO2 emissions reduced in 20 years	-81538

Car crash

small scratch that does not need to be repaired	0
accident on an empty road: the car must be written off	5
accident on a busy road: two cars must be written off	40
30 crashes on a busy road: two cars must be written off	1200

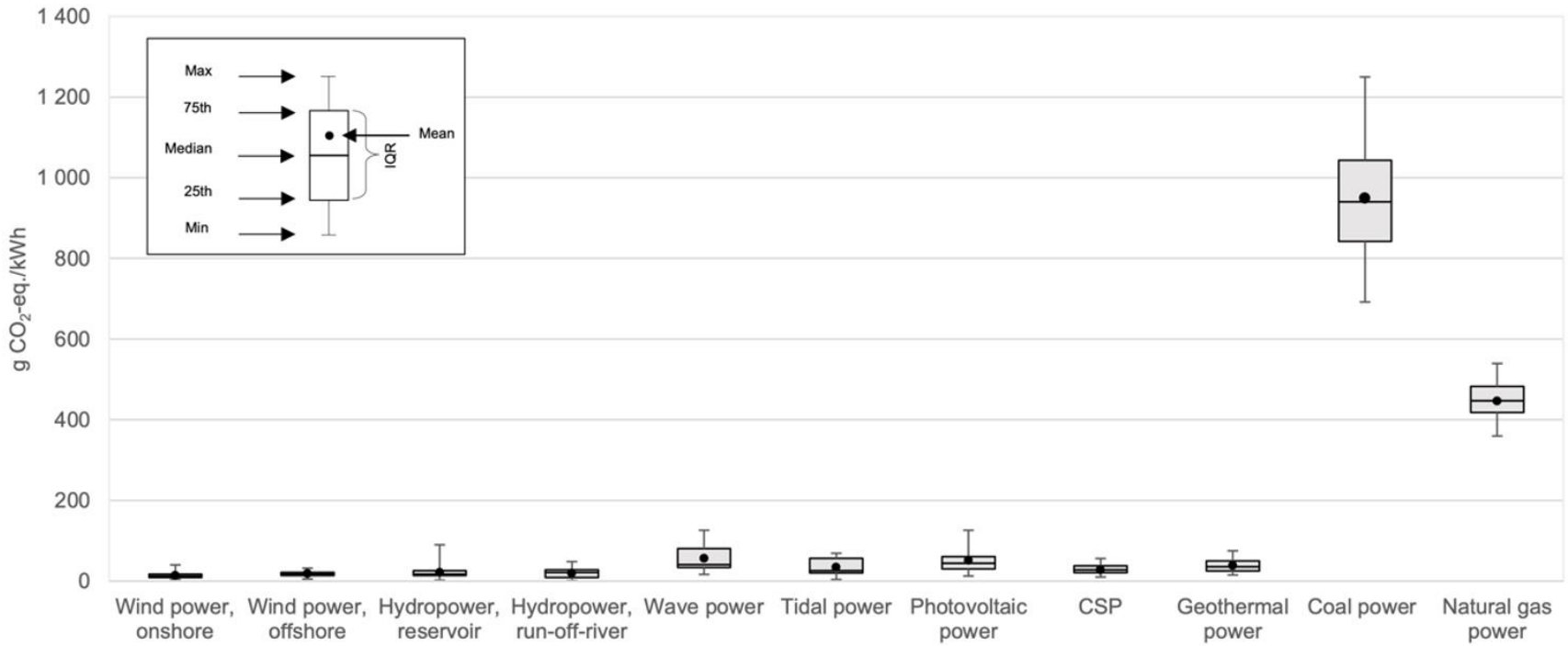
New single family building

3 bedroom brick and plaster semi-detached building	32
4 bedroom brick and plaster detached building	53
20 four bedroom brick and plaster detached buildings	1060

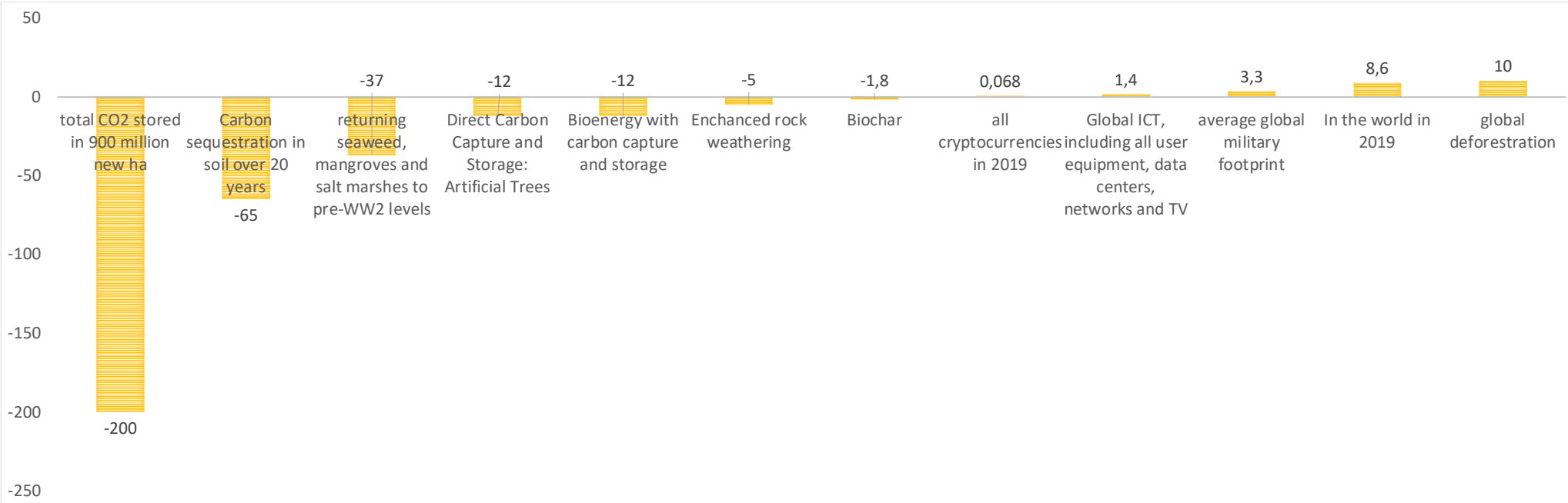
Energy

	Grams CO2/kWh
solar collector	30
solar PV panel with heat pump	30
solar PV panel without heat pump	90
Latvian electricity	57
British Electricity	340
Centralized heat supply with natural gas boilers	264
Individual heating: modern gas boiler	250
Individual heating: old gas boiler	400
Individual heating: liquid diesel	300

Energy production



Billion tons CO₂



Total CO₂ emissions globally in 2021: 37 bill. tonns CO₂

1 tonn CO2

1961 vegetarian meals

138 meat meals

1 flight from Riga to Porto

192 T-shirts

143,200 TV watching hours with 30W LED TV

5 persons consume large latte with cow's milk every day one year



You can travel with 1 tonn CO2 ...

4000 km by
airplane

5700 km by large
petrol car

9200 km by small
petrol car

24000 km by
electrical vehicle

28000 km by train

333333 km by
electric bike



CO₂ reduction activities



Transport:

- Car free life
- If you have to drive, use an electric car, public transport, electric bike, mechanical bike
- reduce flights
- Max fill vehicles
- Drive at optimal speed
- Reduce time spent in congestions



Reducing energy consumption:

- Insulate buildings
- Reduce equipment use and installed capacity
- Use renewable energy resources and heat pumps



Food:

- Give up beef and cow's milk products
- Switch to a vegan diet
- Reduce transport distances (food km)
- Reduce food waste
- Improve cooking efficiency



GROUP ASSIGNMENT

**1. READ
DESCRIPTION OF
JOHN'S DAILY
ROUTINE**

**2. CALCULATE
CURRENT DAILY
CO2 EMISSIONS:**

- FOOD
- TRANSPORT
- ENERGY
- IT EQUIPMENT
- FLOWERS
- OTHER

**3. PROPOSE
ALTERNATIVE
ACTIVITIES TO
REDUCE CO2
EMISSIONS AND
CALCULATE
REDUCTION**

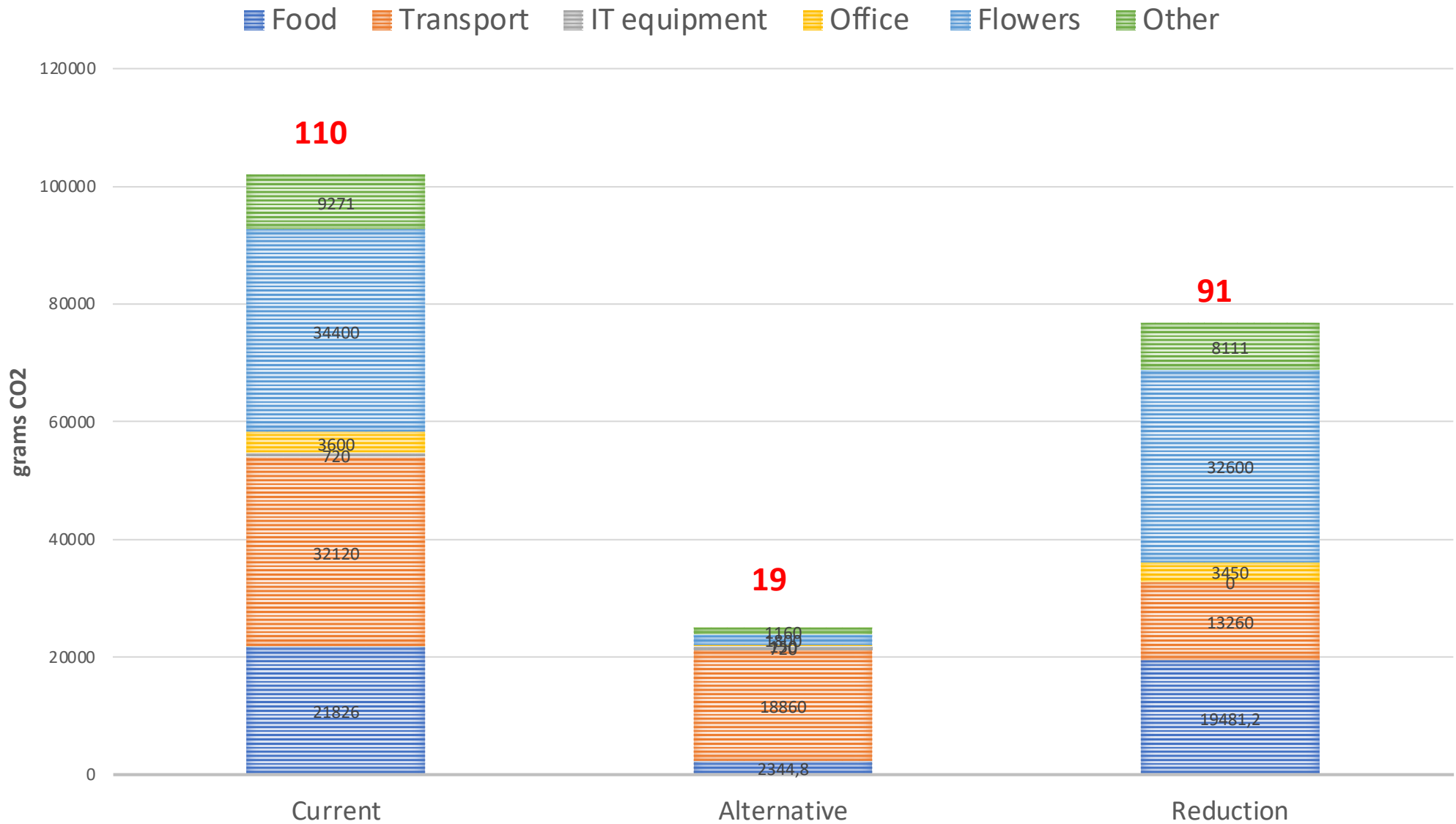
- 4 persons per group
- Group work 40 minutes
- Discussions 30 minutes

JOHN'S DAILY ROUTINE

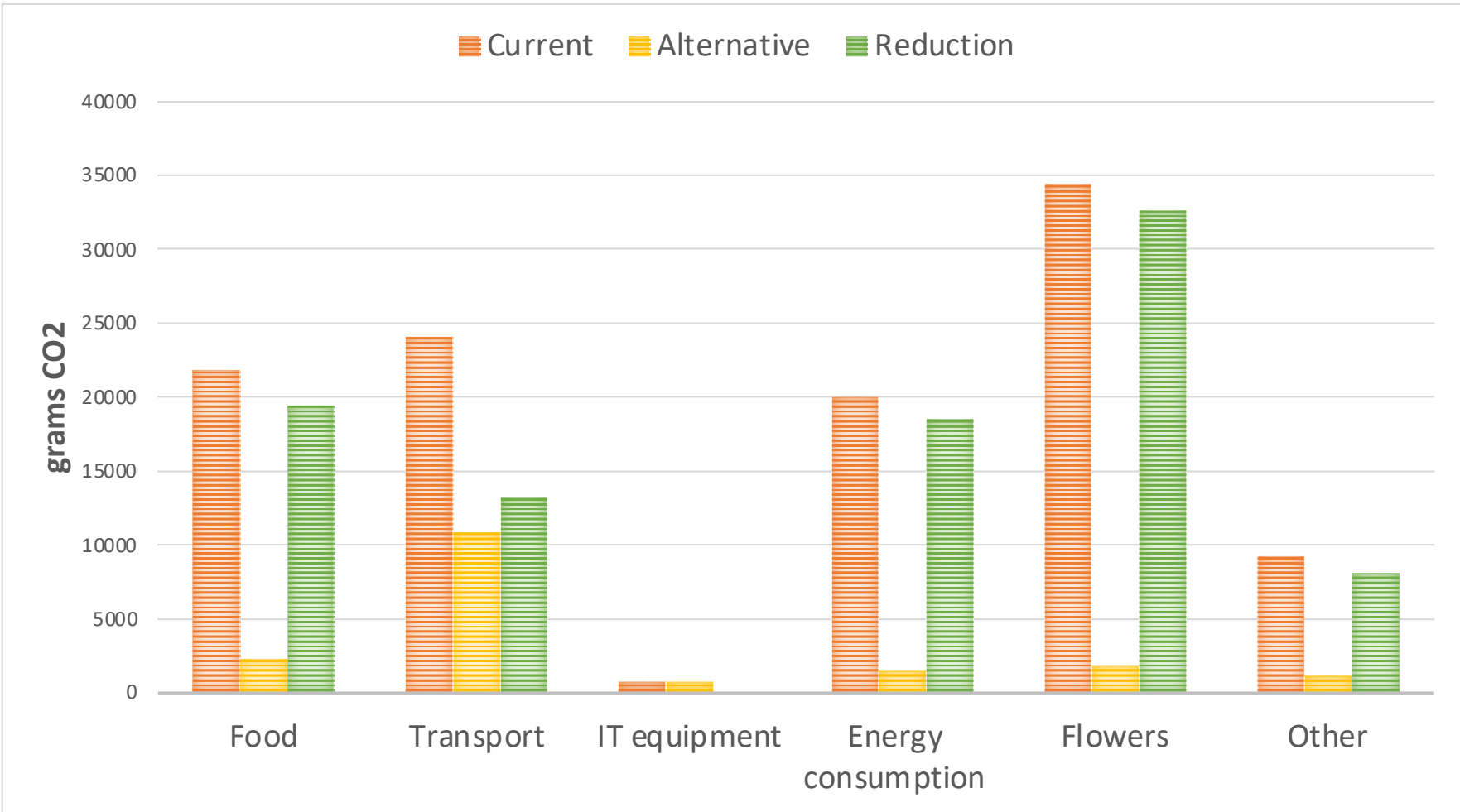
John is an administrative manager at a vocational school. He starts his day with breakfast. He usually eats a bowl of porridge with cow's milk and drinks a latte with cow's milk. Every morning, he carefully irons his shirt and takes a clean (tumble-dried and washed at 90°C) handkerchief made from fabric. He owns new Range Rover Sport HSE and uses it to drive to his office, which is located 10 km from his home. The road has heavy traffic and is congested for 4 km. On his way to the office, John purchases two bottles of water (1 liter per bottle) and drinks throughout the day. He also buys one rose delivered from a greenhouse in the Netherlands to put in the vase on his table. His office is 50 m², and it is located in old non-renovated building which is heated with an individual heating system and an old gas boiler. John uses his smartphone 2 hours a day. He has a desktop with a screen and uses it 6 hours a day, including Google and other search services that use servers and networks. He spends 2 hours in Zoom meetings (parallel to using search services). The school is on two premises, and John must fulfil his work duties by traveling 20 km by bus daily to visit both sites. On his way he writes 4 long e-mails from laptop to laptop that each take John 10 minutes to write and for the recipient 3 minutes to read. During the lunch break, John has pizza Meat Feast, milk ice cream, and a latte with cow milk for lunch. In the afternoon, John eats 1 kg strawberries imported from South Africa and drinks a latte with cow milk. During the day, he washes dishes three times a day by hand with extravagant use of water. He dries his hands with a standard electric dryer six times a day. On his way home, John purchases a flower bouquet of 5 Kenyan or Dutch roses, 5 Dutch lilies, and three Kenyan assorted flowers as a gift for his wife. He takes his Range Rover Sport HSE and drives back home on the road which is congested for 4 km.

CURRENT ACTIVITIES	ALTERNATIVE ACTIVITIES
Porridge with cow's milk	Porridge with water
Latte with cow's milk	Latte with oat milk
carefully ironed shirt	a quick expert touch on a wet shirt
tumble-dried and washed at 90°C handkerchief made from fabric	fabric, dried on a clothesline, washed at 60C together with other laundry
Driving Range Rover Sport HSE	Small electric car (driver only)
Congestions	Congestions
Bottled water (1 liter)	Tap water
One rose delivered from a greenhouse in the Netherlands	Locally grown and sold flower
Non-renovated building with heating system and an old gas boiler	Renovated energy efficient building with solar PV panel with heat pump
Use of smartphone	
desktop with a screen + use servers and networks	
Zoom meetings on desktop with screen	
Travelling by bus	
Long e-mails from laptop to laptop that each take John 10 minutes to write and for the recipient 3 minutes to read	
pizza Meat Feast	veggie bean burger with cheese
milk ice cream	80 grams of frozen juice ice cream
Strawberries imported from South Africa	bananas
dishwashing by hand with extravagant water consumption	with hands rapidly in warm water
dries his hands with a standard electric dryer	Dyson Airblade
5 Kenyan or Dutch roses, 5 Dutch lilies, and three Kenyan assorted flowers	15 flowers grown locally outdoors and sold locally

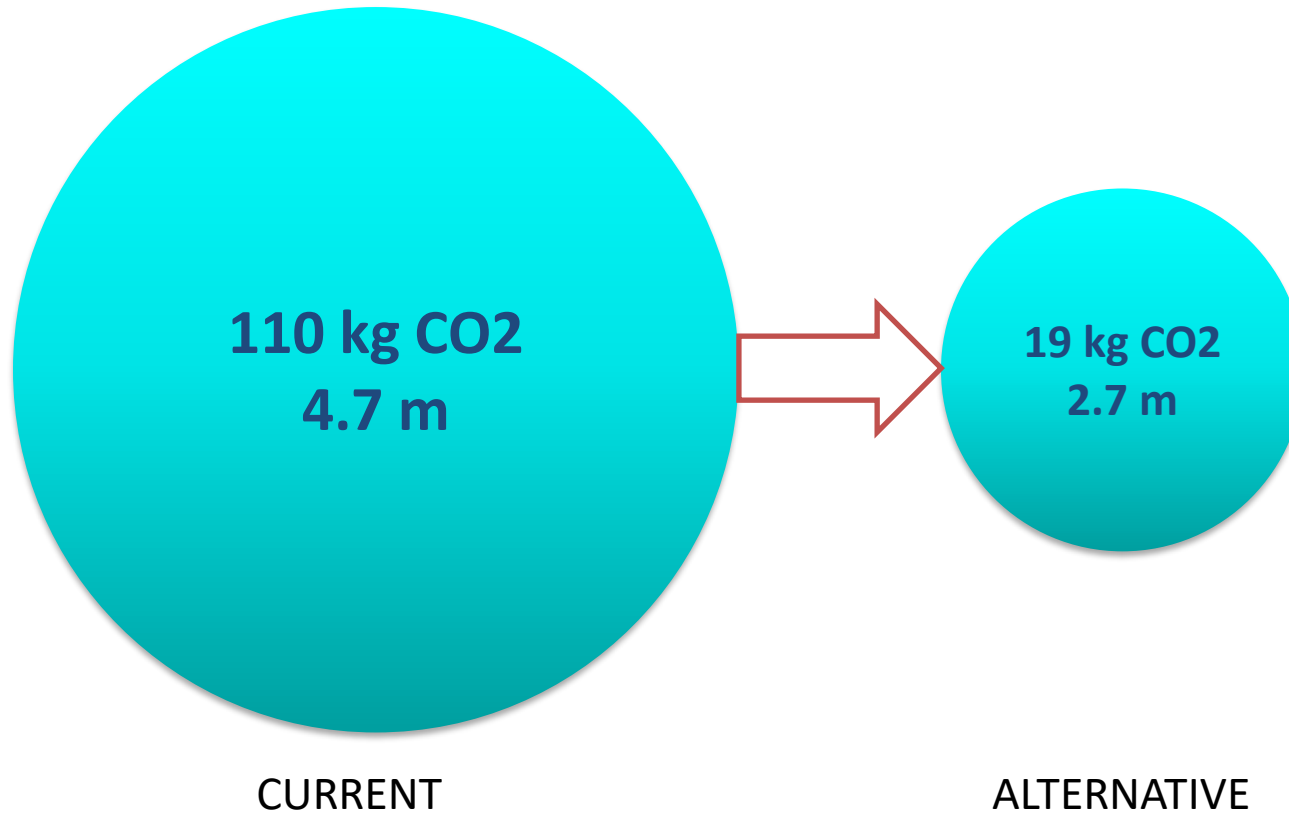
JOHN'S DAILY ROUTINE



JOHN'S DAILY ROUTINE



JOHN'S DAILY ROUTINE



CURRENT ACTIVITIES					ALTERNATIVE ACTIVITIES WITH REDUCED CO2 FOOTPRINT					CO2 REDUCTION
Activity	Measurement unit	Units	Grams of CO2/ measurement unit	Total grams of CO2	Activity	Measurement unit	Units	Grams of CO2/ measurement unit	Total grams of CO2	grams CO2
Porridge with cow's milk	A bowl	1	800	1x800=800	Porridge with water	A bowl	1	110	1x110=110	800-110=690
Latte with cow's milk	Cup	3	552	3x552=1656	Latte with oat milk	Cup	3	288	3x288=864	792
carefully ironed shirt	shirt	1	40	40	a quick expert touch on a wet shirt	shirt	1	8	8	32
tumble-dried and washed at 90°C handkerchief made from fabric		1	165	165	fabric, dried on a clothesline, washed at 60C together with other laundry	handkerchief	1	60	60	105
Driving Range Rover Sport HSE	Km	20	776	15520	Small electric car (driver only)	km	20	113	2260	13260
Congestions	Km	8	1000	8000	Congestions	Km	8	1000	8000	0
Bottled water (1 liter)	Bottle	2	400	800	Tap water	liter	2	0.4	0.8	799.2
One rose delivered from a greenhouse in the Netherlands	Rose	1	2400	2400	Locally grown and sold flower	flower	1	100	100	2300

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Non-renovated building (1 kWh/m2/day) with heating system and an old gas boiler	m2	50	400	20000	Renovated energy efficient building with solar PV panel with heat pump	M2	50	30	1500	18500
Use of smartphone	min/days	120	1	120					120	
desktop with a screen + use servers and networks	h/days	6	72	432					432	
Zoom meetings on desktop with screen	h/days	2	50	100					100	
Travelling by bus	Km	20	30	600					600	
Long e-mails from laptop to laptop that each take John 10 minutes to write and for the recipient 3 minutes to read	Emails	4	17	68					68	
pizza Meat Feast	pizza	1	3270	3270	veggie bean burger with cheese	burger	1	630	630	2640
milk ice cream	Ice cream	1	500	500	80 grams of frozen juice ice cream	ice cream	1	70	70	430

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Strawberries imported from South Africa	Kg	1	14800	14800	bananas	Kg	1	670	670	14130
dishwashing by hand with extravagant water consumption	Times/day	3	3000	9000	with hands rapidly in warm water	Times/day	3	360	1080	7920
dries his hands with a standard electric dryer	Times/day	6	11	66	Dyson Airblade	Times/day	6	2	12	54
5 Kenyan or Dutch roses, 5 Dutch lilies, and three Kenyan assorted flowers	a flower bouquet	1	32000	32000	15 flowers grown locally outdoors and sold locally	a flower bouquet	1	1700	1700	30300
Total, kg CO2				110					19	91
Low price 14" HP Chromebook 14g5		1	329000	329000						
New Range Rover Sport HSE	Car	1	25000000	25000000	Citroen C1, Peugeot 107, basic equipment	1	4000000			21000000