

# The Limits to Growth: Sustainability and the Circular Economy

## Lecture 10: Now What?

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M.Sc. Anant Sujatanagarjuna

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- Updated versions of these slides will be available in our [Github repository](#).

## **NEWS/UPDATES**

## Exam

### Pre-Exam Q&A Session

- There will be a pre-exam Q&A session (via BBB) before the exam
- We will announce date and time in the next few days



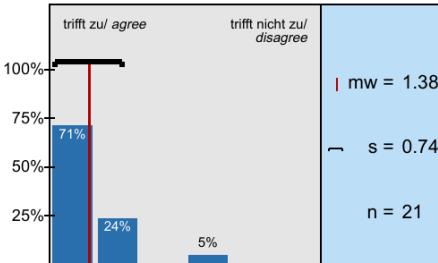
## Bonus Task Feedback

No video submission, yet.

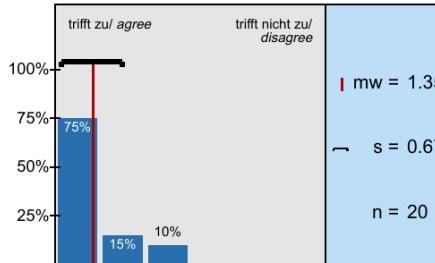
# Course Evaluation Results

## Feedback

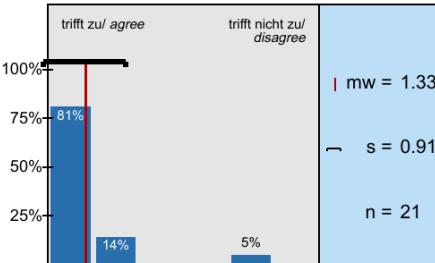
Der inhaltliche Aufbau der Lehrveranstaltung ist logisch und nachvollziehbar.



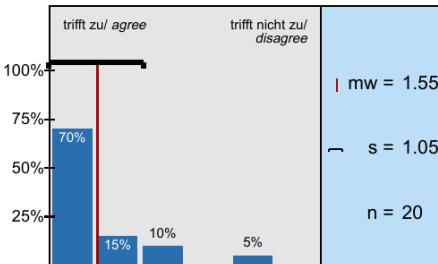
Der / dem Lehrenden ist es wichtig, dass die Studierenden etwas in der Lehrveranstaltung lernen



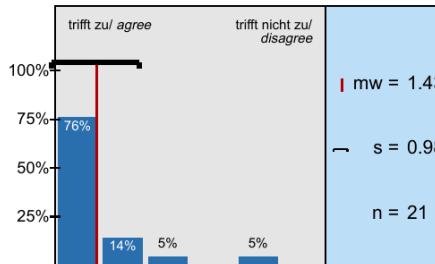
Die / der Lehrende vermittelt den Stoff anschaulich und verständlich.



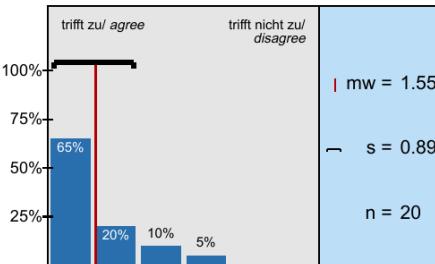
Die / der Lehrende kann auch schwierige Sachverhalte gut erklären.



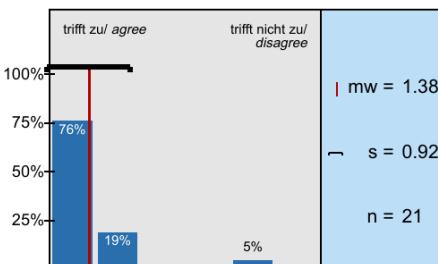
Ich werde zum Midenken motiviert.  
*I am encouraged to think for myself.*



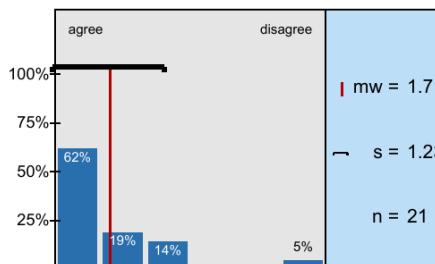
Ich kann die in dieser Lehrveranstaltung behandelten Inhalte und Methoden beschreiben und erläutern.



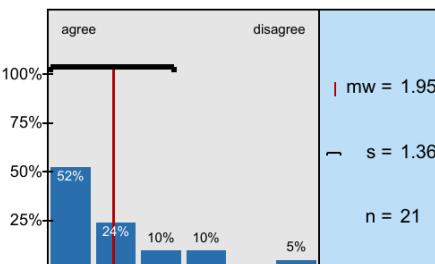
Die Lehrveranstaltung gibt einen guten Überblick über das Themengebiet.



Was the course understandable without prior knowledge?



Should we extend the online learning- and self-study materials?



# Course Evaluation Results

## Feedback

- Comment for 4.4: I prefer the existing system with regular online lectures and recordings in addition, because I'm able to attend the live-lecture only on some Mondays
- Comment for 4.5: I prefer work independently, also the idea with the group-bonus-tasks is great but I just lack the time
- Course content is really well organized and creative exercise as my point of view.
- The Assignmmts especially it was individual task no group work
- This course is interested because we learned about recourses in the world etc.
- die Teilnahme über Quizze und die Dozierende, welche die Inhalte mit sehr viel Herzblut vorgetragen haben
- gute und alltagsnahe Beispiele, angemessener Arbeitsaufwand, Gelegenheiten trotz online Teilnahme aktiv mitzumachen durch die Umfragen

# Course Evaluation Results

## Feedback

5.2) Was hat Ihnen an der Lehrveranstaltung nicht gefallen ? (Nur innerhalb der Berandung schreiben!)  
*Which parts of the course did you not like? (Please do not write outside the borders.)*

- Everything is perfect in this course.
- die Aufgaben waren teilweise zu einfach und dann auf einmal sehr schwer. Ein gutes Mittelmaß wäre gut gewesen.
- späte (bisher noch keine) Rückmeldung zu den Übungen

5.3) Welche Verbesserungsvorschläge haben Sie ? (Nur innerhalb der Berandung schreiben!)  
*What suggestions for improvement do you have? (Please do not write outside the borders.)*

- 4.4: asynchrones Lernen  
4.5: Gruppenarbeit im Rahmen der Übungen zB um Ergebnisse der Übungen zu diskutieren, ansonsten eher selbstständig
- I'm very interested of lecture structure and also very good organization.  
Prof. teaching method is also very well and good explain, and I'm very happy about it.  
Thank you so much, Prof and tutor.
- There are some problems with the video recordings, when clicking lecture number 4 or others it takes to the other lectures.  
loading of the video of previous lectures(old no 1,2 etc in git) has some kind of loading issues even with personal and eduroam network.Haven't experienced such issues with any other lectures videos
- gerne
- overall, its good.

## **EXERCISE 07**

# Exercise 07

## Refresh

	Holistic	Segmented
Optimist	<b>Reformist Circular Society</b> <ul style="list-style-type: none"><li><i>Assumptions:</i> reformed form of capitalism is compatible with sustainability and socio-technical innovations can enable eco-economic decoupling to prevent ecological collapse.</li><li><i>Goal:</i> economic prosperity and human well-being within the biophysical boundaries of the earth.</li><li><i>Means:</i> technological breakthroughs, social innovations and new business models that improve ecological health, resource security, and material prosperity for all.</li></ul>	<b>Techcentric Circular Economy</b> <ul style="list-style-type: none"><li><i>Assumptions:</i> capitalism is compatible with sustainability and technological innovation can enable eco-economic decoupling to prevent ecological collapse.</li><li><i>Goal:</i> sustainable human progress and prosperity without negative environmental externalities.</li><li><i>Means:</i> economic innovations, new business models and unprecedented breakthroughs in CE technologies for the closing of resource loops with economic value creation.</li></ul>
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## Exercise E07

### Feedback

- A lot of empty submissions
- Some submissions that only selected one of the options → no explanations
- Other submissions just reiterated what was written on the slide

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- Votes: 13
  - Reformist CS (Optimist + Holistic): 3
  - Techcentric CE (Optimist + Segmented): 2
  - Transformational CS (Sceptical + Holistic): 6
  - Fortress CE (Skeptical + Segmented): 2

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## **EXERCISE 08**

## Exercise E08

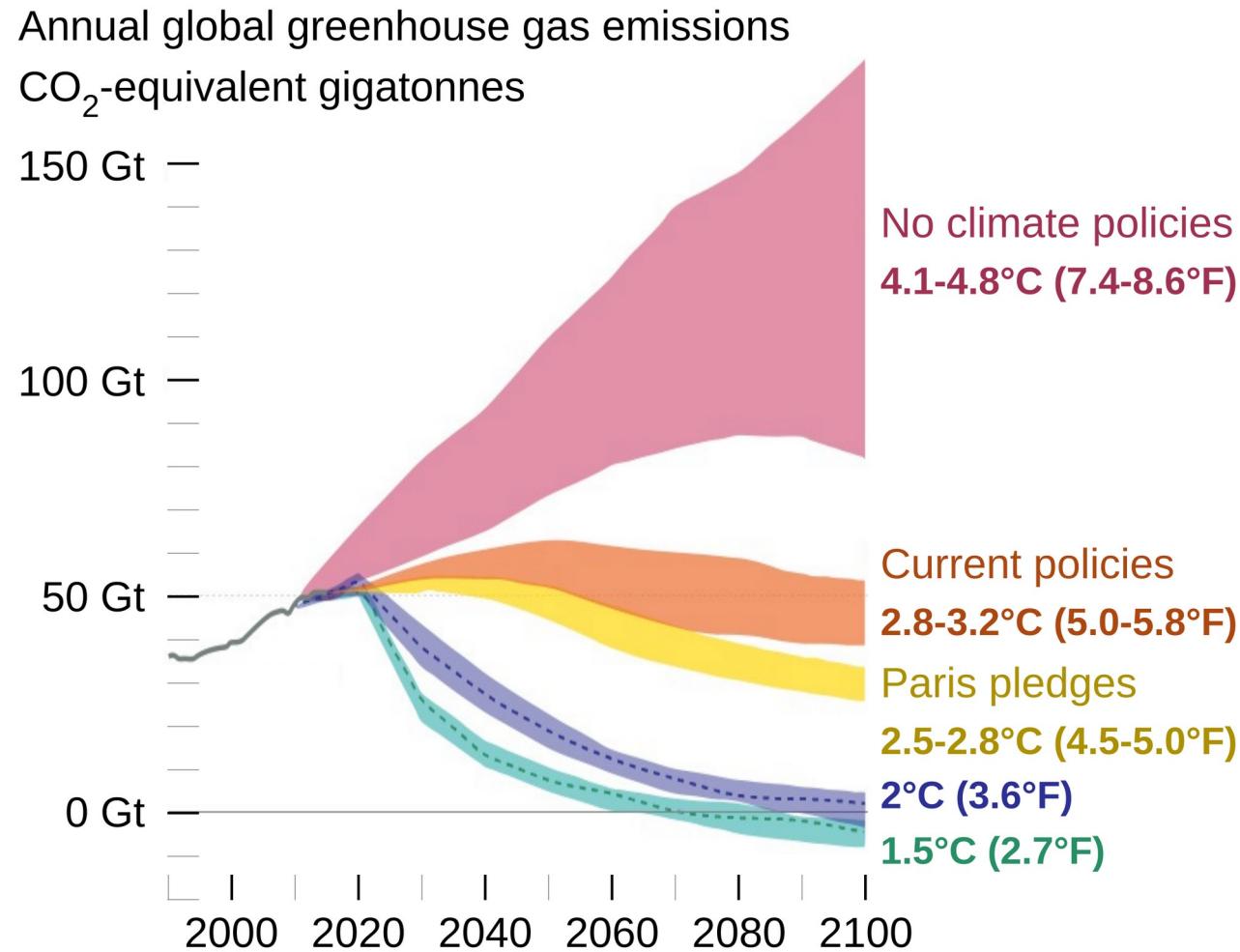
### Feedback

- Coming soon.

## **RECAP - LTG COURSE IN A NUTSHELL**

## LTG Recap

### Climate Change - Global GHG Emission Pathways (2019)



## LTG Recap

### Climate Change - 1.5°C vs. 2/3/4°C

*"If we can keep warming below **3°C** we likely remain within our adaptive capacity as a civilization, but at **2.7°C** warming we would experience great hardship."* -

*Prof. Michael Mann*

# LTG Recap

## Environmental Pollution - Waste



1. "Landfill at Upernivik" by ulalume – <https://www.flickr.com/photos/96649248@N00/43867280734> – CC BY-NC-ND 2.0

2. Christian Hüpfer – <https://flic.kr/p/aKXw2F> – CC BY-SA 2.0

## LTG Recap

### Environmental Pollution - Horrible Waste Management



## LTG Recap

### Dwindling (Non-)Renewable Resources



*"I am afraid of losing my child  
to a resource war because of a  
climate collapse"*

→ *"Our parents will die of old  
age, our children will die of  
climate change"*

## LTG Recap

### 3 Key Challenges of the 21st Century

- 1) Climate change / adaption to climate change
- 2) Environmental pollution
- 3) Dwindling non-renewable resources

## LTG Recap

### Just Not Enough ...



1. Vauxford – [https://commons.wikimedia.org/wiki/File:2018\\_Tesla\\_Model\\_S\\_75D.jpg](https://commons.wikimedia.org/wiki/File:2018_Tesla_Model_S_75D.jpg) – CC BY-SA 4.0.

2. Marco Verch – <https://www.flickr.com/photos/30478819@N08/51303997289/in/photostream/> – CC BY 2.0.

3. <https://pxhere.com/en/photo/1081335> – CC0 1.0.

4. epSos.de – [https://commons.wikimedia.org/wiki/File:Colorful\\_Recycling\\_Containers\\_for\\_Trash.jpg](https://commons.wikimedia.org/wiki/File:Colorful_Recycling_Containers_for_Trash.jpg) – CC BY 2.0.



# LTG Recap

## Life-Cycle Assessment (LCA)



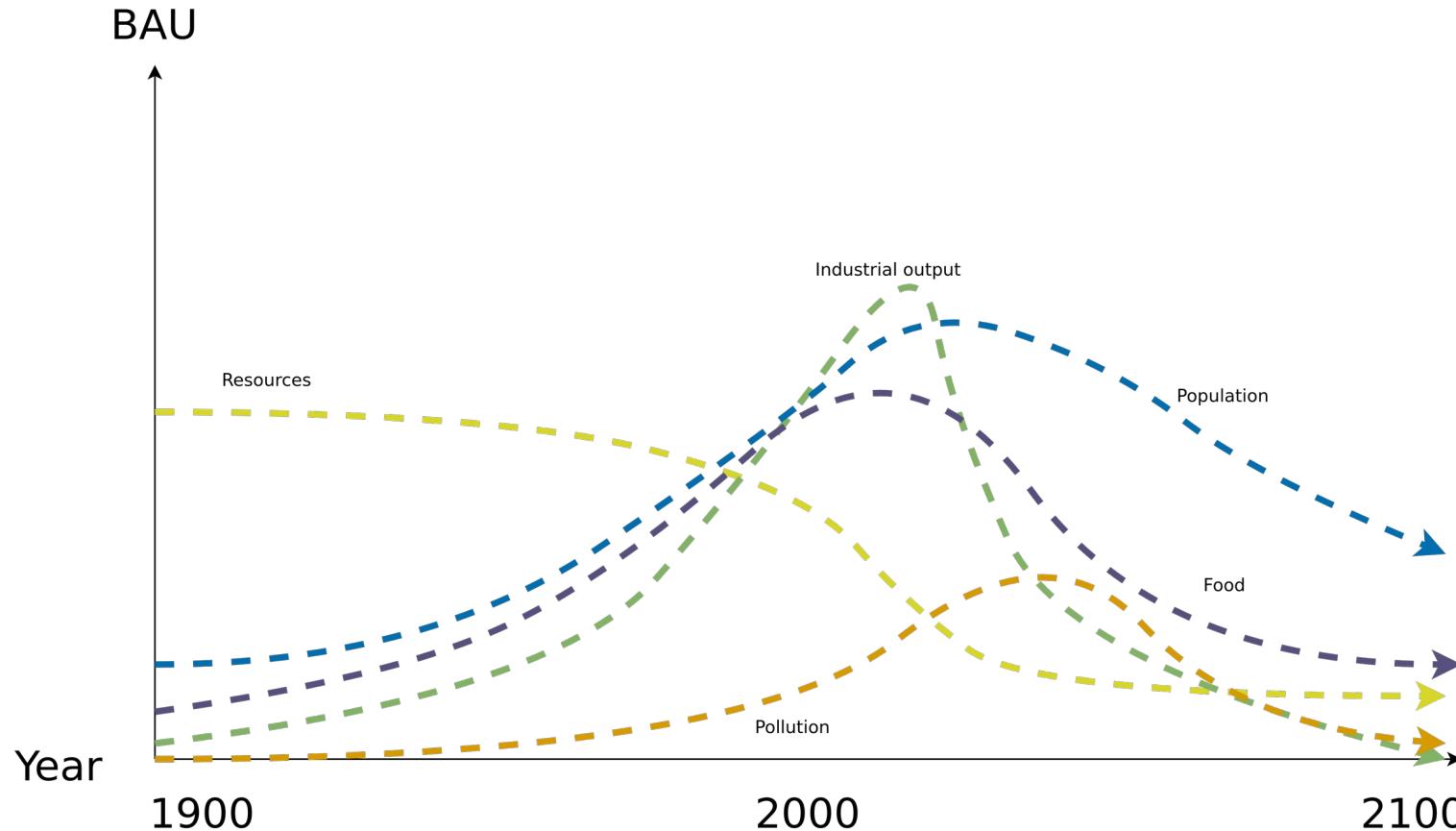
**Battery Electric Vehicles  
(EV)**

Or

**Internal Combustion Engine  
Vehicles**

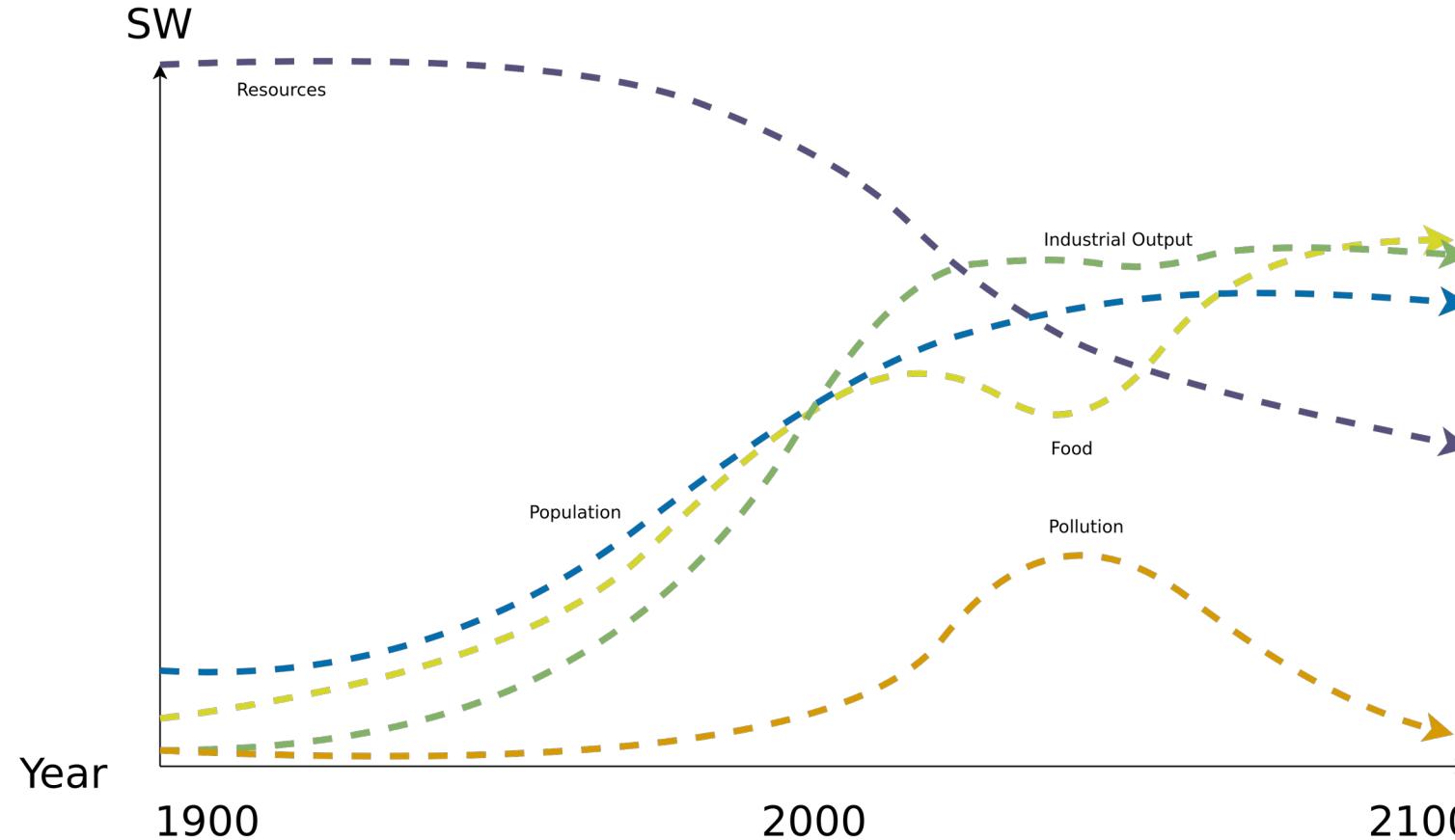
## LTG Recap

### World3 Standard Run - Business-as-Usual (BAU)



## LTG Recap

### World3 - Stabilized World (SW)



→ Population stabilizes in the twenty-first century, as does human welfare on a high level

## LTG Recap

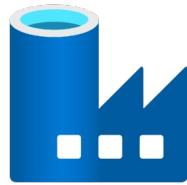
### Linear (Industrial) Economy



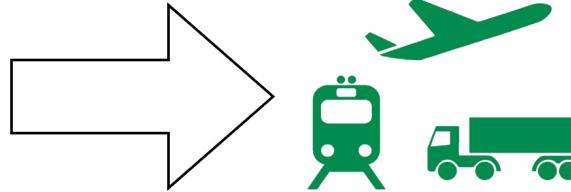
#### RESOURCES

GLOBALIZED INDUSTRIALIZED PROCESSES

**NATURAL RESOURCES** (Water, Energy, Materials) and Human Resources (Labor and Skills) are used to produce manufactured **objects** (infrastructure, buildings, equipment, durable projects).



#### MANUFACTURING



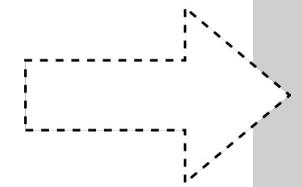
#### DISTRIBUTION



#### POINT OF SALE

GLOBALIZED DISTRIBUTION LOGISTICS

**COMMERCIALIZATION** at the factory gate or at point of sale these objects are put to use (sold, leased, rented, sold as service)...



## LTG Recap

### Linear Economy - In A Nutshell

“Take – Make – Dispose”

## LTG Recap

### Linear Economy - In A Nutshell / Definition

“Take – Make – Dispose”

“Its objectives are to **maintain value** (not to create value added), to **optimise stock** management (not flows) and to **increase the efficiency of using goods** (not of producing goods)”

## LTG Recap

### Waste Is A Human Concept

**Waste = Inefficiency**

## LTG Recap

### Circular Economy



## LTG Recap

### Circular (Industrial) Economy - Definition

“The circular industrial economy **manages stocks** of manufactured assets, such as infrastructure, buildings, vehicles, equipment and consumer goods, to **Maintain their value and utility as high as possible for as long as possible**; and stocks of **resources at their highest purity and value.**”

## LTG Recap

### Performance Economy - Definition

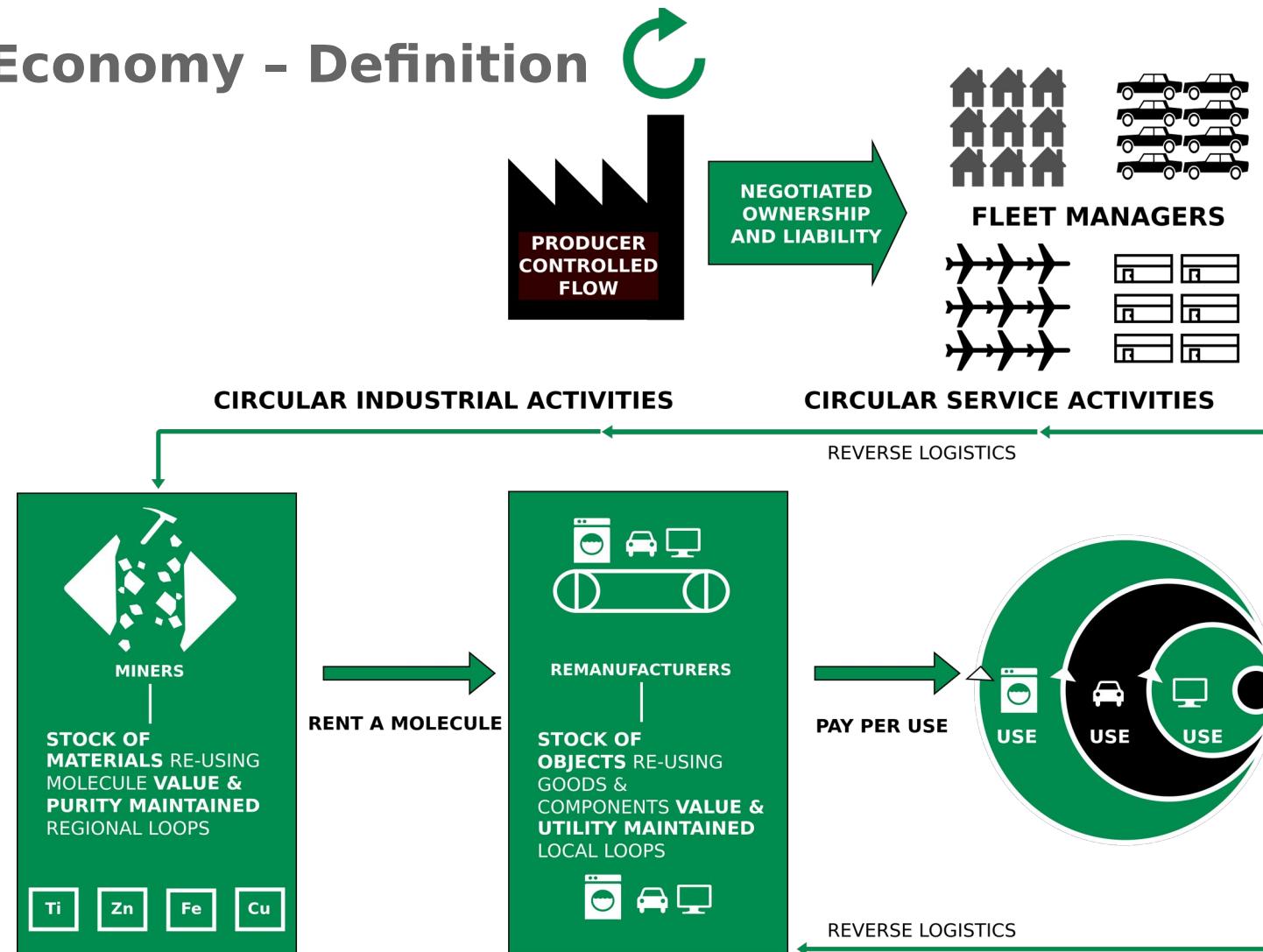


Image adapted from Walter R. Stahel (2019) – The Circular Economy: A User's Guide.

## LTG Recap

### Performance Economy - Definition

„**The Performance Economy sells results instead of objects.** Its economic actors may be manufacturers of durable objects or fleet managers operating them. In both cases, they sell the use of these objects as a service over the longest possible period of time and maximize their profits by exploiting both efficiency and sufficiency solutions. “

## LTG Recap

### Sustainability - Definition

*„Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.“*

## LTG Recap

### Sustainability - Implication

**Sustainability → Consume less**

## LTG Recap

### Circular Society - CE Criticism

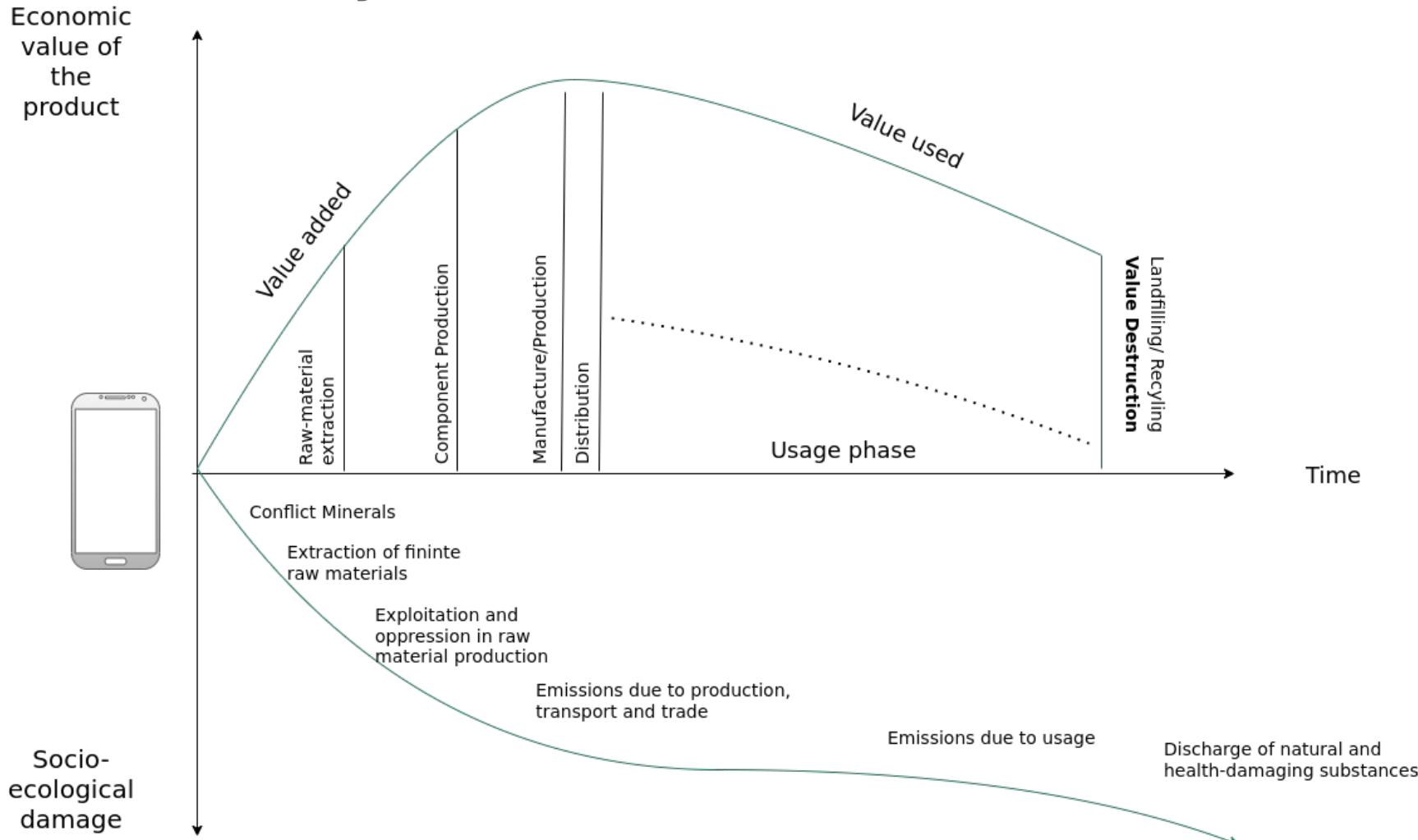


Image adapted from: M. Jaeger-Erben, F. Hofmann (2019) – Kreislaufwirtschaft - Ein Ausweg aus der sozial-ökologischen Krise? – [Link](#).

## LTG Recap

### Circular Society – CE Criticism

- Replace the LE with circularly oriented forms of consumption and production
- CE focus mostly on earned value management (“Wertschöpfungsmanagement”), product-service systems, product/business model innovations within existing power asymmetries
- Decouple economic growth and consumption of natural resources

→ **But why do we need never ending economic growth and why is it good to consume as many goods and services as possible?**

## LTG Recap

### Circular Society – CE Criticism

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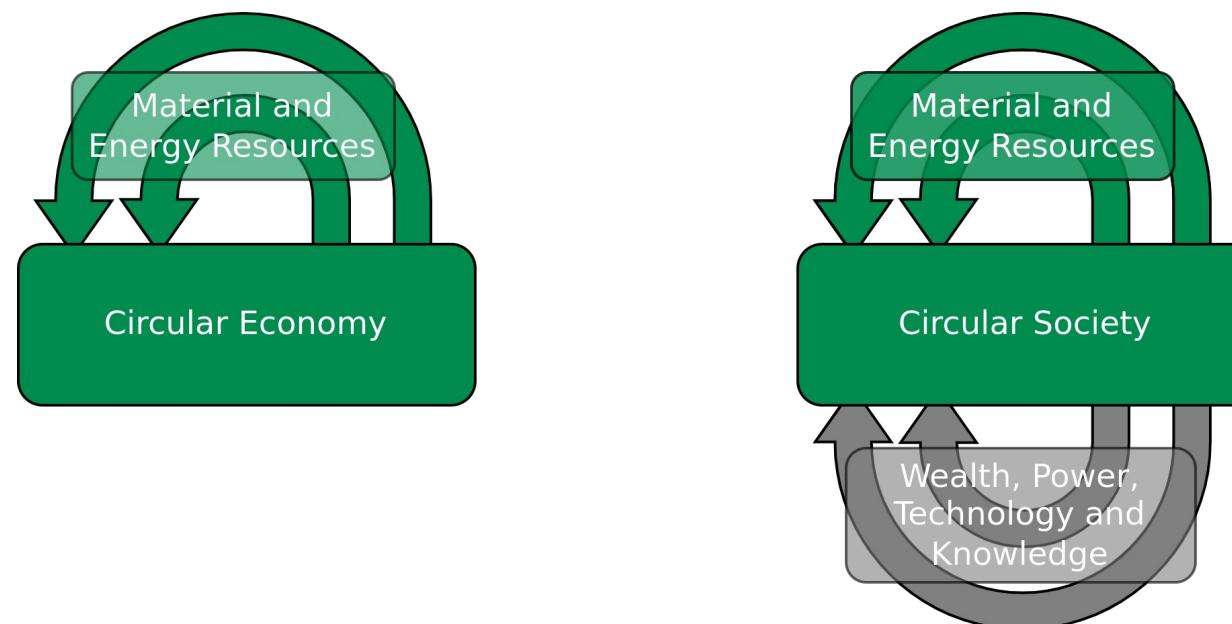
→ **But why do we need never ending economic growth and why is it good to consume as many goods and services as possible?**

- Alternatives:
  - Sufficiency strategies and lifestyle changes
  - Question the prevailing entrepreneurial orientation towards the shareholder concept
  - Deconstruction of existing power and hegemonic relations

## LTG Recap

### Circular Society - Definition

„A circular society defines discourses with a vision of circularity where not only resources are circulated in sustainable loops, but also wealth, knowledge, technology and power is circulated and redistributed throughout society”



# LTG Recap

## CS and CE Perspectives

	Holistic	Segmented
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# LTG Recap

## Technology - Quick Fix?

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## **RECAP - WHAT IS THIS COURSE ABOUT**

## LTG Recap

### What Is This Course All About?

- Gaining an understanding of causes, dimensions, and the characterization of the 3 key challenge of the 21<sup>st</sup> century
  - Climate change / adaption to climate change
  - Environmental pollution
  - Dwindling non-renewable resources

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- Critically assess available solutions

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  - Climate change / adaption to climate change
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  - Dwindling non-renewable resources
- Critically assess available solutions
- **Act before it is too late**

## LTG Recap

### What Is This Course All About?

*This course is supposed to enable **YOU** to create a sustainable future for all of us and future generations.*

## LTG Recap

### What Is This Course All About? - Strategy

*Strategy is “turning resources you have into the power you need to get what you want → your goal. [Marshall Ganz]*

- Strategic Goal (what you want): The goal is a clear, measurable point that allows you to know if you've won or lost, and that meets the challenge your constituency faces.
- Power (what you need): tactics through which you can turn your resources into the capacity you need to achieve your goal.
- Resources (what your constituency has): time, money, skills, relationships, etc.

**ACT NOW**

# Act Now

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## Act Now Courage

*“But the opposite of hope is not despair. It is grief. Even while resolving to limit the damage, we can mourn. And here, the sheer scale of the problem provides a perverse comfort: we are in this together. The swiftness of the change, its scale and inevitability, binds us into one, broken hearts trapped together under a warming atmosphere.*

*We need courage, not hope. Grief, after all, is the cost of being alive. [...] **Courage is the resolve to do well without the assurance of a happy ending.**”*

## Act Now

### Minimize/Avoid Waste - Waste Is A Human Concept

**Waste = Inefficiency**

## Act Now

### Minimize/Avoid Waste - Foodsharing



The screenshot shows a user profile for 'Benjamin' on the foodsharing.de website. At the top, there's a navigation bar with 'foodsharing' and 'Deutschland'. A search bar says 'Search persons, groups, companies, ...'. Below the search bar, a message says 'Neues Update | FAQ zu Corona und foodsharing'. The main profile area shows a photo of a person, the name 'Benjamin', and a status bubble saying 'Benjamin is online.' To the right, there's a summary of activity: 3 Posts, 3 Food baskets, 30 x picked up, and 550 kg saved. Below this, it says 'Benjamin is a foodsaver in: Deutschland, Braunschweig, Niedersachsen, Europa' and 'home district of Benjamin: Braunschweig'.



<https://foodsharing.de/>

## Act Now

### Minimize/Avoid Waste - General

- Taking responsibility (being accountable) for the trash/waste that you create and the resources you consume
  - What is left after you consumed the product/service?
  - Does it generate, or result in trash/waste?
  - Can you reuse it in any other way thereby avoiding trash?
  - Is the generated waste, the implicit/explicit environmental pollution, the used resources, and so on worth the short term pleasure?
- Zero-waste might be unrealistic
- Instead → Reduce your footprint (no only carbon) as much as possible
  - Resources, energy, pollution, emissions, etc.

# Act Now

## Minimize Your Footprint



# Act Now

## Minimize Your Footprint



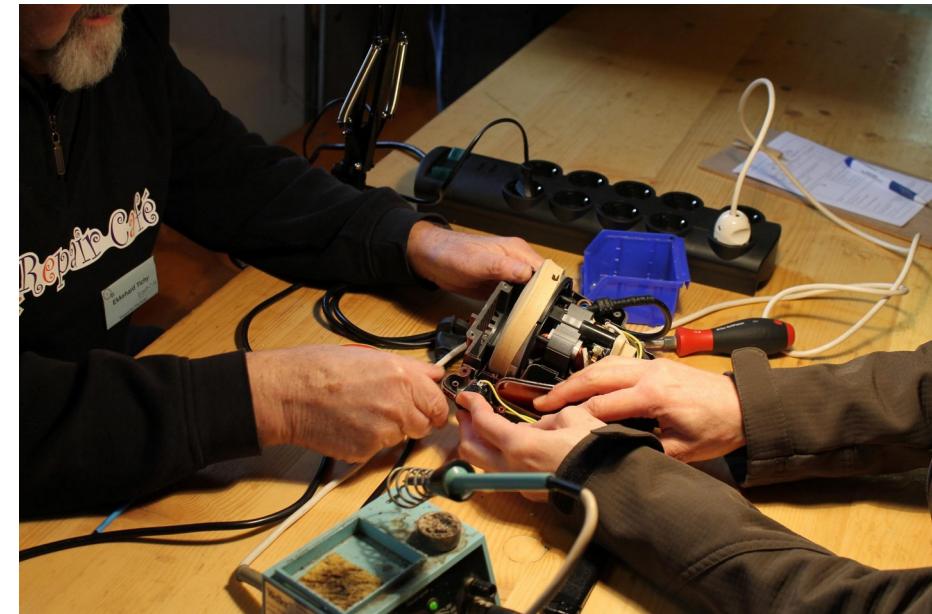
## Act Now

### Minimize Your Footprint - Sustainability

**Sustainability → Consume less**

## Act Now

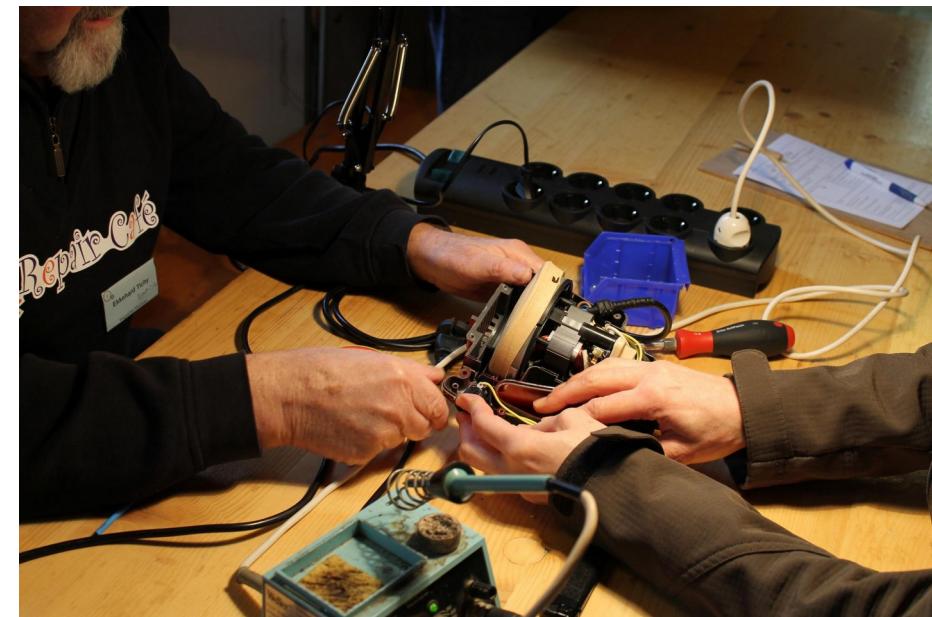
### Minimize Your Footprint - Repair Cafe / Sharing / 2<sup>nd</sup> Hand



1. RaMa2016 – [https://upload.wikimedia.org/wikipedia/commons/1/17/Repair\\_Caf%C3%A9\\_Trier\\_Reparatur.jpg](https://upload.wikimedia.org/wikipedia/commons/1/17/Repair_Caf%C3%A9_Trier_Reparatur.jpg) – CC BY-SA 4.0
2. Ibrahim Husain Meraj – [https://upload.wikimedia.org/wikipedia/commons/9/96/Various\\_tools\\_for\\_cycle\\_repair\\_01.jpg](https://upload.wikimedia.org/wikipedia/commons/9/96/Various_tools_for_cycle_repair_01.jpg) – CC BY-SA 4.0
3. Janne Hellsten – [https://upload.wikimedia.org/wikipedia/commons/e/e3/Brand\\_new\\_second\\_hand.jpg](https://upload.wikimedia.org/wikipedia/commons/e/e3/Brand_new_second_hand.jpg) – CC BY 2.0

## Act Now

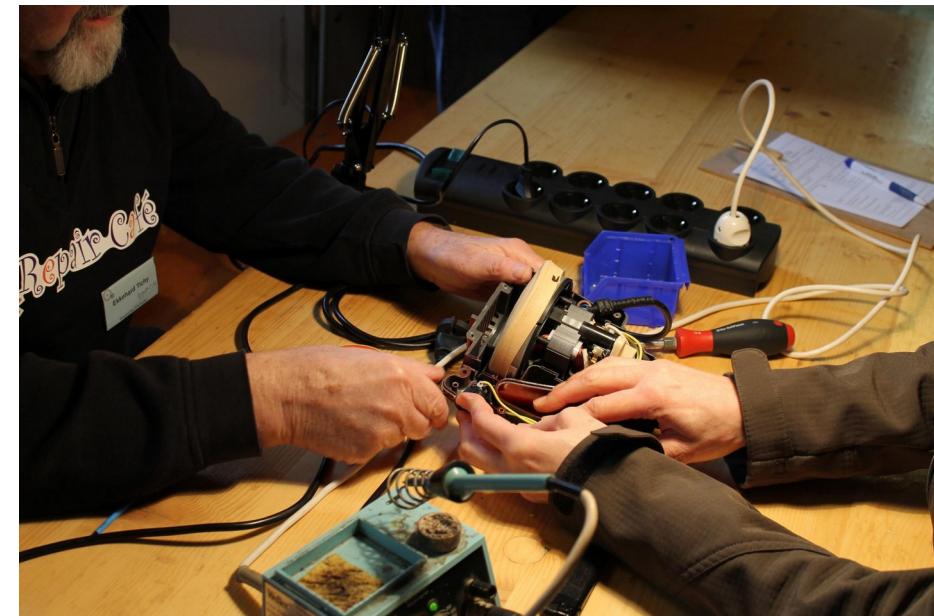
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## Act Now

### Minimize Your Footprint - Repair Cafe / Sharing / 2<sup>nd</sup> Hand



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## Act Now

### Climate-Resilient Food Production

- Agroforestry → Trees/shrubs are grown around or among crops or pastureland ([Link](#))
- Permaculture → Growth of an agricultural ecosystem in a self-sufficient and sustainable way ([Link](#))
- Silvopasture → Trees, forage and domesticated animals in a mutually beneficial way
- Etc.

## Act Now

### Climate-Resilient Food Production - Garden Plot ("Kleingarten")



## Act Now

### Climate-Resilient Food Production – Urban/Balcony Gardening



1. Neitram – [https://upload.wikimedia.org/wikipedia/commons/7/71/Urban-Gardening-Demonstrationsgarten\\_der\\_Hochschule\\_Augsburg\\_01.jpg](https://upload.wikimedia.org/wikipedia/commons/7/71/Urban-Gardening-Demonstrationsgarten_der_Hochschule_Augsburg_01.jpg) – CC BY-SA 4.0

2. Bad Alley – <https://www.flickr.com/photos/badalley/3727226471> – CC BY-NC-SA 2.0

3. Ecoscapes – [https://upload.wikimedia.org/wikipedia/commons/9/9d/Condominium\\_balcony\\_container\\_gardening\\_at\\_night.jpg](https://upload.wikimedia.org/wikipedia/commons/9/9d/Condominium_balcony_container_gardening_at_night.jpg) – CC BY-SA 4.0

## Act Now

### Activism – Fridays for Future / Extinction Rebellion / Etc.

- Short history of actions on climate change
  - Geneva, Kyoto, Copenhagen, Paris, Glasgow, etc.
  - Problem
    - → A lot of bla bla
    - → Lack of progress
    - → Policies favor business as usual instead of acting in accordance with science because they are afraid to make unpopular decisions
- **Individual activism as a response / counter movement to inactive governments**  
who ignore urgent issues (i.e., the three key challenges of the 21<sup>st</sup> century)

## Act Now

### Activism - Fridays for Future / Extinction Rebellion / Etc.

*"Climate activists are sometimes depicted as dangerous radicals, but the truly dangerous radicals are the countries that are increasing the production of fossil fuels."*

**United Nations Secretary General Antonio Guterres**

## Act Now

### Activism - Fridays for Future / Extinction Rebellion / Etc.



## Act Now

### Activism - Fridays for Future / Extinction Rebellion / Etc.



*"I am afraid of losing my child  
to a resource war because of a  
climate collapse"*

## Act Now

### Break Out of the Hamster Wheel

- Assumption → Capitalism = pyramid/ponzy scheme
- What are alternatives?
  - Cooperatives
  - gGmbH (non-profit company with limited liability under German law)
  - Cooperative communities
- Get a job that does not facilitate an unsustainable use of our planet, i.e., the three key challenges of the 21<sup>st</sup> century
- Go local (local cooperation, local consumption, local money, local sourcing of resources)
- Less expenses → less time you need to spend working

## Fun Fact

Google Search Term “sustainable business cooperative”



Ad · <https://www.aramco.com/> ▾

### Aramco Sustainable Business - Building A Better Future

We Believe In The Power Of Energy To Transform Lives And Sustain Our Planet. Find Out More

#### Sustainable Practices

Our approach to sustainability [Learn more about our initiatives](#)

#### People and Community

We put our energy to work making a difference within communities.

#### In-house Technologies

Learn about our methods for increasing safety & efficacy

#### Protecting Our Planet

Find out more about the initiatives we take to help protect our planet.

## Fun Fact

### Google Search Term “sustainable business cooperative”



- 100 companies produced more than 70% of the world's greenhouse gas emissions between 1988 and 2017
- Guess who is on the list?
  - 1) China (Coal) → 14.32%
  - 2) Saudi Arabian Oil Company (Aramco) → 4.50%
  - 3) Gazprom OAO → 3.91%
  - 4) National Iranian Oil → 2.28%
  - 5) ExxonMobil Corp → 1.98%
  - 6) Coal India → 1.87%
  - 7) Petroleos Mexicanos (Pemex) → 1.87%
  - 8) Russia (Coal) → 1.86%
  - 9) Royal Dutch Shell PLC → 1.67%
  - 10) China National Petroleum Corp (CNPC) → 1.56%
  - 11) BP PLC → 1.53%**
  - 12) Chevron Corp → 1.31%**

Blaming individuals and denying any responsibility →  
great strategy!

<https://www.theguardian.com/sustainable-business/2017/jul/10/100-fossil-fuel-companies-investors-responsible-71-global-emissions-cdp-study-climate-change>

## Act Now

### Wales “One Planet Development”

- “One Wales: One Planet”
  - Timeframe → one generation
  - Goal
    - Wales should use only its fair share of the earth’s resources
    - Zero carbon emissions for both use and construction
- How?
  - Low Impact Development principles (applicable in Wales)
  - Prototypes / Test Communities
    - Single homes
    - Co-operative communities

# **WRAP-UP**

## Wrap-Up

- Kate Marvel: “*Courage is the resolve to do well without the assurance of a happy ending.*”
  - You do not have to be a sustainability saint → be as sustainable as possible, it still makes a difference
  - Small progress vs. no progress
  - Silence/being inactive supports the destruction of our planet (← I just checked, still no “*planet B*” available)
  - Do something instead of giving up right away
- Leading by example

## Additional Resources

- D. Thorpe (2015). The 'One Planet' Life – A Blueprint for Low Impact Development – [Link](#)
- Documentary: *Living the Change: Inspiring Stories for a Sustainable Future* (2018) – [Link](#)
- Documentary: A Simpler Way: Crisis as Opportunity (2016) – [Link](#)
- Documentary: Capital in the 21<sup>st</sup> Century (2019) – [Link](#)
- Jared Diamond (2019). *Upheaval: How Nations Cope with Crisis and Change*
- How to Save a Planet – Electrify This! (Podcast) – [Link](#)
- Food and Environment Reporting Network – Hot Farm (Podcast) – [Link](#)
- D. Holmgren (2002). *Permaculture: Principles & Pathways Beyond Sustainability*
- T. Piketty (2013). Capital in the 21<sup>st</sup> Century.

# Questions?