

12100 summer 2025 exam

Der anvendes en scoringsalgoritme, som er baseret på "One best answer"

Dette betyder følgende:

- Der er altid netop ét svar som er mere rigtigt end de andre
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- Hvert rigtigt svar giver 1 point
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The following approach to scoring responses is implemented and is based on "One best answer"

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Page 1

How would you define the functional unit of a coffee machine?



Production of 10 cups of coffee (1 dl) pr day for 1 year in Denmark



Production of 10 kg cups of coffee (1 dl) pr day with the least energy consumption in Denmark



The energy consumption for production of 10 cups of coffee (1 dl) pr day in Denmark (MJ/cup of coffee)



The energy consumption pr cup of coffee produced

How can the rebound effect be interpreted in the IPAT context?

- That more people (P) become more wealthy (A) - therefore the efficiency ($1/T$) must increase
- Since efficiency ($1/T$) increases it will also become cheaper and the overall impact (I) will decrease
- That an increased efficiency ($1/T$) will lead to more people (P) using the technology and therefore a higher environmental impact, i.e. $P \times T$ will increase
- That the consumption (A) and efficiency (T) are not always independent - and increased efficiency can cause increases consumption, i.e. $A \times T$ will increase

What is the typical CO₂ emission per produced energy unit from most renewable energy technologies unit like solar PV, onshore wind and nuclear?

- 5-20 g CO₂/kWh
 - 400 – 1000 g CO₂/kWh
 - 100-400 g CO₂/kWh
 - 20-100 g CO₂/kWh
-

You want to further interpret the impacts of the e-bike and what are the dominant contributions to its carbon footprint per km driven as well as to its health and biodiversity footprints. Download the carbon and health footprint solution file of various vehicles: "[12100 QS carbon_cost_health_absolute Car carbon footprint solutions_S25a](#)". As described in rows 93 to 111 of the carbon footprint tab, the electric bike weight 15 kg with a bike life span of 20000km, it has a Li-ion battery of an additional 3 kg with a battery lifespan of 10000 km. Its electricity consumption amounts to 0.007 kWh/km. The minutes of healthy life gained per km e-biked is estimated at 2/3rd of a conventional bike, that is 6.2 minutes gained per km driven with the e-bike.

Tasks:

- For both the electric car and the electric bike, modify the electricity mix used for charging the battery from the Danish electricity mix low voltage **to the Polish (PL) electricity mix (market for electricity, medium voltage)**. Identify the right process in ecoinvent and then select it first in the selected process and then in the carbon calculator. The Polish electricity mix will be used for the rest of the questions related to the electric car and the e-bike.
- Complement for the e-bike the quantity of battery per e-bike-km in column F
- Look at the results and interpret them to select the one correct answer in the present and following questions.

- For the e-bike carbon footprint, the carbon footprint associated with the manufacturing of the e-bike is lower than the impact of the electricity usage
 - For the e-bike, the non-renewable primary energy consumed by the 10000km of container ship freight is higher than that consumed by the 2000km transportation in a 16-32t truck
 - The amount of battery used in kg per e-biked-km amounts to 2.1E-4
 - The bike usage lifespans expressed in km driven over the bike lifetime has little importance since it only modifies the use stage impacts
- For the carbon footprint of the e-bike, the battery production has a close to 3 times ($\pm 10\%$) lower carbon footprint than the bicycle production

Using the same excel sheet let us now compare the carbon footprint of the e-bike against the petrol, the electric vehicle and the conventional bike (see excel sheet). The Polish electricity mixed is still used for charging the electric vehicle and the e-bike.

- For the electric car with Polish electricity mix, the use phase over 225000 km represents less than 50% of the carbon footprint
 - Per km cycled, the electric bike carbon footprint is close to three times higher ($\pm 20\%$) than the conventional bike
-
- Due to the high fraction of electricity production with coal in Poland, the electric car using the polish electricity mix has a substantially higher footprint than the gasoline car
 - The carbon footprint of 1kWh of polish electricity mix is substantially higher than that of 1 kWh of coal electricity
 - Per V-km, the carbon footprint of the manufacturing stage of the e-bike is more than 10 times lower than the manufacturing of the electric car

We had calculated in our morning coffee exercise that the life cycle carbon footprint of one cup of coffee in Europe amounts to 0.132 kgCO₂e/cup. Let us assume that a European citizen drinks 3 cups of coffee per day and commutes to work 12 km per day (2 x 6km) either with an electric car or an e-bike, both running on Polish electricity mix. Calculate the cumulative carbon footprint of these two activities and select the correct answer for this question

- Since the e-bike requires less effort than the conventional bike, the absolute value of the human health benefit of e-biking is lower than the health impacts of manufacturing the e-bike and its battery
 - The 3 cups coffee consumption per day has a close to 9 times smaller ($\pm 10\%$) footprint compared to the 12 km commuting per day by electric car
-
- The carbon footprint of one cup of coffee is equivalent to approximately 10 km ($\pm 10\%$) by an e-biker
 - For the e-bike commuting scenarios, the use phase is responsible for less than 30% of the ecosystem impacts
 - The carbon footprint scores are based on estimated damages on human health expressed in DALYs, and are therefore highly uncertain

Select the one correct answer for the cumulative carbon footprint of 3 cups of coffee per day and 12 km per day commute to work by an electric car running on a Polish electricity mix

- It is between 10 and 25 kgCO₂eq/d
- It is between 0.25 and 1 kgCO₂eq/d
- It is larger than 25 kgCO₂eq/d
- It is between 1 and 2.5 kgCO₂eq/d

It is between 2.5 and 5 kgCO₂eq/d

- It is between 5 and 10 kgCO₂eq/d
- It is lower than 0.25 kgCO₂eq/d

How would you define public goods?

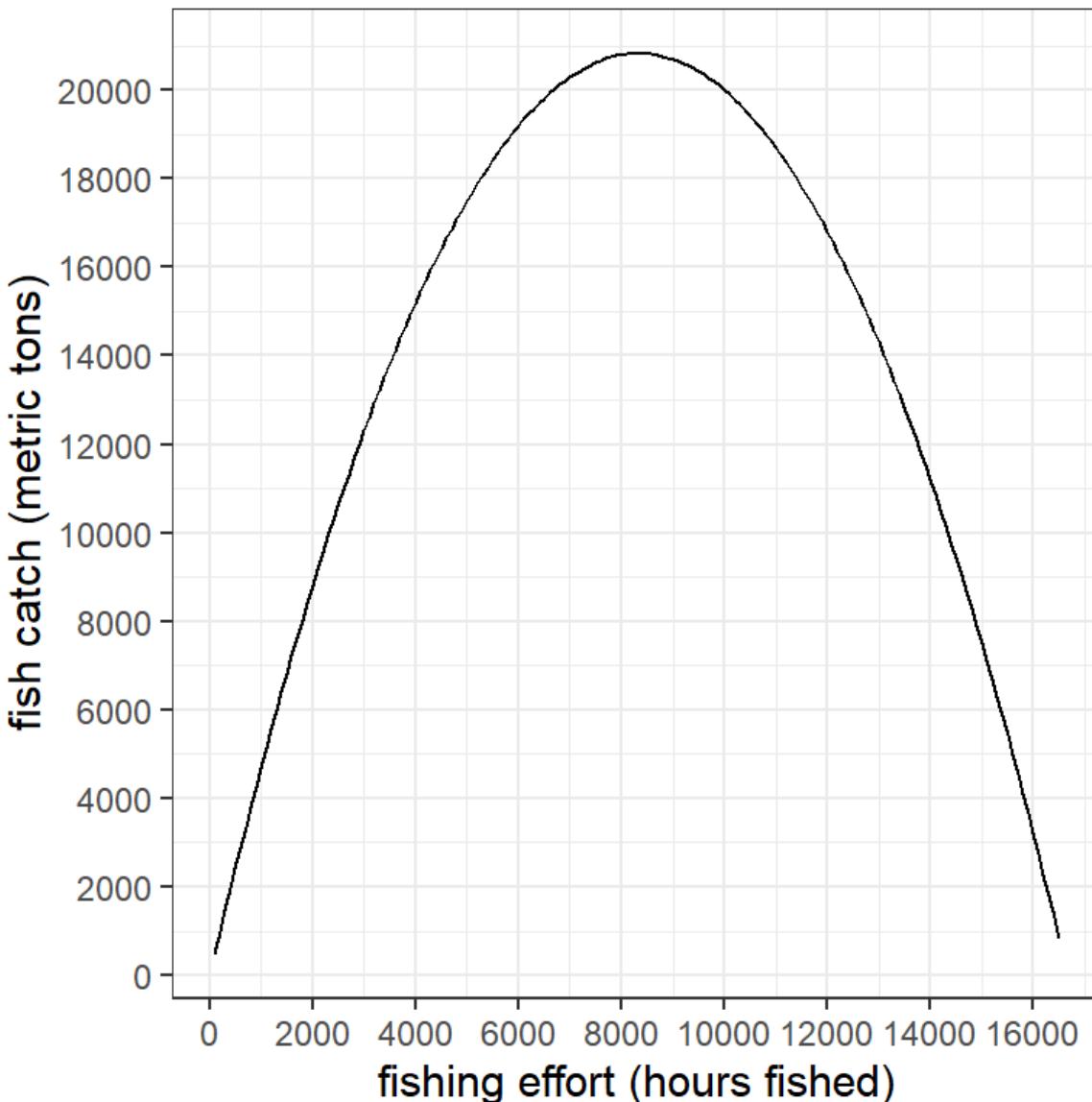
- Users can exclude others from using that good and their use of this good does not affect the ability of others to use it.
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- Users can exclude others from using that good and their use of this good affects the ability of others to use it.
- Users cannot exclude others from using that good and their use of this good affects the ability of others to use it.

How can you prolong the exploitation of a non-renewable resource?

- By being careful about where you discard it
- By maximizing its extraction early on
- By recycling it, reusing it and reducing its use
- By improving technologies used to extract it

Take a look at the figure below displaying information we have obtained about how much fish can be caught annually (in tons) in relation to the fishing effort it took to catch it (cumulative number of hours spent fishing annually).

You have the choice to decide how much fishing effort should take place this year: which of the following four options will not overexploit the fish stock?



8000 hours

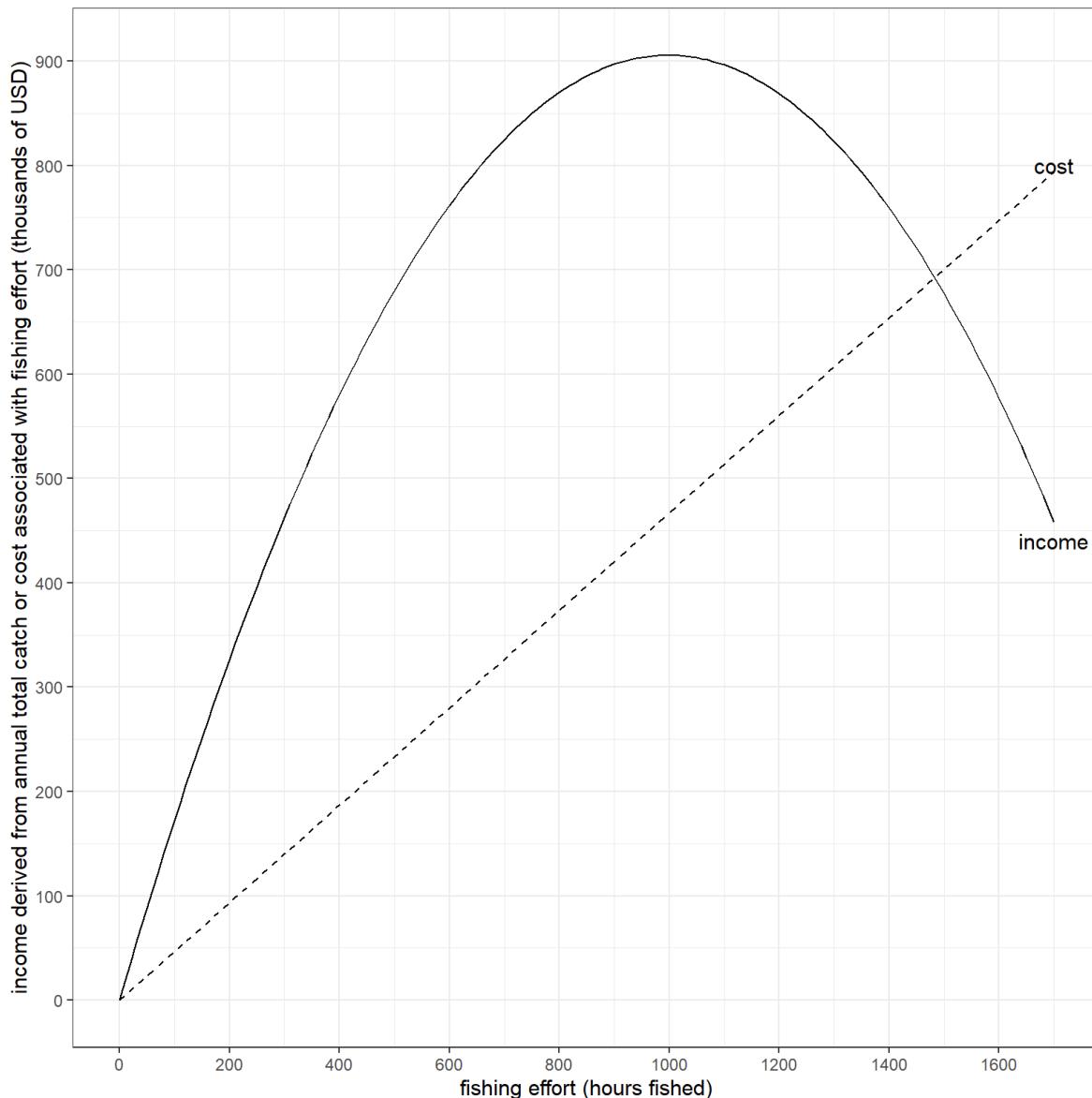
9600 hours

9000 hours

10320 hours

The figure below shows how income and cost vary for a fisher, as they increase their fishing effort.

Given this information, which fishing effort is closest to yielding the Maximum Economic Yield?



1600 hours

1500 hours

1000 hours

100 hours

Are capital expenses normally included in the life cycle costs?

No

Yes

Choose the correct statement

- Life cycle costing always includes environmental costs via monetization of environmental impacts
- Life cycle costing involves defining the product or service system to be studied
- Life cycle costing cannot be used for identifying possible alternatives for development or marketing
- Life cycle costing normally apply organizational boundaries in the scoping

-
- Life cycle costing cannot be used to define trade-offs between criteria such as internal vs. external costs

Using the excel sheet "[1210X - Life cycle costing_exam](#)" try to change the numbers of electricity use and the costs of 1 kWh as well as the efficiency of the gasoline car. If the cost of one kWh reaches 0.5 €/kWh and the gasoline car can drive 30 km pr. l gasoline: how will the price pr vehicle - km for the e-vehicle be compared to gasoline car or leasing the e-vehicle?

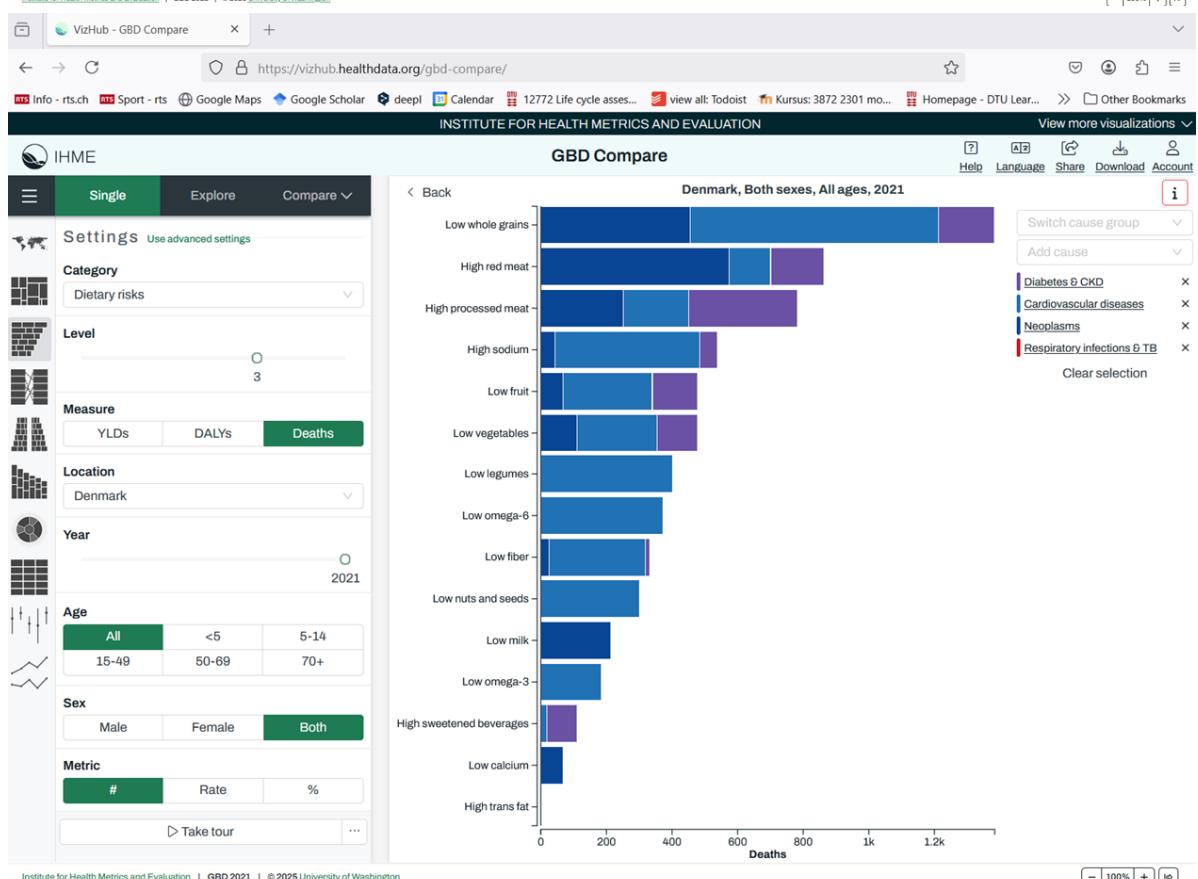
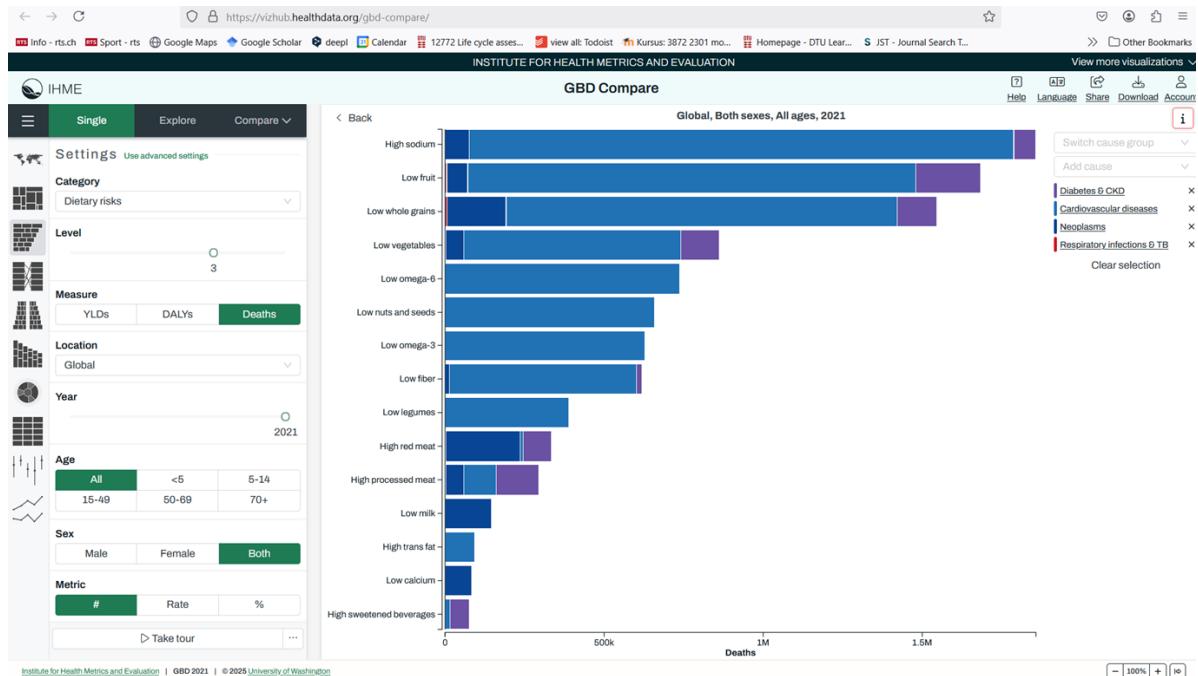
- It will be lower (at app. 70 %) than the price of a leased e-vehicle v-km
 - It will be higher than for the leased car
 - The price will be higher than for the gasoline car
-

- The price will still be lower than for the gasoline car

Using the same excel sheet calculate what happens if you buy a more expensive electric vehicle. If the price of the vehicle is changed to €75,000 and the gasoline car drives 30 km/l gasoline. Choose the correct statement.

- The price pr vehicle – km will still be considerably lower for the electric car
 - The price pr vehicle – km will be considerably higher for the electric car
-
- The price pr vehicle – km will be almost the same for the gasoline car and the electric car.

Looking at these dietary risks from the Global Burden of Disease visualization tool (taken from <https://vizhub.healthdata.org/gbd-compare/>) please choose the correct answer below



- Low consumption of fruit is among the two highest dietary risk factors in Denmark, but it is not at global level
- The risks for the high consumption of sweetened beverages risks are mostly associated with cardiovascular diseases
- According to the GBD, the main impact of a low consumption of calcium is cancer (=neoplasm)

- The risks for the low consumption of omega-3 is ranked higher in Denmark than at global level
 - The risks associated with the low consumption of legumes is among the four lowest risks in Denmark
-

Choose the correct statement

- If a hotdog leads to 36 minutes of life lost, it is mostly because of the sodium contained in the hotdog
 - 1 hour of frying or grilling can lead to indoor exposure that can cause stroke and more than 17 minutes life lost
 - For the impacts of climate change of heat and cold, it is the continents that most induce the climate change (i.e. North America and Europe), that are affected the most and have the maximum minutes lost per person due to the high heat waves observed in Europe and North America
 - For a moderate Parkinson disease, its disability weights are still smaller than 0.2
-

What is one of the early warning signal that a system is close to a state shift?

- The mean of values for observable parameters increases
 - A decrease in autocorrelation of values for observable parameters
 - The median of values for observable parameters decreases
 - The variance of values for observable parameters increases
-

Since 2023 the following number of planetary boundaries have been exceeded

- 6
 - all
 - 4
 - 3
 - 9
-

Ecological footprint of a country represents the following environmental impacts

- Climate change caused by the national emissions
- Number of threatened species in the country
- Climate change and land use caused by the national consumption

-
- Climate change and water use caused by the national consumption
 - Land use and water use occurring within the nation

Earth overshoot day generally falls around 1 August but If everybody had a consumption pattern like in Denmark it would be in

- April
- September
- June
- January

- March

Bocken has a simplified model of circular economy, focusing on three main resource flow strategies: slowing, narrowing and closing. Closing refers to what area of the Circular Economy Scanner?

- Recirculate parts & products (blue area)
 - Rethink and reconfigure business models (orange area)
 - Recirculate materials (grey area)
-

- Restore, reduce and avoid impacts (green area)

Which of the following strategies does **NOT** entail value recovery at a material level?

Reuse

Cascade

Recycle

Recover

Which of the following are **NOT** circular design approaches to product longevity?

Design for emotional durability

Design for physical durability

Design for upgrade

Design for recycling

What is the main gap in existing methods for visualizing LCSA results according to Backes et al.?

They do not sufficiently use both colors and numerical values to ease the interpretation

They do not present both indicators for each sustainability dimension **and** an overall assessment of the full LCSA in a comprehensible way

They only shows aggregated results and do not present indicators for each sustainability dimension

They can only be used for comparisons and not for e.g. optimization of a system

Question 15 (1 point) ✓ Saved

You want to further interpret the impacts of the e-bike and what are the dominant contributions to its carbon footprint per km driven as well as to its health and biodiversity footprints. Download the carbon and health footprint solution file of various vehicles, (that you also obtained in module 6, just a few cosmetic changes in the human health graph): "12100 QS module 7 carbon_cost_health_absolute Car carbon footprint solutions_W25b". As described in rows 94 to 111 of the carbon footprint tab, the electric bike weight 15 kg, has a Li-ion battery of an additional 3.5 kg, for a lifetime of 20000 km. Its electricity consumption amounts to 0.007 kWh/km, using an average European electricity mix (UCTE). The minutes of healthy life gained per km e-biked is estimated at 2/3rd of a conventional bike, that is 6.2 minutes gained per km driven with the e-bike.

Look at the results and interpret them to select the two correct answers in the present and following question

Select 2 correct answer(s)

- The transportation of the e-bike by cargo freight over 10000 km and by truck over 2000 km at the start of its life is completely negligible, with less than 0.1% of the e-bike carbon footprint per km
- For the e-bike carbon footprint, the manufacturing of the bike and its battery is negligible compared to the impact of the electricity usage
- The e-bike lifespan expressed in km driven over the e-bike lifespan is a key parameter and inversely proportional to the vehicle production impacts to calculate the amount of material needed per vehicle-km
- The amount of battery used per e-biked km amount to 3.5 kg
- For the carbon footprint of the e-bike, the battery production has the dominant impact in its life cycle
- The electric bike leads overall to a net gain in human health impacts (negative minutes of life lost) due to the physical exercise

Question 17 (1 point) ✓ Saved

We had calculated in our morning coffee exercise that the life cycle carbon footprint of one cup of coffee in Europe amounts to 0.132 kgCO₂e/cup. Let us assume that a European citizen drinks three cups of coffee per day and commutes to work 10 km per day (2 x 5km) either with an electric car or an e-bike. Calculate the cumulative carbon footprint of these two activities and select the two correct answers for this question

Select 2 correct answer(s)

- Depending on the commute scenario, the impact of the 3 cups of coffee is smaller or higher than those of the 10 km commute
- In all scenarios the coffee contributes to a negligible footprint compared to the commuting
- The uncertainties on the human health benefits of physical activity, less than 1%, so it is certain to say that the minutes of gained from physical activity are very accurate and are certainly larger than the potential benefits of drinking three cups of coffee
- The carbon footprint of one cup of coffee is equivalent to approximately 0.42 km with a European electric vehicle or 10 km by e-bike.
- In both the e-bike and electric car commuting scenarios, the use phase dominates the ecosystem impacts
- The carbon footprint scores are based on estimated damages on human health and ecosystems, and are therefore highly uncertain compared to the ecosystem scores

Question 3 (1 point) Saved

Functions of different sustainability tools

1 

can be used to evaluate the economic cost of a good or a service over its lifecourse

4 

can be used to calculate the direct and indirect impacts of the production and consumption of different products and services on key economic parameters

3 

is an economic method that estimates the equivalent monetary value of the benefits and costs of a project

2 

is developed towards evaluating social impacts of a good or a service over its lifecourse

1. Lifecycle cost analysis
2. Social-Lifecycle cost analysis
3. Cost-Benefit Analysis
4. Input-output models

Question 4 (1 point) ✓ *Saved*

Life cycle costing (LCC) is an approach that assesses the total cost of an asset over its life cycle, including

- initial capital costs
- operating costs
- overall social costs
- the asset's residual value at the end of its life

Question 5 (1 point) ✓ *Saved*

Important social conditions/outcomes to measure regarding the mining and resource extraction sector involved in the production of electric vehicles include:

- Income
- Employment
- Education
- Health

Question 6 (1 point) ✓ *Saved*

What are the principles for the Greenhouse gas protocol accounting and reporting

Select 5 correct answer(s)

Accuracy

Completeness

Balance

Consistency

Comparability

Relevance

Comprehensiveness

Materiality

Transparency

Reliability

Question 14 (1 point) ✓ Saved

Looking at the introduction on health, select the two correct answers

Select 2 correct answer(s)

- DALYs only consider the Years of Life Lost Associated with death
- In the Global Burden of Disease, the Year of Life Lost are based on an ideal maximal life expectancy, rather than the local life expectancy
- For most diseases, their disability weight is between 0.6 and 1
- The global burden of disease primarily provide data for developed countries and need to be extended to e.g. African countries
- A day of use of paint stripper can lead to more than 500 minutes of life lost for the person painting
- Physical exercise only has marginal impact on health of less than 10 minutes per person per day of exercise

Question 9 (1 point) ✓ Saved

What characterises common goods?

- users cannot exclude others from using that good and their use of this good does not affect the ability of others to use it.
- users can exclude others from using that good and their use of this good does not affect the ability of others to use it.
- users cannot exclude others from using that good and their use of this good affects the ability of others to use it.
- users can exclude others from using that good and their use of this good affects the ability of others to use it.

Question 10 (1 point) ✓ Saved

what is the difference between a common and a public good?

- users cannot exclude others from using a public good but they can do so for a common good
- the use of a common good by a user affect the ability of others to use it, while it is not the case for a public good.
- the use of a public good by a user affect the ability of others to use it, while it is not the case for a common good.
- users can exclude others from using a public good but they cannot do so for a common good

Question 8 (1 point) ✓ Saved

Which are the GHG gases included in the Kyoto-protocol?

Select 6 correct answer(s)

SF₆

PFOS

CO₂

PFCs

CH₄

N₂O

CO

HCFCs

H₂O

HFCs

NO₂

Question 11 (1 point) ✓ Saved

For any renewable resource, what is the maximum sustainable yield?

- it is the amount of that resource which can be harvested when the resource is depleted
- it is the amount of that resource which can be harvested to maximise the economic yield
- it is the maximum amount of that resource which can be harvested without reducing the amount of resource available
- it is the maximum amount of that resource which can be harvested without jeopardising the resource availability in the future

Question 12 (1 point) ✓ Saved

What is the Maximum economic yield?

- it is the amount of resource harvest for which income generated is equal to the cost of the harvest
- it is the amount of resource harvest for which the economic returns are greater than the resource yield
- it is the amount of resource harvest for which income is maximised
- it is the amount of resource harvest for which revenues are maximised

Question 7 (1 point) ✓ Saved

Match the following activities with the GHG scope they belong to

Goods transport by a contractor

Running the data-servers at company's own facilities

Heating of own offices with electric heating unit

1. Scope 1

Producing steam on-site from natural gas

2. Scope 2

3. Scope 3

Driving to work in a car leased by the company

Delivering products or services in company vehicles

Question 16 (1 point) ✓ Saved

Let us now compare the carbon footprint of the e-bike against the petrol and the electric vehicle

Select 2 correct answer(s)

- The electric car has a lower carbon footprint than the petrol car whatever the provenance or source of the electricity
- The electric bike has approximately a 12 times lower carbon footprint than an electric car with the same electricity source
- For the electric vehicle, the use phase always dominates the carbon footprint whatever the electricity source
- The carbon footprint is calculated using Global Warming Potential (GWP100) enabling us to compare the climate change impacts of different greenhouse gases relative to CO₂.
- For the gasoline car, it is the supply chain of the petrol, low sulfur in Europe that dominates the carbon footprint

Question 18 (1 point) ✓ Saved

Select the ONE correct answer for the cumulative carbon footprint of three cups of coffee per day and 10 km per day commute to work by EU electric car

- It is It is
- It is higher than 10 kgCO₂e/d
- It is between 1 and 3 kgCO₂e/d
- It is between 0.3 and 1 kgCO₂e/d
- It is between 3 and 10 kgCO₂e/d

What are the consequences of failing to meet the SDGs?

- there are none
- countries failing to meet the SDGs will be fined
- countries failing to meet the SDGs will have trade sanctions applied
- we will not be able to meet the Rio 1992 Declaration commitments

0.5 / 1 point

Question 11

In which of the following initiatives has UN Global compact been one of the initiators?

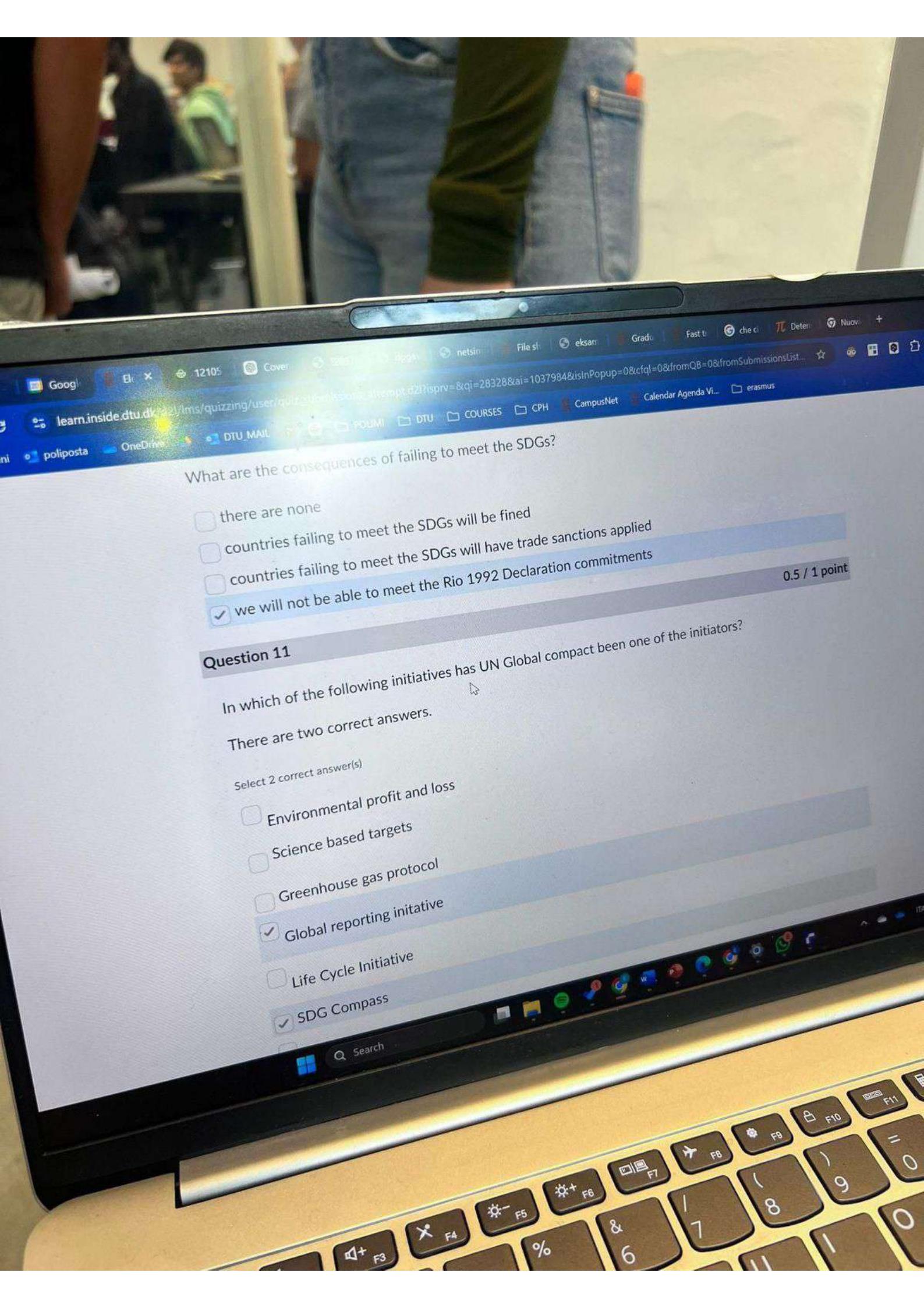
There are two correct answers.

Select 2 correct answer(s)

- Environmental profit and loss
- Science based targets
- Greenhouse gas protocol
- Global reporting initiative
- Life Cycle Initiative
- SDG Compass

Search

Search



Question 13 (1 point) ✓ Saved

Open the [Global Burden of Disease visualization tool](#)

Select the third icon in the left menu, "Risks by causes".

In the left column, select "Level" 2 with your cursor, select "Global" or "Denmark" depending on the proposed answer as a "Location", select "DALYs" as the metric and "rate" to get the total rate of burden of disease death per *100000 inhabitants per year*.

When needed click on the Dietary risks to get the 15 dietary risks

Select the two correct answers below

Select 2 correct answer(s)

- According to the GBD, the main impact of a low consumption of milk is osteoporosis
- The burden of disease rate per 100000 for lack of whole grain is higher in Denmark than at global level (hint: look at the x-axis)
- Over consumption of meat is among the two highest dietary risks in Denmark
- High sodium is among the two highest dietary risk factor at global level, but not for Denmark
- Looking at the number "#" instead of rate, none of the dietary risk exceed 20000 DALY per year for the Danish population
- The highest impacts for the high in red meat risks are associated with diabetes and kidney disease

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Before starting the multiple choice exam, please download the excel sheet "[1210X QS carbon cost health absolute Car carbon footprint solutions S25a](#)" and the excel sheet "[12101 - life cycle costing exam](#)".

Page 1

How would you define the functional unit of a washing machine?

- Washing of 10 kg clothes per week to an acceptable cleanliness for one year in Denmark

- The energy consumption pr kg of clothes washed
- Washing of 10 kg clothes per week to an acceptable cleanliness with the least energy consumption in Denmark
- The energy consumption for washing 10 kg of clothes at 40° C in Denmark
-

How do you interpret the I=PAT equation?

- P and A represent the impact of producing services
- I represent the environmental impact of Product A during its lifetime T
- I represent the total anthropogenic environmental impact as a function of population size, affluence, and technology

-
- T represent the time showing that environmental impact increase with time

What is the typical CO₂ emission per energy unit produced from a coal fired power plant with no carbon capture?

- 100-400 g CO₂e / kWh
- 5-20 g CO₂e / kWh
- 20-100 g CO₂e / kWh
- 400-1000 g CO₂e / kWh

You want to further interpret the impacts of the e-bike and what are the dominant contributions to its carbon footprint per km driven as well as to its health and biodiversity footprints. Open and use the carbon and health footprint solution file of various vehicles: "1210X QS carbon_cost_health_absolute Car carbon footprint solutions_S25a". As described in rows 94 to 111 of the carbon footprint tab, the electric bike weight 19 kg with a bike life span of 30000km, it has a Li-ion battery of an additional 4 kg with a battery lifespan of 15000 km. Its electricity consumption amounts to 0.007 kWh/km. The minutes of healthy life gained per km e-biked is estimated at 2/3rd of a conventional bike, that is 6.2 minutes gained per km driven with the e-bike.

Start by changing in the spreadsheet for the charging of the electric car and of the electric bike from the European electricity mix medium voltage **to the Danish electricity mix (market for electricity, low voltage)**. Identify the right process in ecoinvent and then select it first in the selected process and then in the carbon calculator.

Also complement for the e-bike the quantity of battery per e-bike-km in column F. Look at the results and interpret them to select the correct answer in the present and following question.

- The transportation of the e-bike by cargo freight over 10000 km and by truck over 2000 km at the start of its life still plays a substantial role, with close to 20% of the e-bike carbon footprint per km
- The amount of battery used in kg per e-biked-km amount to 2.67E-4
- The battery usage lifespans expressed in km driven over the battery lives is an important parameter that mostly modifies the use stage impacts, that is the electricity used per vehicle-km
- Due to its electricity consumption, cycling on the electric bike leads to an overall net loss in human health, since health impacts of emissions associated with the bike manufacturing added to the health impacts of electricity are higher than the health gain associated to the physical exercise
- For the carbon footprint of the e-bike, the battery production has a higher carbon footprint than the bicycle production due to its shorter lifespan

Let us now compare the carbon footprint of the e-bike against the petrol and the electric vehicle.

Select the one correct answer.

- For the electric car with Danish electricity mix, the use phase represents more than 50% but less than 65% of the carbon footprint
 - The carbon footprint of use phase of the gasoline car is more than 5 times higher than the carbon footprint of the use phase of the electric car.
 - The electric car using coal electricity has a lower footprint than the gasoline car
 - The carbon footprint of an electric vehicle is dominated by methane emissions, since methane is a main contributor to electricity production in Denmark and in the car manufacturing.
- Thanks to the high renewable fraction in the Danish electricity mix, the electric bike has a more than 40 times lower carbon footprint than a gasoline car

We had calculated in our morning coffee exercise that the life cycle carbon footprint of one cup of coffee in Europe amounts to 0.132 kgCO₂e/cup. Let us assume that a European citizen drinks 4 cups of coffee per day and commutes to work 15 km per day (2 x 7.5km) either with an electric car or an e-bike. Calculate the cumulative carbon footprint of these two activities and select the correct answer for this question

Select the one correct answer.

- In all scenarios the coffee contributes to a much smaller footprint compared to the commuting
- For both the e-bike and electric car commuting scenarios, the use phase is responsible for at least 30% of the ecosystem impacts
 - The carbon footprint scores are based on estimated damages on ecosystems, and are therefore highly uncertain compared to the human health impacts
 - According to this calculation, the health physical exercise benefits of driving the car are surprisingly higher in absolute value than the health impacts of the gasoline car emissions and manufacturing
 - The carbon footprint of one cup of coffee is equivalent to approximately 7 km (+20%) by e-bike

Select the one correct answer for the cumulative carbon footprint of 4 cups of coffee per day and 15 km per day commute to work by an electric car running on a DK electricity mix.

- It is lower than 0.25 kgCO₂e/d
 - It is between 2.5 and 5 kgCO₂e/d
 - It is between 1 and 2.5 kgCO₂e/d
-
- It is between 0.25 and 1 kgCO₂e/d
 - It is between 5 and 10 kgCO₂e/d

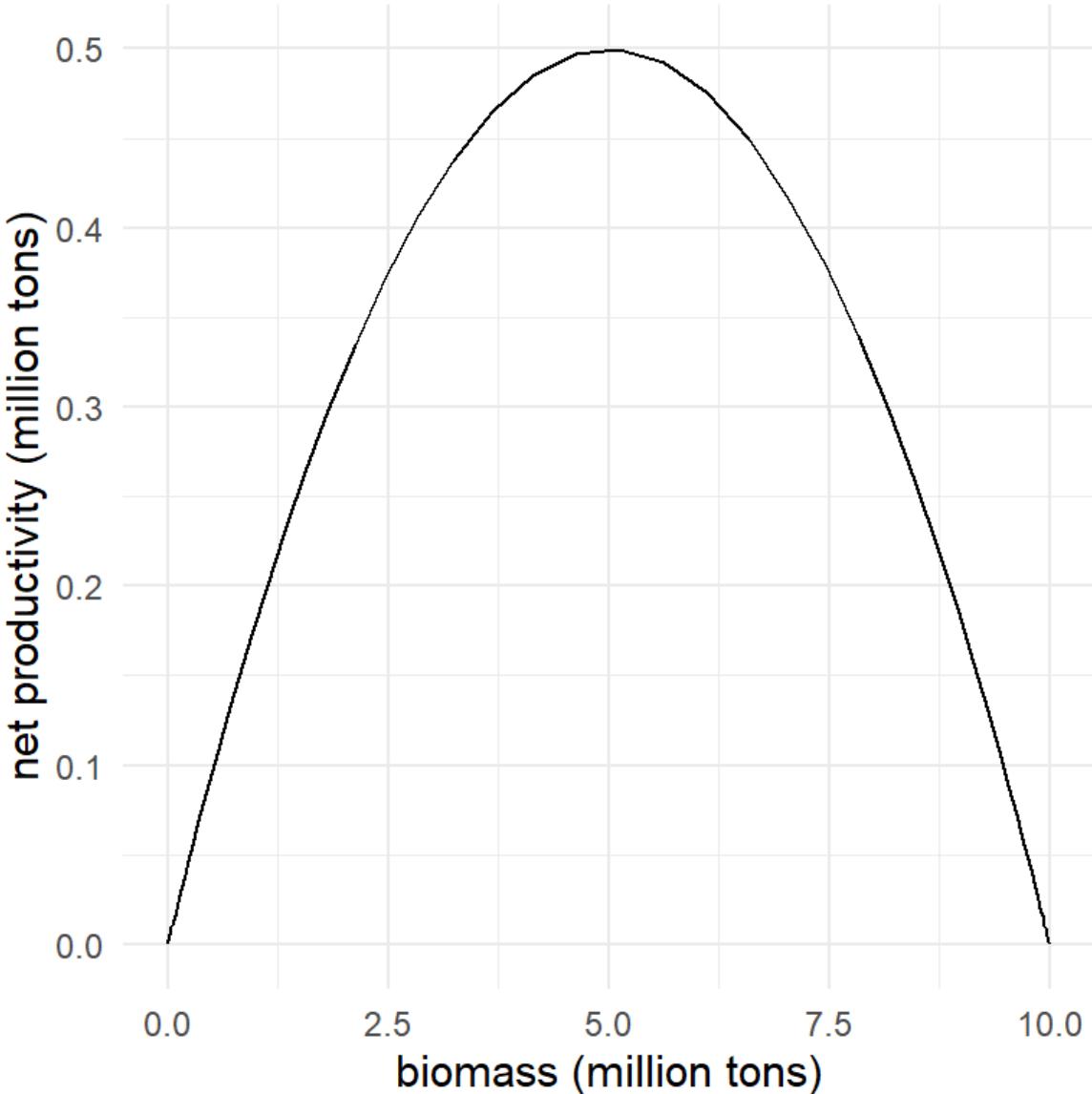
How would you define common goods?

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-
- Users cannot exclude others from using that good and their use of this good affects the ability of others to use it.

Can you use a renewable resource indefinitely?

- Yes, by ensuring that the extraction rate exceeds its replenishing rate
 - No, the extraction rate must be so small to do so that extraction patterns are not economically viable
 - No, renewable resources disappear eventually
-
- Yes, by ensuring that the extraction rate stays at or below its replenishing rate

Take a look at the figure below displaying information about the net productivity of a fish stock in relation to its biomass. What is the Maximum Sustainable Yield for this stock?

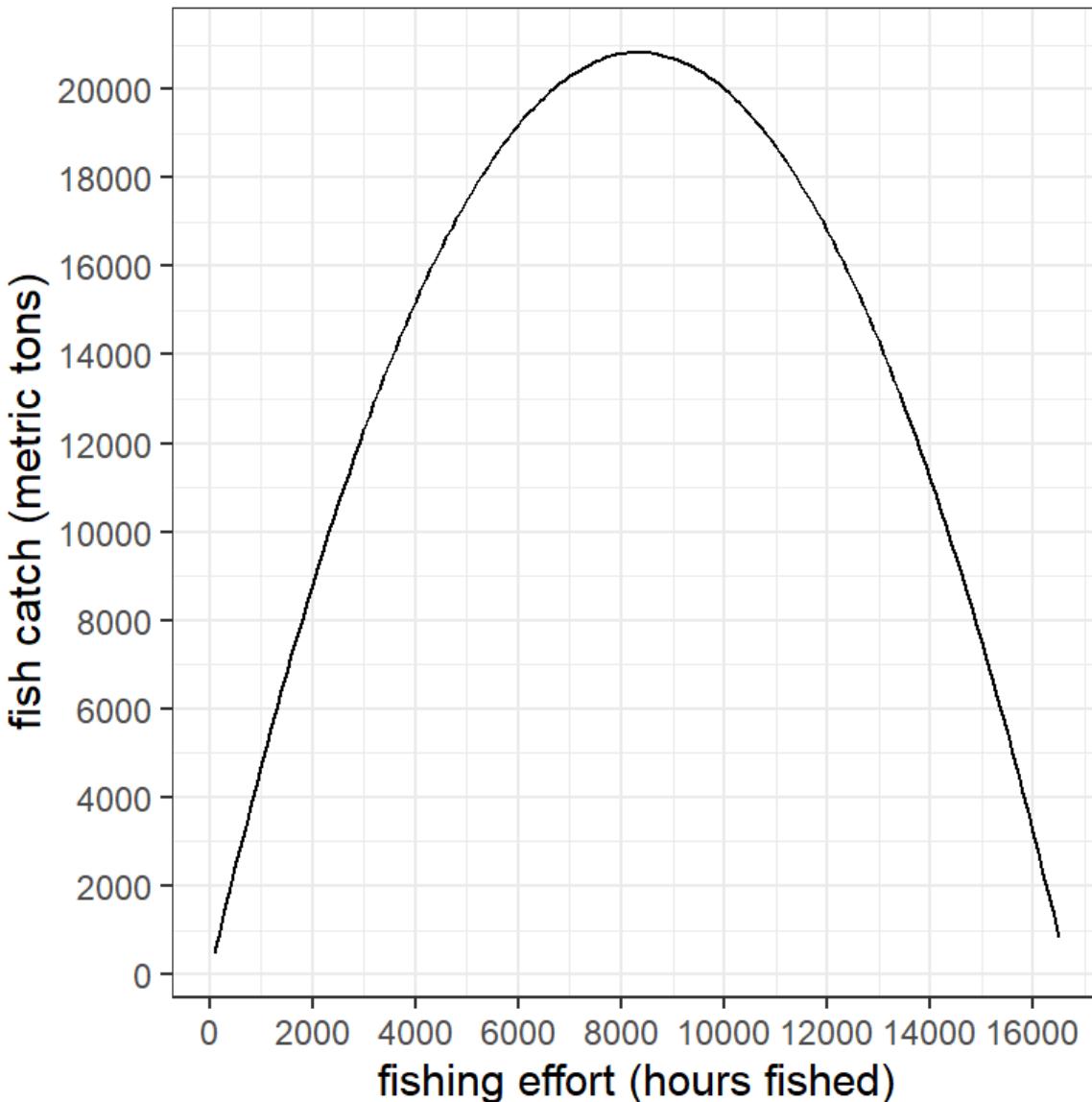


- 2.5 million tons
- 0
- 5 million tons
- 0.5 million tons

Take a look at the figure below displaying information we have obtained about how much fish can be caught annually (in tons) in relation to the fishing effort it took to catch it (cumulative number of hours spent fishing annually).

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You have the choice to decide how much fishing effort should take place this year: which of the following four options will be a sustainable fishing effort?



9000 hours

8000 hours

9600 hours

10320 hours

Are disposal costs or residual value normally included in the life cycle costs?

Yes

No

Which of these activities are normally NOT part of the goal and scope of LCC:

- Determine the purpose of LCC analysis
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Define the scope of the system

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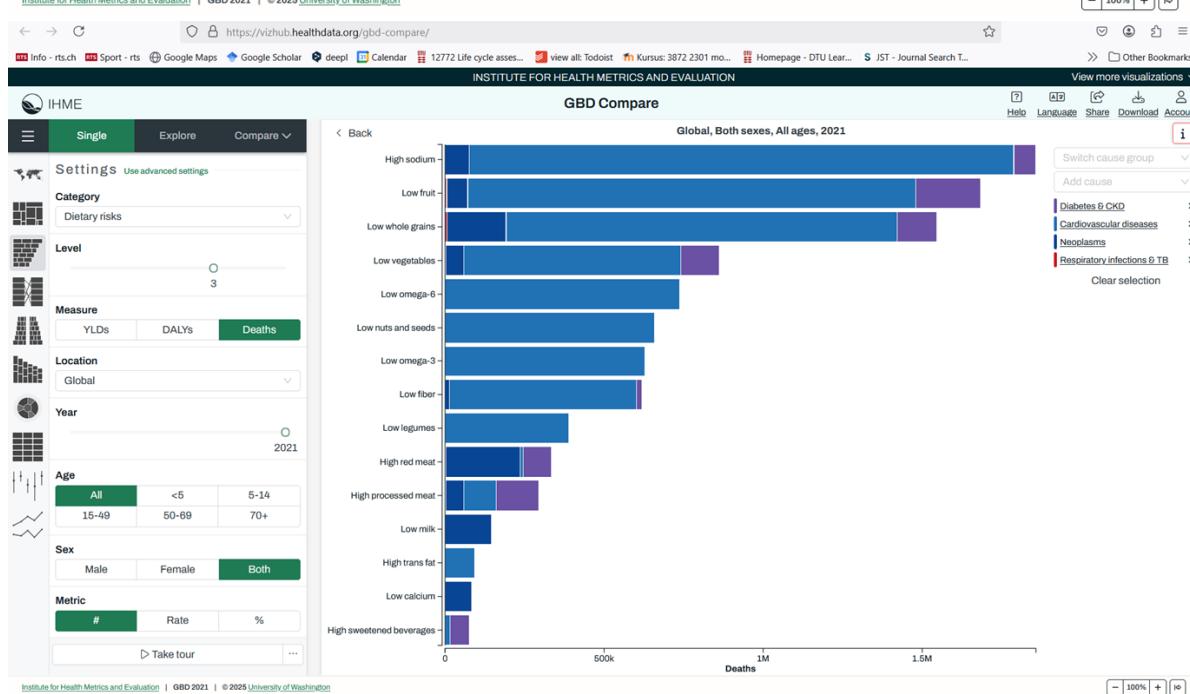
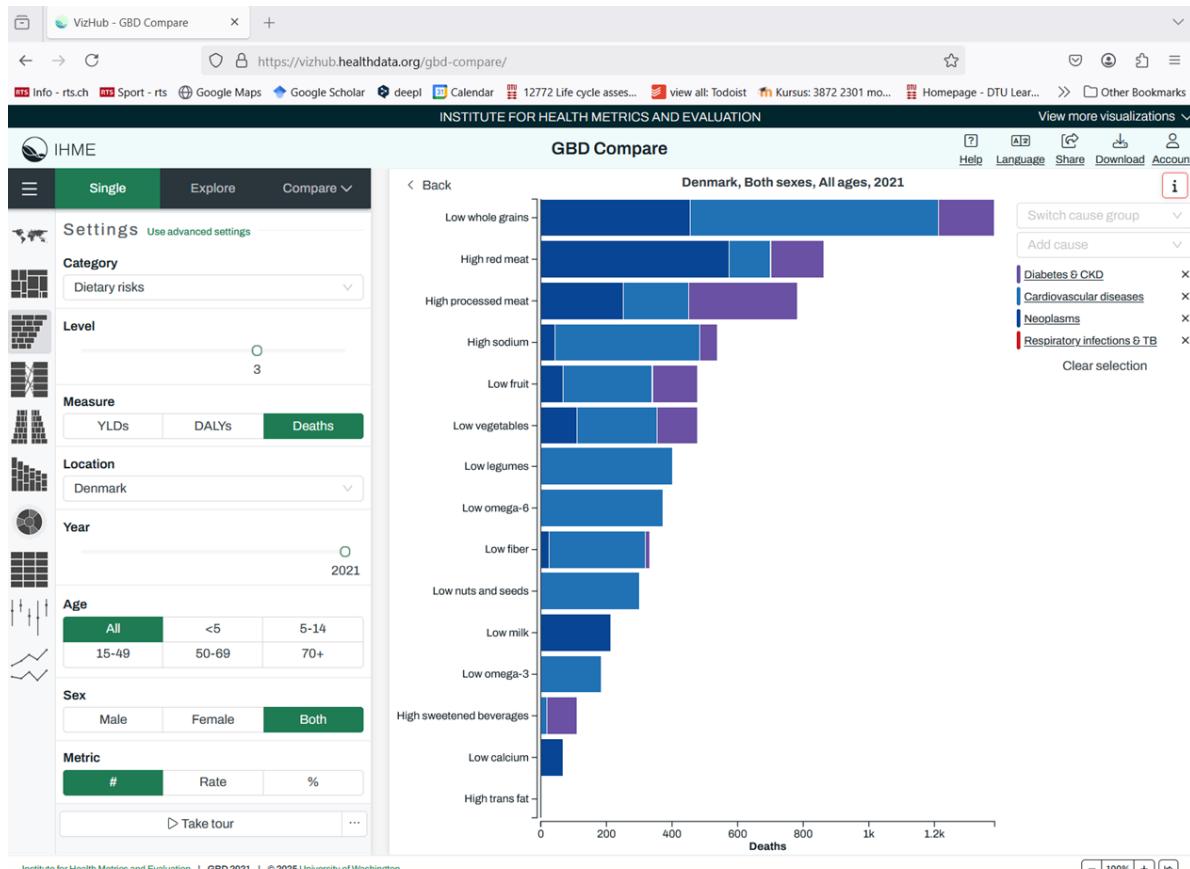
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- It will be the same as for the leased car
 - The price will still be lower than for the gasoline car
- The price will be higher than for the gasoline car
- It will still be lower (at app. 91%) of the price of a leased car v-km
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Now change the price back to 0.2 €/kWh but this time change the vehicle life span of the electric vehicle to 150000 km. How does the price of 1 v-km change?

- It becomes the same as the gasoline car
 - It becomes approximately 130% of the original price
- It remains lower than the gasoline car

Looking at these dietary risks from the Global burden of disease visualization tool taken from (<https://vizhub.healthdata.org/gbd-compare/>) please choose the correct answer below.



- None of the dietary risks exceed 1000 death per year for the Danish population
- Under consumption of fruit is among the two highest dietary risk factors at global level, but it is not in Denmark
- The risks associated with low consumption of legumes are mostly associated with diabetes and kidney disease

- The sum of all dietary risk is higher than 8000 death per year for the Danish population
 - According to the GBD, the main impact of a low consumption of calcium is osteoporosis
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Health question - Select the one correct answer

- Body lotion and cream containing hydroquinone can lead to more than 50 minutes of life lost per person per day
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- If a hotdog leads to 36 minutes of life lost, it is mostly because of the transfat (TFA) contained in the hotdog
- Per km biked or run, the minutes or hours of health gained are higher for biking than for running
- For a moderate Parkinson disease, its disability weights are still smaller than 0.2

Taxation (e.g., a carbon or a biodiversity tax) is a kind of economic intervention to encourage sustainability transitions. What is the purpose of taxation in such a context?

- it punishes bad practices
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Which of the following are NOT earth system processes in the planetary boundaries framework of absolute sustainability?

Depletion of fossil resources

- Biogeochemical flows
 - Land-system change
 - Stratospheric ozone depletion
 - Ocean acidification
-

Which of the following is a measure of eco-efficiency?

- km/h
- GDP/person
- kg CO₂-eq/km
- Person/GDP

USD/kWh

Earth overshoot day is the day of the year where...?

- the highest ecological footprint accumulated across all countries is registered
 - The highest global average temperature of the atmosphere is registered
 - the highest emission of greenhouse gases is registered (measured in CO₂-equivalents)
- the accumulated ecological footprint across all countries exceeds the total productive area of the planet
- the highest global average temperature of the oceanic surface waters is registered
-

Bocken has a simplified model of circular economy, focusing on three main resource flow strategies: slowing, narrowing and closing. Narrowing refers to what area of the Circular Economy Scanner?

- Recirculate parts & products (blue area)
- Recirculate materials (grey area)
- Rethink and reconfigure business models (orange area)
- Restore, reduce and avoid impacts (green area)

What does sustainability transition mean?

- a democratic approach to change the way societies work
- utopic scenario where the planet is moved away from planetary boundaries
- interventions so that acceptable outcomes on the three dimensions of sustainability are sustained and unacceptable conditions are changed towards more sustainable outcomes
- a revolutionary approach to change the way societies work

Which of the following stakeholders are usually NOT present in a linear value chain?

- Component Manufacturers
- Materials Providers
- Value Recovery companies
- Logistic Providers

Which of the following statements are correct?

- The interpretation must always include a quantitative uncertainty assessment of the parameters in order to be able to run a monte carlo simulation
- There are seldomly trade-offs between indicators and or sustainability dimensions
- MDCA methods can be used for making a fully objective choice
- The interpretation of the assessment involves an evaluation of the completeness (how well is the system covered).

Let us now compare the carbon footprint of the e-bike against the petrol and the electric vehicle.
Select the one correct answer.

Choose one answer

- The carbon footprint of an electric vehicle is dominated by methane emissions, since methane is a main contributor to electricity production in Denmark and in the car manufacturing.
- For the electric car with Danish electricity mix, the use phase represents more than 50% but less than 65% of the carbon footprint
- The carbon footprint of use phase of the gasoline car is more than 5 times higher than the carbon footprint of the use phase of the electric car.
- Thanks to the high renewable fraction in the Danish electricity mix, the electric bike has a more than 40 times lower carbon footprint than a gasoline car
- The electric car using coal electricity has a lower footprint than the gasoline car

Page 6

We had calculated in our morning coffee exercise that the life cycle carbon footprint of one cup of coffee in Europe amounts to 0.132 kgCO₂e/cup. Let us assume that a European citizen drinks 4 cups of coffee per day and commutes to work 15 km per day (2 x 7.5km) either with an electric car or an e-bike. Calculate the cumulative carbon footprint of these two activities and select the correct answer for this question. Select the one correct answer.

Choose one answer

- The carbon footprint of one cup of coffee is equivalent to approximately 7 km (+-20%) by e-bike
- In all scenarios the coffee contributes to a much smaller footprint compared to the commuting
- According to this calculation, the health physical exercise benefits of driving the car are surprisingly higher in absolute value than the health impacts of the gasoline car emissions and manufacturing
- The carbon footprint scores are based on estimated damages on ecosystems, and are therefore highly uncertain compared to the human health impacts
- For both the e-bike and electric car commuting scenarios, the use phase is responsible for at least 30% of the ecosystem impacts

Page 7

Select the one correct answer for the cumulative carbon footprint of 4 cups of coffee per day and 15 km per day commute to work by an electric car running on a DK electricity mix.

Choose one answer

It is between 0.25 and 1 kgCO₂e/d

It is lower than 0.25 kgCO₂e/d

It is between 5 and 10 kgCO₂e/d

It is between 1 and 2.5 kgCO₂e/d

It is between 2.5 and 5 kgCO₂e/d

Page 8

How would you define common goods?

Choose one answer

- Users cannot exclude others from using that good and their use of this good affects the ability of others to use it.
- Users can exclude others from using that good and their use of this good affects the ability of others to use it.
- Users cannot exclude others from using that good and their use of this good does not affect the ability of others to use it.
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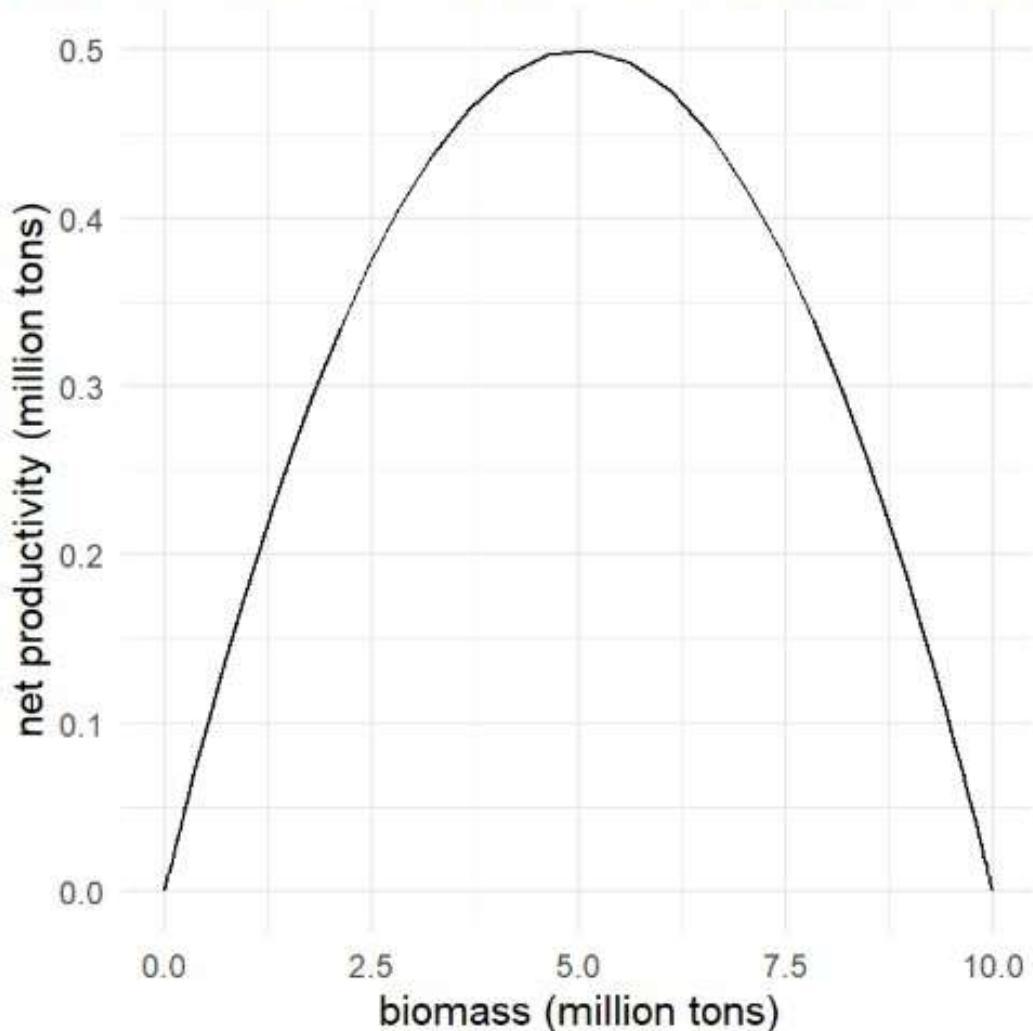
Page 9

Can you use a renewable resource indefinitely?

Choose one answer

- Yes, by ensuring that the extraction rate exceeds its replenishing rate
- Yes, by ensuring that the extraction rate stays at or below its replenishing rate
- No, renewable resources disappear eventually
- No, the extraction rate must be so small to do so that extraction patterns are not economically viable

Take a look at the figure below displaying information about the net productivity of a fish stock in relation to its biomass. What is the Maximum Sustainable Yield for this stock?



Choose one answer:

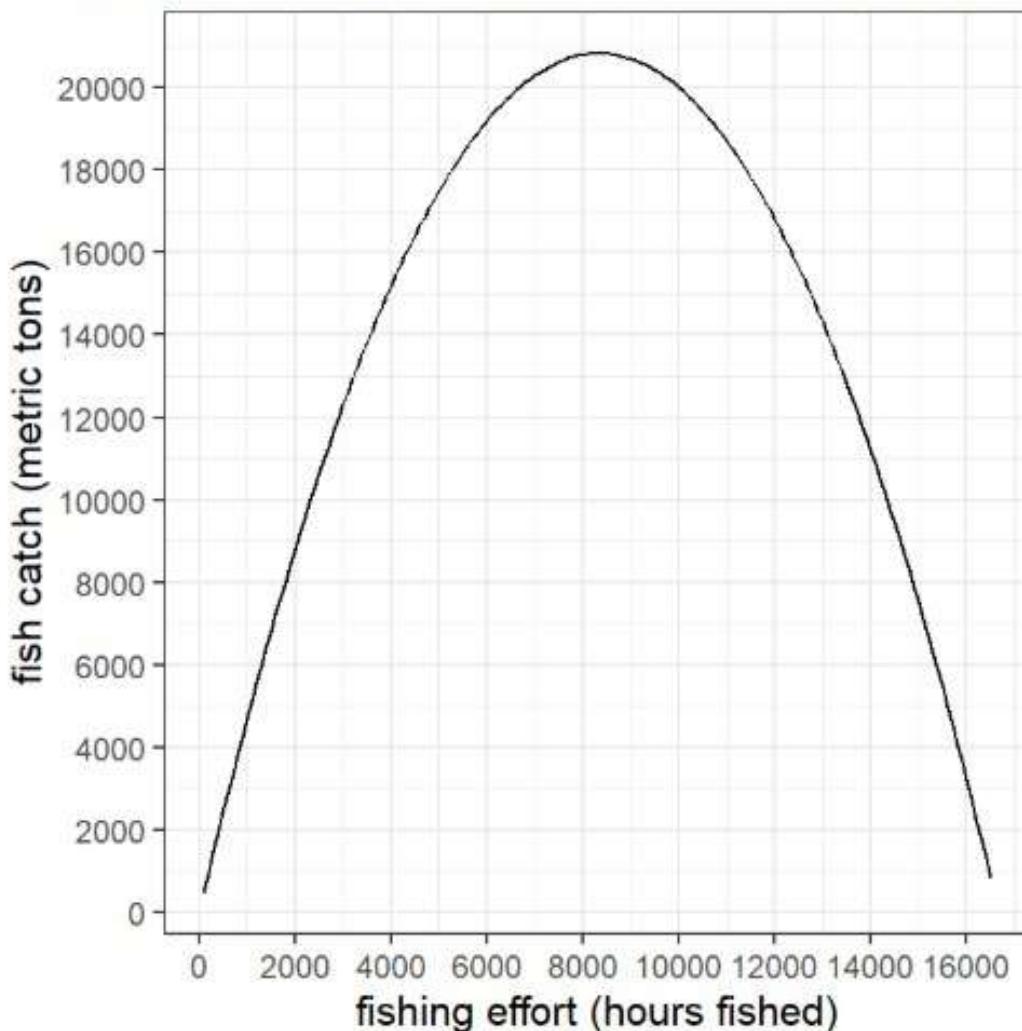
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- 5 million tons
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You have the choice to decide how much fishing effort should take place this year: which of the following four options will be a sustainable fishing effort?



Choose one answer

- 10320 hours
- 9000 hours
- 8000 hours
- 9600 hours

Page 12

Are disposal costs or residual value normally included in the life cycle costs?

Choose one answer

No

Yes

Page 20

Which of the following is a measure of eco-efficiency?

Choose one answer

GDP/person

km/h

kg CO₂-eq/km

Person/GDP

USD/kWh

Page 14

Using the excel sheet "12101 - Life cycle costing_exam" try to change the numbers of electricity use and the costs of 1 kWh. First let the electricity use be 0.26 kWh/km as in the Carbon footprint excel. If the cost of one kWh reaches 0.75 €/kWh how will the price pr vehicle - km be compared to gasoline car or leasing the e-vehicle?

Choose one answer

- The price will be higher than for the gasoline car
- It will be the same as for the leased car
- The price will still be lower than for the gasoline car
- It will still be lower (at app. 91%) of the price of a leased car v-km

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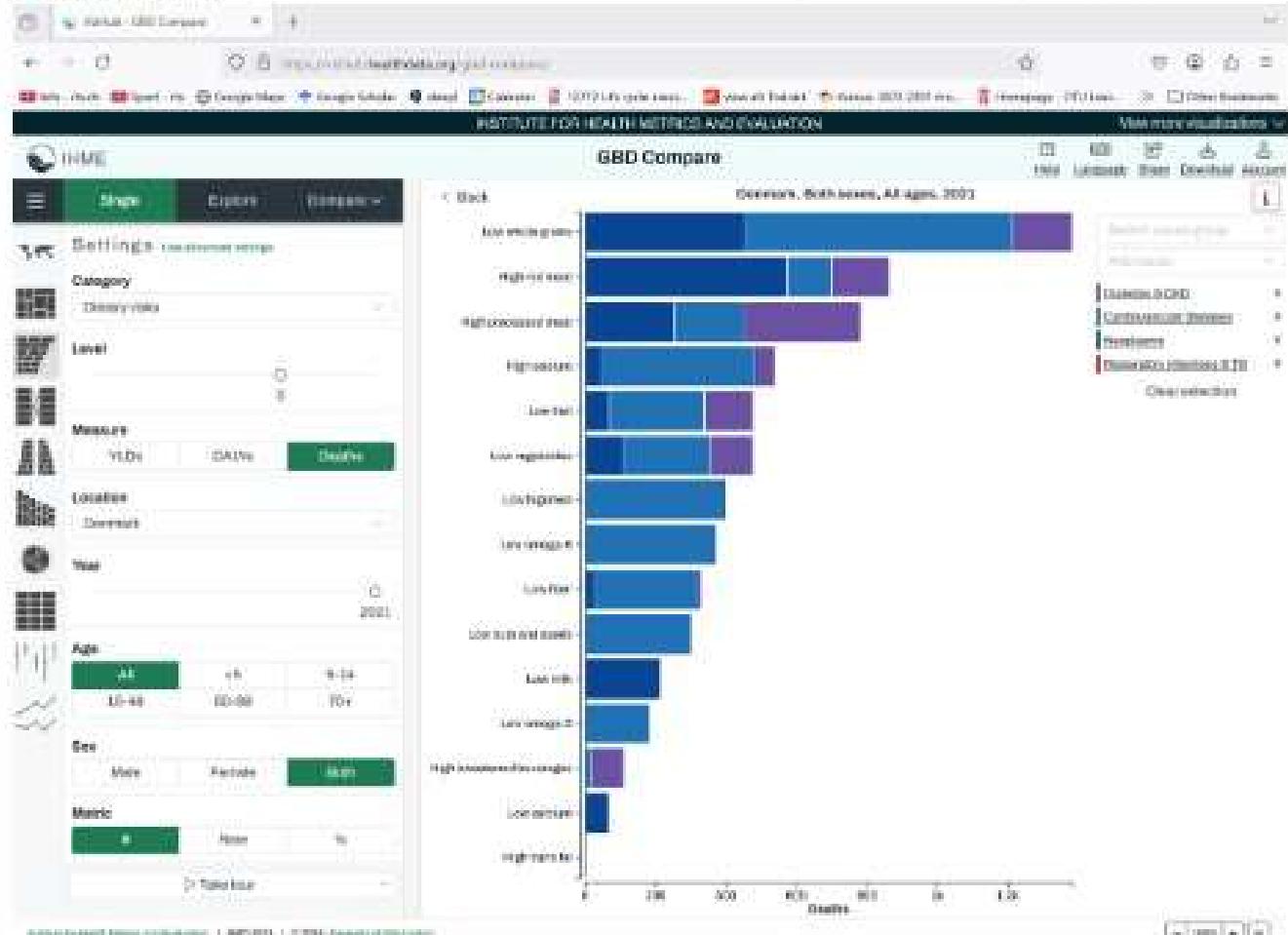
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- It remains lower than the gasoline car
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Looking at these dietary risks from the Global burden of disease visualization tool taken from (<https://vizhub.healthdata.org/gbd-compare/>) please choose the correct answer below:



Choose one answer:

- Underconsumption of fruit is among the two highest dietary risk factors at global level, but it is not in Denmark.
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Page 21

Earth overshoot day is the day of the year where...?

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- the highest global average temperature of the oceanic surface waters is registered
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Bocken has a simplified model of circular economy, focusing on three main resource flow strategies: slowing, narrowing and closing. Narrowing refers to what area of the Circular Economy Scanner?

Choose one answer

Restore, reduce and avoid impacts (green area)

- Rethink and reconfigure business models (orange area)
- Recirculate materials (grey area)
- Recirculate parts & products (blue area)

Page 23

What does sustainability transition mean?

Choose one answer

- a revolutionary approach to change the way societies work
- utopic scenario where the planet is moved away from planetary boundaries
- a democratic approach to change the way societies work
- Interventions so that acceptable outcomes on the three dimensions of sustainability are sustained and unacceptable conditions are changed towards more sustainable outcomes

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Which of the following stakeholders are usually NOT present in a linear value chain?

Choose one answer

Component Manufacturers

Materials Providers

Value Recovery companies

Logistic Providers

Page 25

Which of the following statements are correct?

Choose one answer

- The interpretation must always include a quantitative uncertainty assessment of the parameters in order to be able to run a monte carlo simulation
- The interpretation of the assessment involves an evaluation of the completeness (how well is the system covered).
- There are seldomly trade-offs between indicators and or sustainability dimensions
- MDCA methods can be used for making a fully objective choice

Page 2

How do you interpret the I=PAT equation?

Choose one answer

- P and A represent the impact of producing services
- I represent the total anthropogenic environmental impact as a function of population size, affluence, and technology
- T represent the time showing that environmental impact increase with time
- I represent the environmental impact of Product A during its lifetime T

Page 3

What is the typical CO₂ emission per energy unit produced from a coal fired power plant with no carbon capture?

Choose one answer

- 20-100 g CO₂e / kWh
- 100-400 g CO₂e / kWh
- 5-20 g CO₂e / kWh
- 400-1000 g CO₂e / kWh

You want to further interpret the impacts of the e-bike and what are the dominant contributions to its carbon footprint per km driven as well as to its health and biodiversity footprints. Open and use the carbon and health footprint solution file of various vehicles: "1210X QS carbon_cost_health_absolute Car carbon footprint solutions_S25a". As described in rows 94 to 111 of the carbon footprint tab, the electric bike weight 19 kg with a bike life span of 30000km, it has a Li-ion battery of an additional 4 kg with a battery lifespan of 15000 km. Its electricity consumption amounts to 0.007 kWh/km. The minutes of healthy life gained per km e-biked is estimated at 2/3rd of a conventional bike, that is 6.2 minutes gained per km driven with the e-bike.

Start by changing in the spreadsheet for the charging of the electric car and of the electric bike from the European electricity mix medium voltage to the Danish electricity mix (market for electricity, low voltage). Identify the right process in ecoinvent and then select it first in the selected process and then in the carbon calculator.

Also complement for the e-bike the quantity of battery per e-bike-km in column F

Look at the results and interpret them to select the correct answer in the present and following question.

Choose one answer

- The battery usage lifespans expressed in km driven over the battery lives is an important parameter that mostly modifies the use stage impacts, that is the electricity used per vehicle-km
- The amount of battery used in kg per e-biked-km amount to 2.67E-4
- Due to its electricity consumption, cycling on the electric bike leads to an overall net loss in human health, since health impacts of emissions associated with the bike manufacturing added to the health impacts of electricity are higher than the health gain associated to the physical exercise
- For the carbon footprint of the e-bike, the battery production has a higher carbon footprint than the bicycle production due to its shorter lifespan
- The transportation of the e-bike by cargo freight over 10000 km and by truck over 2000 km at the start of its life still plays a substantial role, with close to 20% of the e-bike carbon footprint per km

Page 1

How would you define the functional unit of a washing machine?

Choose one answer

- The energy consumption pr kg of clothes washed
- Washing of 10 kg clothes per week to an acceptable cleanliness for one year in Denmark
- The energy consumption for washing 10 kg of clothes at 40° C in Denmark
- Washing of 10 kg clothes per week to an acceptable cleanliness with the least energy consumption in Denmark

Page 17

Health question - Select the one correct answer

Choose one answer

- For the impacts of climate change of heat and cold, it is the continents that most induce the climate change (i.e. North America and Europe), that are affected the most and have the maximum minutes lost per person due to the high heat waves observed in Europe and North America
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Taxation (e.g., a carbon or a biodiversity tax) is a kind of economic intervention to encourage sustainability transitions. What is the purpose of taxation in such a context?

Choose one answer

- it helps to internalize in the price of goods and services their impact on communities and the planet
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- it punishes bad practices

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Which of the following are **NOT** earth system processes in the planetary boundaries framework of absolute sustainability?

Choose one answer

- Ocean acidification
- Depletion of fossil resources
- Stratospheric ozone depletion
- Land-system change
- Biogeochemical flows

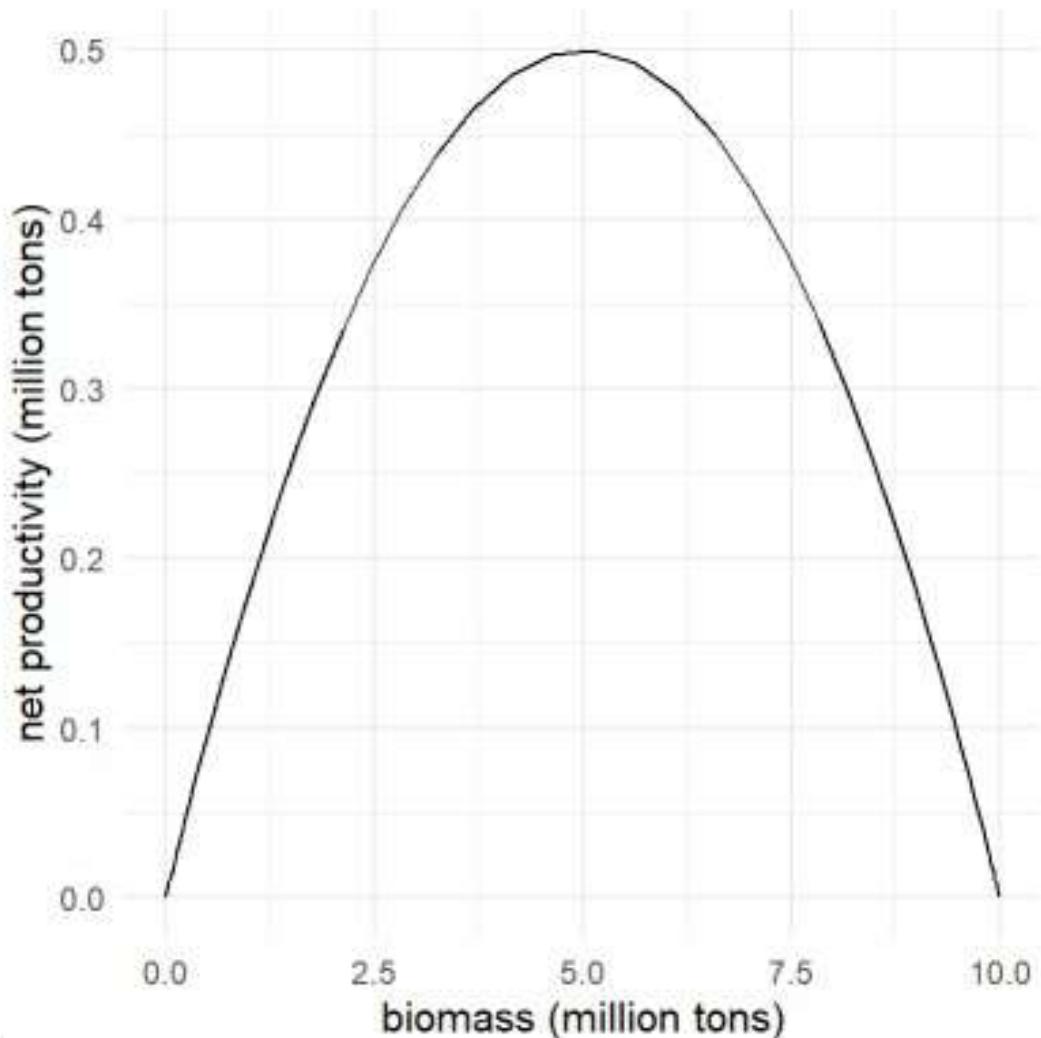
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Which of these activities are normally NOT part of the goal and scope of LCC:

Choose one answer

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Take a look at the figure below displaying information about the net productivity of a fish stock in relation to its biomass. What is the Maximum Sustainable Yield for this stock?



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No

Yes

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Now change the price back to 0.2 €/kWh but this time change the vehicle life span of the electric vehicle to 150000 km. How does the price of 1 v-km change?

Choose one answer

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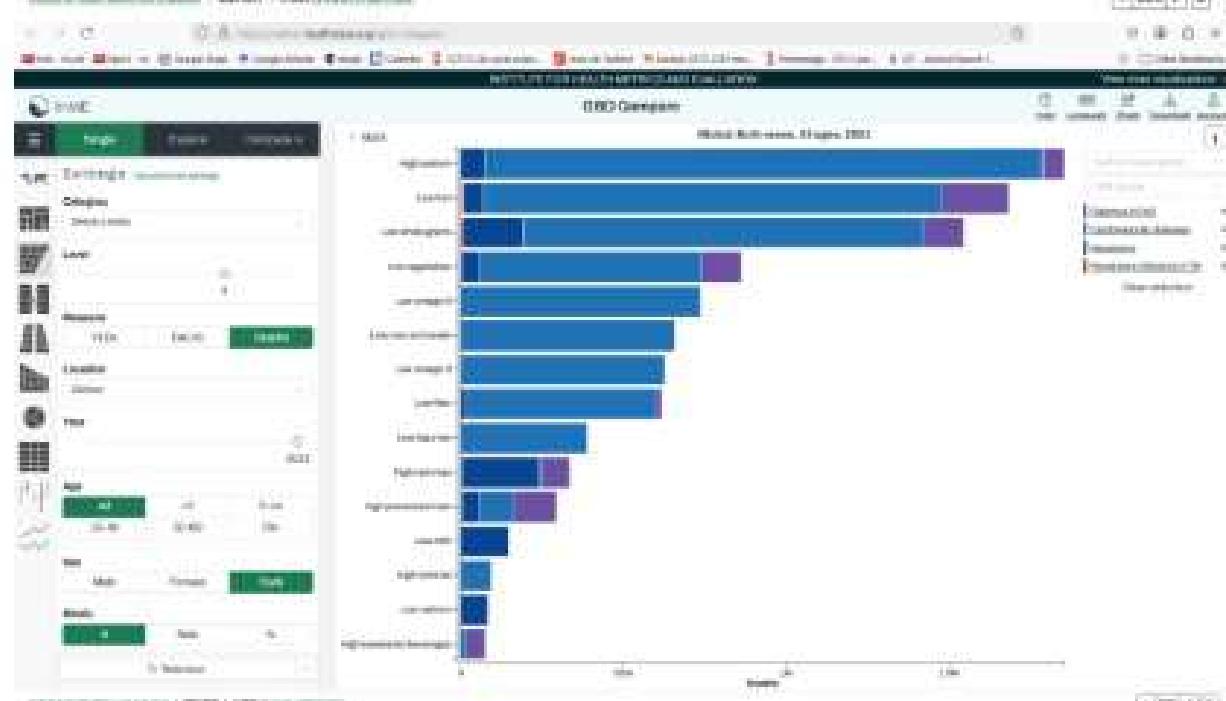
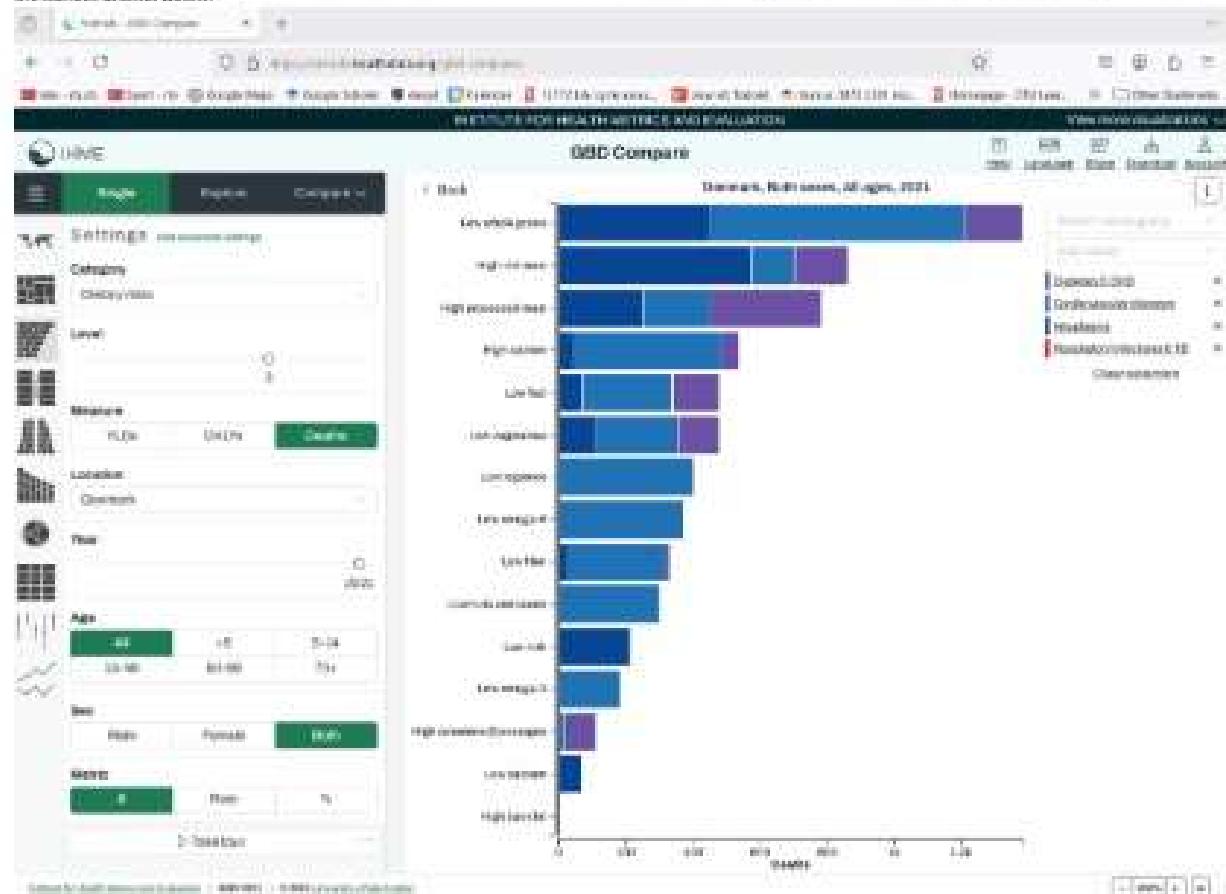
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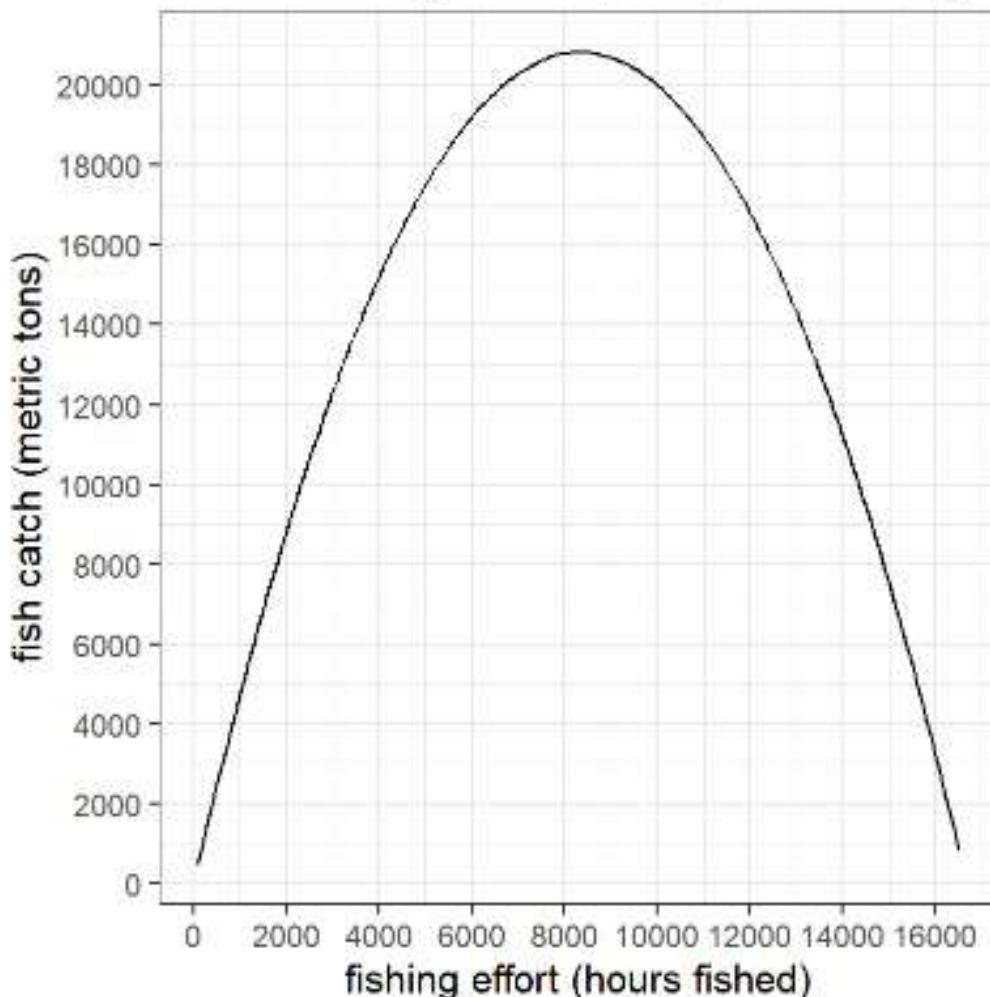
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Choose one answer

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Select the one correct answer.

Choose one answer

- For both the e-bike and electric car commuting scenarios, the use phase is responsible for at least 30% of the ecosystem impacts
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- In all scenarios the coffee contributes to a much smaller footprint compared to the commuting
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Select the one correct answer for the cumulative carbon footprint of 4 cups of coffee per day and 15 km per day commute to work by an electric car running on a DK electricity mix.

Choose one answer

- It is lower than 0.25 kgCO₂e/d
- It is between 1 and 2.5 kgCO₂e/d
- It is between 0.25 and 1 kgCO₂e/d
- It is between 2.5 and 5 kgCO₂e/d
- It is between 5 and 10 kgCO₂e/d



Before starting the multiple choice exam, please download the excel sheet "[1210X QS carbon_cost_health_absolute Car carbon footprint solutions_S25a](#)" and the excel sheet "[12101 - life cycle costing_exam](#)".

Page 1

How would you define the functional unit of a washing machine?

Choose one answer

- Washing of 10 kg clothes per week to an acceptable cleanliness with the least energy consumption in Denmark
- The energy consumption pr kg of clothes washed
- Washing of 10 kg clothes per week to an acceptable cleanliness for one year in Denmark
- The energy consumption for washing 10 kg of clothes at 40° C in Denmark

Page 2

How do you interpret the $I = PAT$ equation?

Choose one answer

- P and A represent the impact of producing services
- T represent the time showing that environmental impact increase with time
- I represent the environmental impact of Product A during its lifetime T
- I represent the total anthropogenic environmental impact as a function of population size, affluence, and technology

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Page 9

Can you use a renewable resource indefinitely?

Choose one answer

- No, the extraction rate must be so small to do so that extraction patterns are not economically viable
- No, renewable resources disappear eventually
- Yes, by ensuring that the extraction rate exceeds its replenishing rate
- Yes, by ensuring that the extraction rate stays at or below its replenishing rate

Page 5

Let us now compare the carbon footprint of the e-bike against the petrol and the electric vehicle.
Select the one correct answer.

Choose one answer

- For the electric car with Danish electricity mix, the use phase represents more than 50% but less than 65% of the carbon footprint
- The carbon footprint of use phase of the gasoline car is more than 5 times higher than the carbon footprint of the use phase of the electric car.
- Thanks to the high renewable fraction in the Danish electricity mix, the electric bike has a more than 40 times lower carbon footprint than a gasoline car
- The electric car using coal electricity has a lower footprint than the gasoline car
- The carbon footprint of an electric vehicle is dominated by methane emissions, since methane is a main contributor to electricity production in Denmark and in the car manufacturing.

12101 summer 2025 exam

Der anvendes en scoringsalgoritme, som er baseret på "One best answer"

Dette betyder følgende:

- Der er altid netop ét svar som er mere rigtigt end de andre
- Studerende kan kun vælge ét svar per spørgsmål
- Hvert rigtigt svar giver 1 point
- Hvert forkert svar giver 0 point (der benyttes IKKE negative point)

The following approach to scoring responses is implemented and is based on "One best answer"

- There is always only one correct answer – a response that is more correct than the rest
- Students are only able to select one answer per question
- Every correct answer corresponds to 1 point
- Every incorrect answer corresponds to 0 points (incorrect answers do not result in subtraction of points)

Before starting the multiple choice exam, please download the excel sheet "[1210X QS carbon cost health absolute Car carbon footprint solutions S25a](#)" and the excel sheet "[12101 - life cycle costing exam](#)".

Page 1

How would you define the functional unit of a washing machine?

- Washing of 10 kg clothes per week to an acceptable cleanliness for one year in Denmark

- The energy consumption pr kg of clothes washed
- Washing of 10 kg clothes per week to an acceptable cleanliness with the least energy consumption in Denmark
- The energy consumption for washing 10 kg of clothes at 40° C in Denmark
-

How do you interpret the I=PAT equation?

- P and A represent the impact of producing services
- I represent the environmental impact of Product A during its lifetime T
- I represent the total anthropogenic environmental impact as a function of population size, affluence, and technology

-
- T represent the time showing that environmental impact increase with time

What is the typical CO₂ emission per energy unit produced from a coal fired power plant with no carbon capture?

- 100-400 g CO₂e / kWh
- 5-20 g CO₂e / kWh
- 20-100 g CO₂e / kWh
- 400-1000 g CO₂e / kWh

You want to further interpret the impacts of the e-bike and what are the dominant contributions to its carbon footprint per km driven as well as to its health and biodiversity footprints. Open and use the carbon and health footprint solution file of various vehicles: "1210X QS carbon_cost_health_absolute Car carbon footprint solutions_S25a". As described in rows 94 to 111 of the carbon footprint tab, the electric bike weight 19 kg with a bike life span of 30000km, it has a Li-ion battery of an additional 4 kg with a battery lifespan of 15000 km. Its electricity consumption amounts to 0.007 kWh/km. The minutes of healthy life gained per km e-biked is estimated at 2/3rd of a conventional bike, that is 6.2 minutes gained per km driven with the e-bike.

Start by changing in the spreadsheet for the charging of the electric car and of the electric bike from the European electricity mix medium voltage **to the Danish electricity mix (market for electricity, low voltage)**. Identify the right process in ecoinvent and then select it first in the selected process and then in the carbon calculator.

Also complement for the e-bike the quantity of battery per e-bike-km in column F. Look at the results and interpret them to select the correct answer in the present and following question.

- The transportation of the e-bike by cargo freight over 10000 km and by truck over 2000 km at the start of its life still plays a substantial role, with close to 20% of the e-bike carbon footprint per km
- The amount of battery used in kg per e-biked-km amount to 2.67E-4
- The battery usage lifespans expressed in km driven over the battery lives is an important parameter that mostly modifies the use stage impacts, that is the electricity used per vehicle-km
- Due to its electricity consumption, cycling on the electric bike leads to an overall net loss in human health, since health impacts of emissions associated with the bike manufacturing added to the health impacts of electricity are higher than the health gain associated to the physical exercise
- For the carbon footprint of the e-bike, the battery production has a higher carbon footprint than the bicycle production due to its shorter lifespan

Let us now compare the carbon footprint of the e-bike against the petrol and the electric vehicle.

Select the one correct answer.

- For the electric car with Danish electricity mix, the use phase represents more than 50% but less than 65% of the carbon footprint
 - The carbon footprint of use phase of the gasoline car is more than 5 times higher than the carbon footprint of the use phase of the electric car.
 - The electric car using coal electricity has a lower footprint than the gasoline car
 - The carbon footprint of an electric vehicle is dominated by methane emissions, since methane is a main contributor to electricity production in Denmark and in the car manufacturing.
- Thanks to the high renewable fraction in the Danish electricity mix, the electric bike has a more than 40 times lower carbon footprint than a gasoline car

We had calculated in our morning coffee exercise that the life cycle carbon footprint of one cup of coffee in Europe amounts to 0.132 kgCO₂e/cup. Let us assume that a European citizen drinks 4 cups of coffee per day and commutes to work 15 km per day (2 x 7.5km) either with an electric car or an e-bike. Calculate the cumulative carbon footprint of these two activities and select the correct answer for this question

Select the one correct answer.

- In all scenarios the coffee contributes to a much smaller footprint compared to the commuting
- For both the e-bike and electric car commuting scenarios, the use phase is responsible for at least 30% of the ecosystem impacts
 - The carbon footprint scores are based on estimated damages on ecosystems, and are therefore highly uncertain compared to the human health impacts
 - According to this calculation, the health physical exercise benefits of driving the car are surprisingly higher in absolute value than the health impacts of the gasoline car emissions and manufacturing
 - The carbon footprint of one cup of coffee is equivalent to approximately 7 km (+20%) by e-bike

Select the one correct answer for the cumulative carbon footprint of 4 cups of coffee per day and 15 km per day commute to work by an electric car running on a DK electricity mix.

- It is lower than 0.25 kgCO₂e/d
 - It is between 2.5 and 5 kgCO₂e/d
 - It is between 1 and 2.5 kgCO₂e/d
-
- It is between 0.25 and 1 kgCO₂e/d
 - It is between 5 and 10 kgCO₂e/d

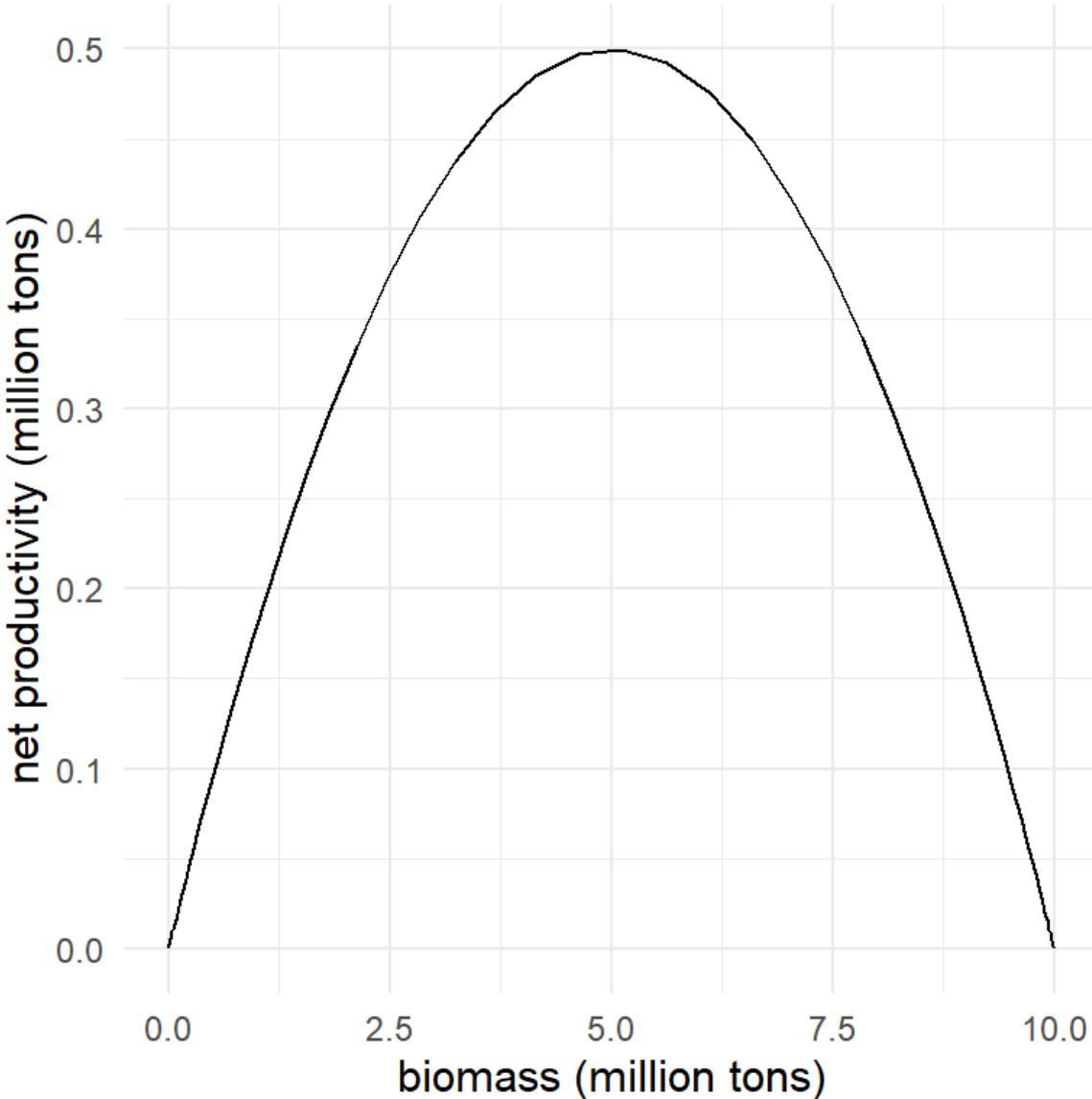
How would you define common goods?

- Users cannot exclude others from using that good and their use of this good does not affect the ability of others to use it.
 - Users can exclude others from using that good and their use of this good affects the ability of others to use it.
 - Users can exclude others from using that good and their use of this good does not affect the ability of others to use it.
-
- Users cannot exclude others from using that good and their use of this good affects the ability of others to use it.

Can you use a renewable resource indefinitely?

- Yes, by ensuring that the extraction rate exceeds its replenishing rate
 - No, the extraction rate must be so small to do so that extraction patterns are not economically viable
 - No, renewable resources disappear eventually
-
- Yes, by ensuring that the extraction rate stays at or below its replenishing rate

Take a look at the figure below displaying information about the net productivity of a fish stock in relation to its biomass. What is the Maximum Sustainable Yield for this stock?

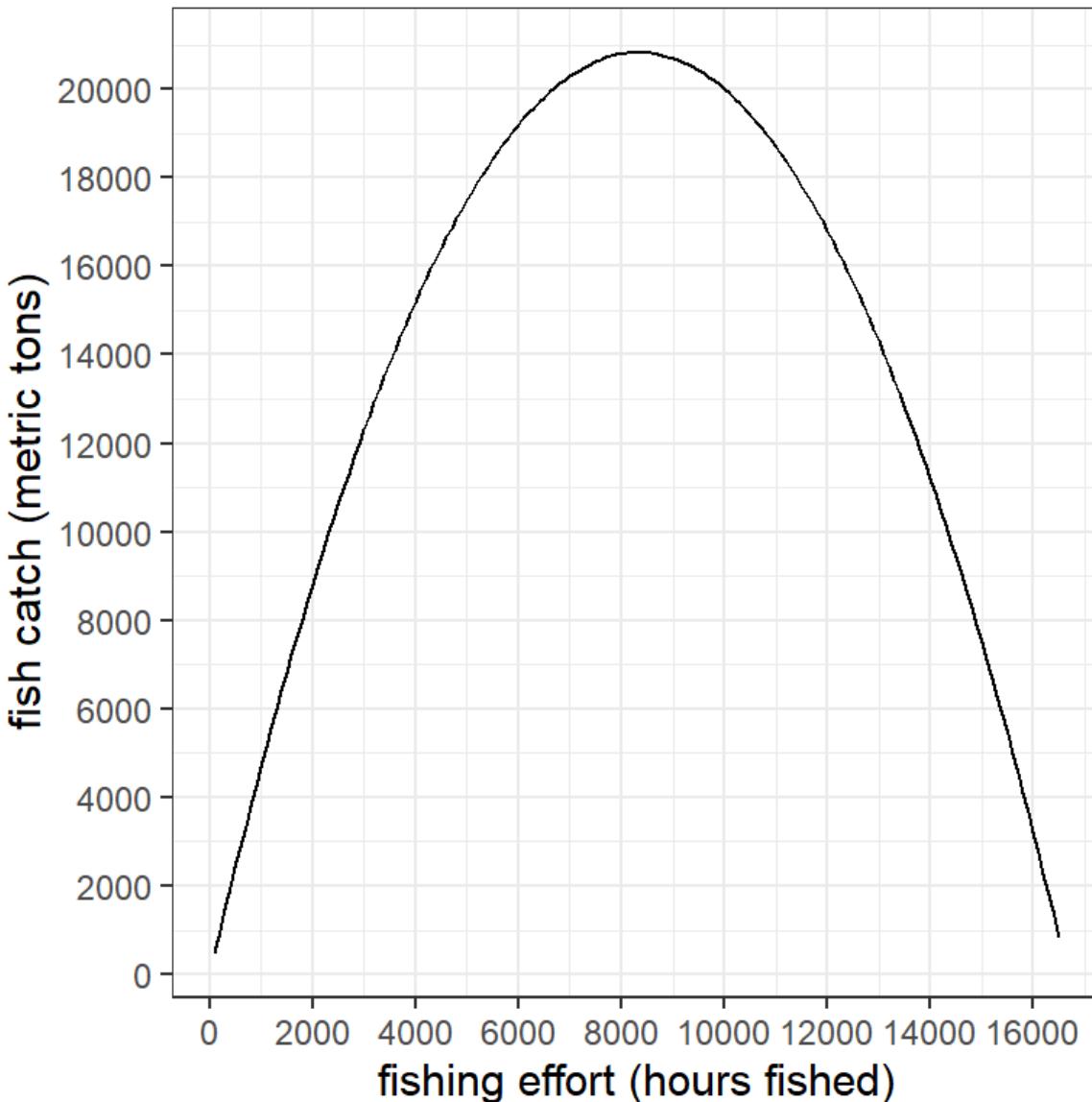


- 2.5 million tons
- 0
- 5 million tons
- 0.5 million tons

Take a look at the figure below displaying information we have obtained about how much fish can be caught annually (in tons) in relation to the fishing effort it took to catch it (cumulative number of hours spent fishing annually).

In addition, you know that you will catch by accident about 1 dolphin per 1000 hours of fishing. The population of dolphins exposed to this accidental mortalities cannot sustain more than 10 deaths caused by fishing per year.

You have the choice to decide how much fishing effort should take place this year: which of the following four options will be a sustainable fishing effort?



9000 hours

8000 hours

9600 hours

10320 hours

Are disposal costs or residual value normally included in the life cycle costs?

Yes

No

Which of these activities are normally NOT part of the goal and scope of LCC:

- Determine the purpose of LCC analysis
- Select the appropriate model

Define the scope of the system

- Consider the volatility of costs and cost-influencing parameters
-

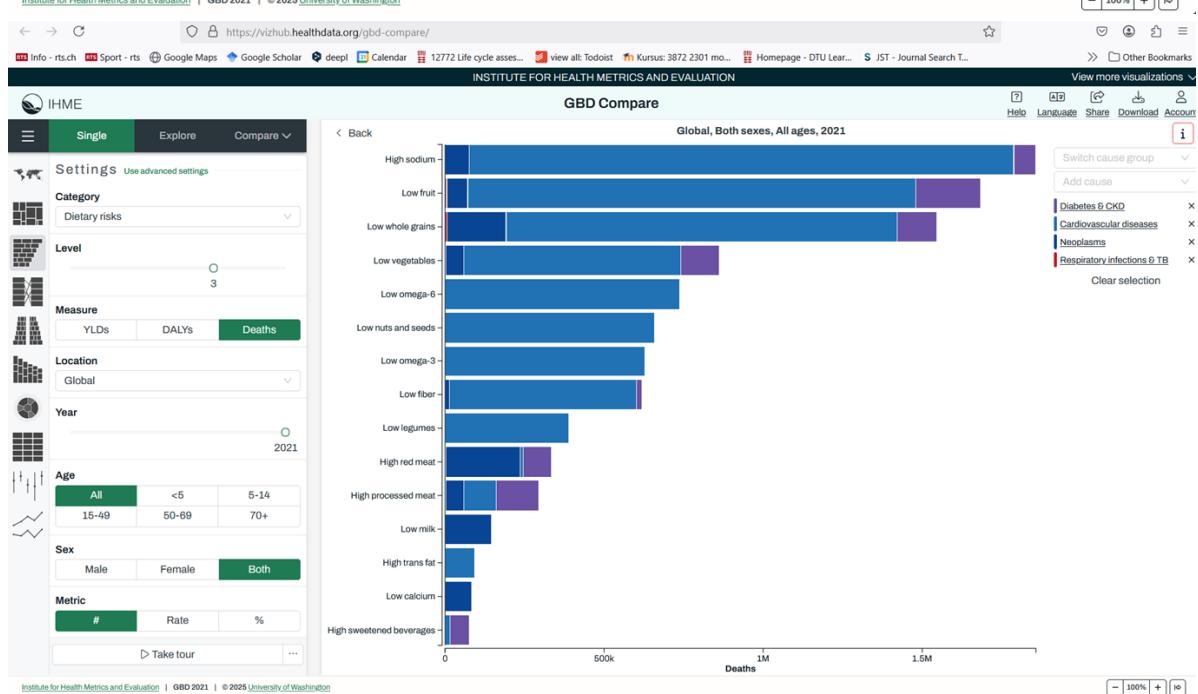
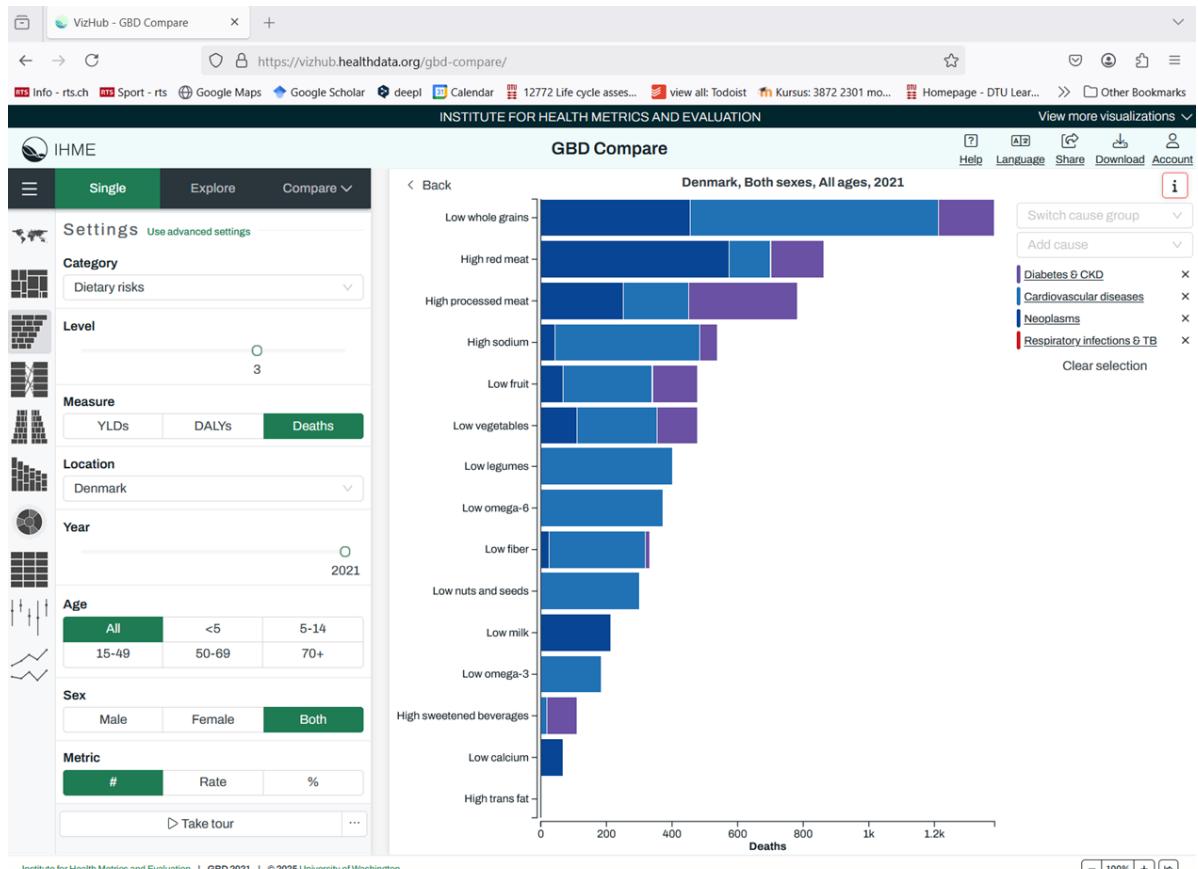
Using the excel sheet “12101 - Life cycle costing_exam” try to change the numbers of electricity use and the costs of 1 kWh. First let the electricity use be 0.26 kWh/km as in the Carbon footprint excel. If the cost of one kWh reaches 0.75 €/kWh how will the price pr vehicle - km be compared to gasoline car or leasing the e-vehicle?

- It will be the same as for the leased car
 - The price will still be lower than for the gasoline car
- The price will be higher than for the gasoline car
- It will still be lower (at app. 91%) of the price of a leased car v-km
-

Now change the price back to 0.2 €/kWh but this time change the vehicle life span of the electric vehicle to 150000 km. How does the price of 1 v-km change?

- It becomes the same as the gasoline car
 - It becomes approximately 130% of the original price
- It remains lower than the gasoline car

Looking at these dietary risks from the Global burden of disease visualization tool taken from (<https://vizhub.healthdata.org/gbd-compare/>) please choose the correct answer below.



- None of the dietary risks exceed 1000 death per year for the Danish population
- Under consumption of fruit is among the two highest dietary risk factors at global level, but it is not in Denmark
- The risks associated with low consumption of legumes are mostly associated with diabetes and kidney disease

- The sum of all dietary risk is higher than 8000 death per year for the Danish population
 - According to the GBD, the main impact of a low consumption of calcium is osteoporosis
-

Health question - Select the one correct answer

- Body lotion and cream containing hydroquinone can lead to more than 50 minutes of life lost per person per day
- For the impacts of climate change of heat and cold, it is the continents that most induce the climate change (i.e. North America and Europe), that are affected the most and have the maximum minutes lost per person due to the high heat waves observed in Europe and North America
- If a hotdog leads to 36 minutes of life lost, it is mostly because of the transfat (TFA) contained in the hotdog
- Per km biked or run, the minutes or hours of health gained are higher for biking than for running
- For a moderate Parkinson disease, its disability weights are still smaller than 0.2

Taxation (e.g., a carbon or a biodiversity tax) is a kind of economic intervention to encourage sustainability transitions. What is the purpose of taxation in such a context?

- it punishes bad practices
 - it helps to internalize in the price of goods and services their impact on communities and the planet
 - it helps pay for adaptation to climate change
 - it redistributes wealth
-

Which of the following are NOT earth system processes in the planetary boundaries framework of absolute sustainability?

Depletion of fossil resources

- Biogeochemical flows
 - Land-system change
 - Stratospheric ozone depletion
 - Ocean acidification
-

Which of the following is a measure of eco-efficiency?

- km/h
- GDP/person
- kg CO₂-eq/km
- Person/GDP

USD/kWh

Earth overshoot day is the day of the year where...?

- the highest ecological footprint accumulated across all countries is registered
 - The highest global average temperature of the atmosphere is registered
 - the highest emission of greenhouse gases is registered (measured in CO₂-equivalents)
- the accumulated ecological footprint across all countries exceeds the total productive area of the planet
- the highest global average temperature of the oceanic surface waters is registered
-

Bocken has a simplified model of circular economy, focusing on three main resource flow strategies: slowing, narrowing and closing. Narrowing refers to what area of the Circular Economy Scanner?

- Recirculate parts & products (blue area)
- Recirculate materials (grey area)
- Rethink and reconfigure business models (orange area)
- Restore, reduce and avoid impacts (green area)

What does sustainability transition mean?

- a democratic approach to change the way societies work
- utopic scenario where the planet is moved away from planetary boundaries
- interventions so that acceptable outcomes on the three dimensions of sustainability are sustained and unacceptable conditions are changed towards more sustainable outcomes
- a revolutionary approach to change the way societies work

Which of the following stakeholders are usually NOT present in a linear value chain?

- Component Manufacturers
- Materials Providers
- Value Recovery companies
- Logistic Providers

Which of the following statements are correct?

- The interpretation must always include a quantitative uncertainty assessment of the parameters in order to be able to run a monte carlo simulation
- There are seldomly trade-offs between indicators and or sustainability dimensions
- MDCA methods can be used for making a fully objective choice
- The interpretation of the assessment involves an evaluation of the completeness (how well is the system covered).

Question 1 (1 point) ✓ Saved

Various tools are available to support sustainability assessments at the company level. These tools should be used to:

- Only examine the social outcomes of their goods and services
- Be used to maximise profit, while ensuring minimum impact to the environment
- Support companies to make decisions that minimise the impact to the environment, whilst also enhancing the social and economic wellbeing of society
- Exclusively examine the environmental impacts of their goods and services

Question 2 (1 point) ✓ Saved

Cost Benefit Analysis can be used to calculate the direct and indirect impacts of the production and consumption of different products and services on key economic parameters

- True
- False

Question 3 (1 point) ✓ Saved

Functions of different sustainability tools

- | | | |
|-----|--|---|
| 1 ▾ | can be used to evaluate the economic cost of a good or a service over its lifecourse | 1. Lifecycle cost analysis
2. Social-Lifecycle cost analysis
3. Cost-Benefit Analysis
4. Input-output models |
| 4 ▾ | can be used to calculate the direct and indirect impacts of the production and consumption of different products and services on key economic parameters | |
| 3 ▾ | is an economic method that estimates the equivalent monetary value of the benefits and costs of a project | |
| 2 ▾ | is developed towards evaluating social impacts of a good or a service over its lifecourse | |

Question 4 (1 point) ✓ Saved

Life cycle costing (LCC) is an approach that assesses the total cost of an asset over its life cycle, including

- initial capital costs
- operating costs
- overall social costs
- the asset's residual value at the end of its life

Question 5 (1 point) ✓ Saved

Important social conditions/outcomes to measure regarding the mining and resource extraction sector involved in the production of electric vehicles include:

- Income
- Employment
- Education
- Health

Question 6 (1 point) ✓ Saved

What are the principles for the Greenhouse gas protocol accounting and reporting

Select 5 correct answer(s)

- Accuracy
- Completeness
- Balance
- Consistency
- Comparability
- Relevance
- Comprehensiveness
- Materiality
- Transparency
- Reliability

Question 7 (1 point) ✓ Saved

Match the following activities with the GHG scope they belong to

- | | |
|------------------------------------|--|
| <input type="button" value="3 ▾"/> | Goods transport by a contractor |
| <input type="button" value="2 ▾"/> | Running the data-servers at company's own facilities |
| <input type="button" value="2 ▾"/> | Heating of own offices with electric heating unit |
| <input type="button" value="1 ▾"/> | Producing steam on-site from natural gas |
| <input type="button" value="3 ▾"/> | Driving to work in a car leased by the company |
| <input type="button" value="1 ▾"/> | Delivering products or services in company vehicles |
1. Scope 1
2. Scope 2
3. Scope 3

Question 8 (1 point) ✓ Saved

Which are the GHG gases included in the Kyoto-protocol?

Select 6 correct answer(s)

- SF₆
- PFOS
- CO₂
- PFCs
- CH₄
- N₂O
- CO
- HCFCs
- H₂O
- HFCs
- NO₂

Question 9 (1 point) ✓ Saved

What characterises common goods?

- users cannot exclude others from using that good and their use of this good does not affect the ability of others to use it.
- users can exclude others from using that good and their use of this good does not affect the ability of others to use it.
- users cannot exclude others from using that good and their use of this good affects the ability of others to use it.
- users can exclude others from using that good and their use of this good affects the ability of others to use it.

Question 10 (1 point) ✓ Saved

what is the difference between a common and a public good?

- users cannot exclude others from using a public good but they can do so for a common good
- the use of a common good by a user affect the ability of others to use it, while it is not the case for a public good.
- the use of a public good by a user affect the ability of others to use it, while it is not the case for a common good.
- users can exclude others from using a public good but they cannot do so for a common good

Question 11 (1 point) ✓ Saved

For any renewable resource, what is the maximum sustainable yield?

- it is the amount of that resource which can be harvested when the resource is depleted
- it is the amount of that resource which can be harvested to maximise the economic yield
- it is the maximum amount of that resource which can be harvested without reducing the amount of resource available
- it is the maximum amount of that resource which can be harvested without jeopardising the resource availability in the future

Question 12 (1 point) ✓ Saved

What is the Maximum economic yield?

- it is the amount of resource harvest for which income generated is equal to the cost of the harvest
- it is the amount of resource harvest for which the economic returns are greater than the resource yield
- it is the amount of resource harvest for which income is maximised
- it is the amount of resource harvest for which revenues are maximised

Question 13 (1 point) ✓ Saved

Open the [Global Burden of Disease visualization tool](#)

Select the third icon in the left menu, "Risks by causes".

In the left column, select "Level" 2 with your cursor, select "Global" or "Denmark" depending on the proposed answer as a "Location", select "DALYs" as the metric and "rate" to get the total rate of burden of disease death per *100000 inhabitants per year*.

When needed click on the Dietary risks to get the 15 dietary risks

Select the two correct answers below

Select 2 correct answer(s)

- According to the GBD, the main impact of a low consumption of milk is osteoporosis
- The burden of disease rate per 100000 for lack of whole grain is higher in Denmark than at global level (hint: look at the x-axis)
- Over consumption of meat is among the two highest dietary risks in Denmark
- High sodium is among the two highest dietary risk factor at global level, but not for Denmark
- Looking at the number "#" instead of rate, none of the dietary risk exceed 20000 DALY per year for the Danish population
- The highest impacts for the high in red meat risks are associated with diabetes and kidney disease

Question 14 (1 point) ✓ Saved

Looking at the introduction on health, select the two correct answers

Select 2 correct answer(s)

- DALYs only consider the Years of Life Lost Associated with death
- In the Global Burden of Disease, the Year of Life Lost are based on an ideal maximal life expectancy, rather than the local life expectancy
- For most diseases, their disability weight is between 0.6 and 1
- The global burden of disease primarily provide data for developed countries and need to be extended to e.g. African countries
- A day of use of paint stripper can lead to more than 500 minutes of life lost for the person painting
- Physical exercise only has marginal impact on health of less than 10 minutes per person per day of exercise

Question 15 (1 point) ✓ Saved

You want to further interpret the impacts of the e-bike and what are the dominant contributions to its carbon footprint per km driven as well as to its health and biodiversity footprints. Download the carbon and health footprint solution file of various vehicles, (that you also obtained in module 6, just a few cosmetic changes in the human health graph): "12100 QS module 7 carbon_cost_health_absolute Car carbon footprint solutions_W25b". As described in rows 94 to 111 of the carbon footprint tab, the electric bike weight 15 kg, has a Li-ion battery of an additional 3.5 kg, for a lifetime of 20000 km. Its electricity consumption amounts to 0.007 kWh/km, using an average European electricity mix (UCTE). The minutes of healthy life gained per km e-biked is estimated at 2/3rd of a conventional bike, that is 6.2 minutes gained per km driven with the e-bike.

Look at the results and interpret them to select the two correct answers in the present and following question

Select 2 correct answer(s)

- The transportation of the e-bike by cargo freight over 10000 km and by truck over 2000 km at the start of its life is completely negligible, with less than 0.1% of the e-bike carbon footprint per km
- For the e-bike carbon footprint, the manufacturing of the bike and its battery is negligible compared to the impact of the electricity usage
- The e-bike lifespan expressed in km driven over the e-bike lifespan is a key parameter and inversely proportional to the vehicle production impacts to calculate the amount of material needed per vehicle-km
- The amount of battery used per e-biked km amount to 3.5 kg
- For the carbon footprint of the e-bike, the battery production has the dominant impact in its life cycle
- The electric bike leads overall to a net gain in human health impacts (negative minutes of life lost) due to the physical exercise

Question 16 (1 point) ✓ Saved

Let us now compare the carbon footprint of the e-bike against the petrol and the electric vehicle

Select 2 correct answer(s)

- The electric car has a lower carbon footprint than the petrol car whatever the provenance or source of the electricity
- The electric bike has approximately a 12 times lower carbon footprint than an electric car with the same electricity source
- For the electric vehicle, the use phase always dominates the carbon footprint whatever the electricity source
- The carbon footprint is calculated using Global Warming Potential (GWP100) enabling us to compare the climate change impacts of different greenhouse gases relative to CO₂.
- For the gasoline car, it is the supply chain of the petrol, low sulfur in Europe that dominates the carbon footprint

Question 17 (1 point) ✓ Saved

We had calculated in our morning coffee exercise that the life cycle carbon footprint of one cup of coffee in Europe amounts to 0.132 kgCO₂e/cup. Let us assume that a European citizen drinks three cups of coffee per day and commutes to work 10 km per day (2 x 5km) either with an electric car or an e-bike. Calculate the cumulative carbon footprint of these two activities and select the two correct answers for this question

Select 2 correct answer(s)

- Depending on the commute scenario, the impact of the 3 cups of coffee is smaller or higher than those of the 10 km commute
- In all scenarios the coffee contributes to a negligible footprint compared to the commuting
- The uncertainties on the human health benefits of physical activity, less than 1%, so it is certain to say that the minutes of gained from physical activity are very accurate and are certainly larger than the potential benefits of drinking three cups of coffee
- The carbon footprint of one cup of coffee is equivalent to approximately 0.42 km with a European electric vehicle or 10 km by e-bike.
- In both the e-bike and electric car commuting scenarios, the use phase dominates the ecosystem impacts
- The carbon footprint scores are based on estimated damages on human health and ecosystems, and are therefore highly uncertain compared to the ecosystem scores

Question 18 (1 point) ✓ Saved

Select the ONE correct answer for the cumulative carbon footprint of three cup of coffee per day and 10 km per day commute to work by EU electric car

- It is
- It is higher than 10 kgCO₂e/d
- It is between 1 and 3 kgCO₂e/d
- It is between 0.3 and 1 kgCO₂e/d
- It is between 3 and 10 kgCO₂e/d

learn.inside.dtu.dk /lms/quizzing/user/quiz_start.htm?quiz_id=10000000000000000000000000000000

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What are the consequences of failing to meet the SDGs?

there are none
 countries failing to meet the SDGs will be fined
 countries failing to meet the SDGs will have trade sanctions applied
 we will not be able to meet the Rio 1992 Declaration commitments

0.5 / 1 point

Question 11

In which of the following initiatives has UN Global compact been one of the initiators?

There are two correct answers.

Select 2 correct answer(s)

Environmental profit and loss
 Science based targets
 Greenhouse gas protocol
 Global reporting initiative
 Life Cycle Initiative
 SDG Compass

Exam test - Results



Attempt 2 of Unlimited

Written 01 June, 2025 8:26 PM - 01 June, 2025 8:41 PM

Quiz modules 4-7

Question 1

1 / 1 point

Various tools are available to support sustainability assessments at the company level. These tools should be used to:

- Only examine the social outcomes of their goods and services
- Be used to maximise profit, while ensuring minimum impact to the environment
- Support companies to make decisions that minimise the impact to the environment, whilst also enhancing the social and economic wellbeing of society
- Exclusively examine the environmental impacts of their goods and services

Question 2

1 / 1 point

Cost Benefit Analysis can be used to calculate the direct and indirect impacts of the production and consumption of different products and services on key economic parameters

- True

False

Question 3

1 / 1 point

Functions of different sustainability tools

- can be used to calculate the direct and indirect impacts of the production and consumption of different products and services on key economic parameters
- is developed towards evaluating social impacts of a good or a service over its lifecourse
- is an economic method that estimates the equivalent monetary value of the benefits and costs of a project
- can be used to evaluate the economic cost of a good or a service over its lifecourse
- 4 1. Lifecycle cost analysis
- 2 2. Social-Lifecycle analysis
- 3 3. Cost-Benefit Analysis
- 1 4. Input-output models

Question 4

1 / 1 point

Life cycle costing (LCC) is an approach that assesses the total cost of an asset over its life cycle, including

initial capital costs

operating costs

Overall social costs



- the asset's residual value at the end of its life

Question 5

1 / 1 point

Important social conditions/outcomes to measure regarding the mining and resource extraction sector involved in the production of electric vehicles include:

- Income
- Employment
- Education
- Health

Question 6

1 / 1 point

What characterises common goods?

- users can exclude others from using that good and their use of this good does not affect the ability of others to use it.
- users cannot exclude others from using that good and their use of this good affects the ability of others to use it.
- users can exclude others from using that good and their use of this good affects the ability of others to use it.
- users cannot exclude others from using that good and their use of this good does not affect the ability of others to use it.

Question 7

1 / 1 point

what is the difference between a common and a public good?

- users cannot exclude others from using a public good but they can do so for a common good

- the use of a public good by a user affect the ability of others to use it, while it is not the case for a common good.
- users can exclude others from using a public good but they cannot do so for a common good
- the use of a common good by a user affect the ability of others to use it, while it is not the case for a public good.

Question 8

1 / 1 point

For any renewable resource, what is the maximum sustainable yield?

- it is the amount of that resource which can be harvested when the resource is depleted
- it is the amount of that resource which can be harvested to maximise the economic yield
- it is the maximum amount of that resource which can be harvested without reducing the amount of resource available
- it is the maximum amount of that resource which can be harvested without jeopardising the resource availability in the future

Question 9

1 / 1 point

What is the Maximum economic yield?

- it is the amount of resource harvest for which the economic returns are greater than the resource yield
- it is the amount of resource harvest for which income is maximised
- it is the amount of resource harvest for which revenues are maximised
- it is the amount of resource harvest for which income generated is equal to the cost of the harvest

Question 10

1 / 1 point

Open the Global Burden of Disease visualization tool

Select the third icon in the left menu, "Risks by causes".

In the left column, select "Level" 2 with your cursor, select "Global" or "Denmark" depending on the proposed answer as a "Location", select "DALYs" as the metric and "rate" to get the total rate of burden of disease death per 100000 inhabitants per year.

When needed click on the Dietary risks to get the 15 dietary risks

Select the two correct answers below

- The highest impacts (Global) for the high in red meat risks are associated with diabetes and kidney disease
- The burden of disease rate per 100000 for lack of whole grain is significantly higher in Denmark than at global level (hint: look at the x-axis)
- Over consumption of meat is among the two highest dietary risks in Denmark
- According to the GBD, the main impact of a low consumption of milk is osteoporosis
- Looking at the number "#" instead of rate, none of the dietary risk exceed 20000 DALY per year for the Danish population
- High sodium is among the two highest dietary risk factor at global level, but not for Denmark

Question 11

1 / 1 point

Looking at the introduction on health, select the two correct answers

- DALYs only consider the Years of Life Lost Associated with death
- In the Global Burden of Disease, the Year of Life Lost are based

- on an ideal maximal life expectancy, rather than the local life expectancy
- For most diseases, their disability weight is between 0.6 and 1
- The global burden of disease primarily provide data for developed countries and need to be extended to e.g. African countries
- A day of use of paint stripper can lead to more than 500 minutes of life lost for the person painting
- Physical exercise only has marginal impact on health of less than 10 minutes per person per day of exercise

Question 12

1 / 1 point

You want to further interpret the impacts of the e-bike and what are the dominant contributions to its carbon footprint per km driven as well as to its health and biodiversity footprints. Download the carbon and health footprint solution file of various vehicles: "1210X QS carbon_cost_health_absolute Car carbon footprint solutions_W25b". As described in rows 94 to 111 of the carbon footprint tab, the electric bike weight 15 kg, has a Li-ion battery of an additional 3.5 kg, for a lifetime of 20000 km. Its electricity consumption amounts to 0.007 kWh/km, using an average European electricity mix (UCTE). The minutes of healthy life gained per km e-biked is estimated at 2/3rd of a conventional bike, that is 6.2 minutes gained per km driven with the e-bike.

Look at the results and interpret them to select the two correct answers in the present and following question

- The e-bike lifespan expressed in km driven over the e-bike lifespan is a key parameter and inversely proportional to the vehicle production impacts to calculate the amount of material needed per vehicle-km
- For the e-bike carbon footprint, the manufacturing of the bike and its battery is negligible compared to the impact of the

electricity usage

- For the carbon footprint of the e-bike, the battery production has the dominant impact in its life cycle
- The transportation of the e-bike by cargo freight over 10000 km and by truck over 2000 km at the start of its life is completely negligible, with less than 0.1% of the e-bike carbon footprint per km
- The electric bike leads overall to a net gain in human health impacts (negative minutes of life lost) due to the physical exercise
- The amount of battery used per e-biked km amount to 3.5 kg

Question 13

1 / 1 point

Let us now compare the carbon footprint of the e-bike against the petrol and the electric vehicle

- The electric car has a lower carbon footprint than the petrol car whatever the provenance or source of the electricity
- For the gasoline car, it is the supply chain of the petrol, low sulfur in Europe that dominates the carbon footprint
- The carbon footprint is calculated using Global Warming Potential (GWP100) enabling us to compare the climate change impacts of different greenhouse gases relative to CO₂.
- The electric bike has approximately a 12 times lower carbon footprint than an electric car with the same electricity source
- For the electric vehicle, the use phase always dominates the carbon footprint whatever the electricity source

Question 14

1 / 1 point

We had calculated in our morning coffee exercise that the life cycle

carbon footprint of one cup of coffee in Europe amounts to 0.132 kgCO₂e/cup. Let us assume that a European citizen drinks three cups of coffee per day and commutes to work 10 km per day (2 x 5km) either with an electric car or an e-bike. Calculate the cumulative carbon footprint of these two activities and select the two correct answers for this question

- Depending on the commute scenario, the impact of the 3 cups of coffee is smaller or higher than those of the 10 km commute
- In both the e-bike and electric car commuting scenarios, the use phase dominates the ecosystem impacts
- The uncertainties on the human health benefits of physical activity, less than 1%, so it is certain to say that the minutes of gained from physical activity are very accurate and are certainly larger than the potential benefits of drinking three cups of coffee
- The carbon footprint of one cup of coffee is equivalent to approximately 0.88 km with a European electric vehicle or 10 km by e-bike.
- The carbon footprint scores are based on estimated damages on human health and ecosystems, and are therefore highly uncertain compared to the ecosystem scores
- In all scenarios the coffee contributes to a negligible footprint compared to the commuting

Question 15

1 / 1 point

Select the ONE correct answer for the cumulative carbon footprint of three cup of coffee per day and 10 km per day commute to work by EU electric car

- It is between 3 and 10 kgCO₂e/d
- It is higher than 10 kgCO₂e/d
- It is

- It is between 0.3 and 1 kgCO2e/d
- It is between 1 and 3 kgCO2e/d

Done