MOVECO

# CIRCULAR ECONOMY INNOVATION TOOLS
# School of Thought-section Blue Economy

Qualification Programme Handbook

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# 2. INTRODUCTION

## 2.1. INTRODUCTION

This document can either be used as background material for trainers and participants in a **workshop** or also by individual readers (**self-study** or within a self-formed study-group). For both cases, there are notes provided that guide through the material.

Indicative questions encourage you to reflect what you have just read.

In addition, throughout the text, you will find some indicative questions framed and marked by "?" that encourage to reflect what you have just read.

Cross-references to the case studies and further MOVECO materials help to deepen your knowledge about circular economy.

Moreover, there are cross- references to the case studies or other MOVECO material (such as the fact sheets) marked by "💡".

Practical exercises are pointed out for trainer-led workshops or self-study by individual readers or a self-formed study group

Further, the pencil sign points out practical exercises that can be done as part of a trainer-led workshop or in self-study by individual readers or a self-formed study group.

For the **practical** work, there are several **case studies** that invite discussion or reflection – paired with empty templates for worksheets that encourage looking at a self-chosen practical product example. In the end, there is a short quiz to test the knowledge gained in this section of the toolbox. You will find any specific terminology explained in the **glossary**. If you use this section as part of a workshop, there is an **evaluation form** at the very end that can be used to collect feedback at the end of the workshop.

# 3. CONTENT

## 3.1. GENERAL OVERVIEW

Gunter Pauli is the founder and director of Zero Emissions Research and Initiatives, who created the mentality, philosophy and methodology behind the concept. In his research, Pauli presents multiple energy innovations: water, construction or food industry.

According to Gunter Pauli, sustainable business that operates on the Blue Economy principles makes it possible to meet the basic, primary needs of all but without exploiting natural resources and yet without giving up a certain level of modern living and service. Blue Economy is a new business design model, a market-oriented business model that combines sustainable business and sustainable growth.

The term Blue Economy means using resources in a cascade system, the waste resulting from the consumption of a product, becoming the raw material for cash flow. Thus, new jobs are created, social capital is built up and incomes are growing - without exploiting or affecting the environment, but rather preserving it and improving it. This makes sustainable development possible.

The current global economic system can be transformed into sustainable development through innovation and entrepreneurship. Innovations and rising living standards are promoted through demand, through free market economy mechanisms, and through education, not by inhibiting them by social barriers and cost.

## 3.2. PRINCIPLES OF BLUE ECONOMY

According to Gunter Pauli[1], the theory of Blue Economy is based on a set of 20 principles:

- Solutions are mainly based on physics and the major decision criteria are related to “pressure” and “temperature”
- Investigate every physical resource to see if it is really necessary in the system; if not, it is better to reject it
- A natural system follows the route “nutrients-matter-energy” (everything is transformed, no waste exists)
- Nature has evolved from very few species to a wide biodiversity, therefore diversity is necessary for a sustainable equilibrium (which is opposed to the principle of standardization in the artificial systems)
- According to the natural rules, the idea is to achieve more results with less resources and to interdict monopolization
- The gravitational force is the most important source of energy in nature, followed by solar energy
- Water is the primary solvent in nature; no toxic compositions are used by nature in this respect
- In nature innovations take place in every moment

[1] Pauli G. The blue economy official portal. www.theblueeconomy.org. Visited 30.04.2018

- Natural systems work with locally available resources
- Natural systems evolve from sufficiency to abundance; nothing is consumed more than necessary
- Natural systems have a non-linear and adaptive behavior
- Every natural system is biodegradable sooner or later
- In a natural system everything is connected to everything and the system evolves towards harmony and symbiosis
- Water, air, and soil are considered commons in nature, they should be free of any taxation and are in abundance
- Natural processes generate multiple positive effects
- Risk sharing is a characteristic of natural systems
- Natural systems are efficient, maximizing the results from the use of available material and energy
- In nature, all individual elements search for optimum
- In nature, negative factors are converted into positive factors and problems are converted into opportunities
- A natural system tends towards economies of scope; thus, any natural innovation generates benefits for all."

It is a big challenge to transpose the Blue Economy principles into practical design rules for developing so-called “blue” consumer goods and other “blue-driven” products.

Therefore, it is a huge to consider blue design principles for new product development in a world that loves comfort, personalization and extra-wealth more than a decent living in a balanced and sustainable environment, with reasonable chances to happiness and dignity for every human being. From this perspective, blue design should provide not only products that respect Blue Economy principles and meet the needs, but also inspirational solutions that educate people towards a moderate, highly balanced and responsible living style.

Thus, blue design is one of the means for building the conceptual age; an age of responsible actions, where all people, starting with designers and design engineers, accept the “blue” living style. In practice this cannot simultaneously happen to all industrial areas and to all products.

## 3.3. CASE STUDIES 1 -STONE PAPER

The first example is about stone paper. Blue Economy proposes that we work with what we have in the proximity. "Mines create dumps, quarries have massive dust. Particles in the air increase the risk of respiratory diseases. After 17 years of work, William Liang and his family succeeded in the industrialization of stone paper. In 2016 the total output capacity is 687,000 tons. Considering that this was only 18,000 tons a few years ago, we notice a dramatic growth in paper that is 100% recyclable, forever, that consumes no water in production and frees up land to convert empty forests to biodiverse forests, or use the land to farm food, replenishing the soil. Instead of wood, stone paper makes use of limestone ($CaCO_3$) obtained from existing limestone quarries. The limestone is then pulverised into a fine white chalk powder and mixed with a small amount of high-density polyethylene (HDPE) (Blue Economy, 2014). The production of stone paper has been claimed to require less energy, to be less water intensive and be free of chemicals. As calcium carbonate is readily available as waste in limestone quarries, the use of

this waste material rather than using up raw materials; trees, has made stone paper seem all the more favourable than pulp paper."[2]

## 3.4. CASE STUDIES 2-BLUER HAIR DRYER

The second example is about designing a complex product; that is a "bluer" hair dryer. *In this case, a pregnant focus to design the body of the hair dryer was on following blue design principles:*

- *BD1: Place parts in advance in a way they can go immediately into action when required*
- *BD10:Temporarily connect the system to another one that can be easily removed*
- *BD16: Those systems that interact with the main system have to be homogeneous*
- *BD21: Make the system permeable or add supplementary permeable elements*
- *BD28: Make working conditions such as no need to modify the energy involved.*

This body concept sees the hair dryer as part of a multifunctional bath- equipment. The body concept is illustrated in Figure 1.

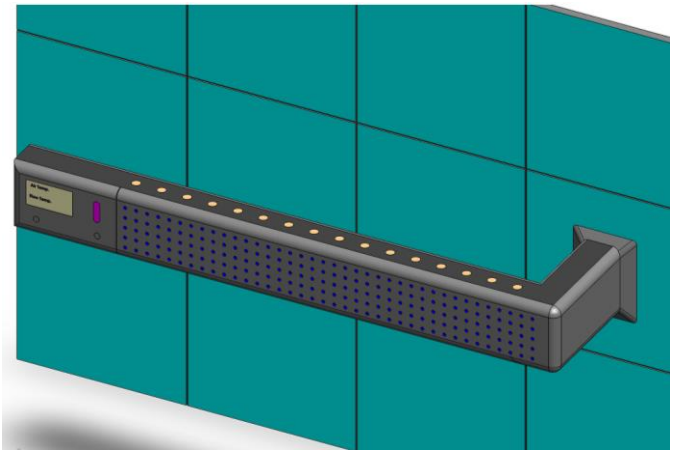

**Figure 1.** The body concept of a bluer hair dryer[3]

The rack in Figure 1 is for hanging wet towels, but it incorporates a dryer, too. The user can let the towel to dry naturally or dry it off and even sterilize it with the dryer function (see the ionizer top holes in Figure 2). To dry the hair, the user just remove the towel from the rack and switch on the hair dryer (see the front holes in Figure 2). "*For the on/off button and for the display panel the organic electronics is considered (see Figure 2). Organic electronics can be locally manufactured. The body solution of the hair dryer is in line with the following blue guidelines:*

- Design the product in a way that will not affect comfort and mood
- Create solutions with leveraging and diversification effects
- Do more functions with less components

[2] http://www.zeri.org/stone-paper.html - visited on 30.04.2018

[3] https://ac.els-cdn.com/S221282711600192X/1-s2.0-S221282711600192X-main.pdf?_tid=a080aead-7b9f-4b1d-95ab-553c62ee28c1&acdnat=1523263082_a430bc680d13b209fb03f232e01aa02c -visited on 30.04.2018

- Do not design the “blue” solution in isolation; make it connected with other systems of the ecosystem and share the risk with the other systems (force the other systems to become “blue”, too).”[4]

"For the other modules of the hair dryer, the design team has studied human and animal reaction to different air temperatures. The design team concluded to keep only one temperature level for hair drying, at an optimum level of 70-90 ˚F or 21-32 ˚C. To heat the air, an infrared (IR) led or a small resistor is considered (seeing that recycled material can be used). To generate the electric energy, a magnetic motor was chosen. Impulse to start motion of the magnetic motor, is done by compressed air. The compressed air is ensured by a micro hydro-turbine that fills an air reservoir (see Figure 2). It is mounted in a hidden niche from the bathroom.

Figure 2. Micro hydro-turbine

*The micro hydro-turbine is actuated each time the toilet is flashed, the shower and the water from the washbasin are used. Compressed air is actually seen as a mean for energy storage. The blue principle “BD9:* use cyclic actions and centrifugal force” was considered for actuation. Idea for introducing a magnetic motor for air heating is inspired from the blue principle “BD22: *instead of an expensive unit use several inexpensive ones, comprising some properties”. The blue design principles “BD1: place parts in advance in a way they can go immediately into action when required” and “BD15: use an intermediary system to do an action” are the sources of inspiration for introducing the micro hydro-turbine. The energy storage and generation is ensured with local resources.*

The concept uses local resources for product manufacturing, which is in line with blue design principle. To build the air tank and micro hydro-turbine recycled materials can be used without any problem. The magnetic motor is very cheap, as well as reliable and, as practice already proved, it can be locally built. In principle, even the use of the compressed air could be removed if the magnetic motor has the power to rotate the mini-fun and feed with electricity the wire of the heating generator. If the product is part of a blue ecosystem, where electric energy is produced with local resources (e.g. biogas, solar panels, heat from the thorium underground, recycled materials, the kinetic energy generated by special floors due to our walking, thorium reactors, wind power, jellyfish, roundup, etc.), the energy can be supplied from the local power system. If we impose that any solution to have a correspondence in the nature, the conclusion is that nature works in most of the cases by means of chemical reactions through organic structures or by means of large and very large scale ecosystems. Thus, generation of heat, electric

[4] Brad S. et al. TRIZ to support blue design of products. Procedia CIRP, 39 (2016), 125-131, 2016.

current or air streams in a tiny space by replicating solutions from the natural systems is not reliable today. But it might be possible to design and build systems that collect and store electric energy, heat and even compressed air from the nature. The stored resources can be further accessed by various product units when it is necessary."[5]

## 3.5. EXERCISE 1

Exercise 1 : Use blue economy principles to find strong and weak points in your company.

Working in small groups, based on a production flow identified by each group, applying the blue economy principles, identify whether the waste resulting from the production process of your company can become raw material for other products or create new jobs.

Each group will have to perform a SWOT-analysis.


## 3.6. EXERCISE 2

Exercise 2 : Using the Blue-design principles and guidelines, try to design a new product.

1. **Design :**
   a. Define material flows:
   b. Choose one or more materials in your product.
   c. Design the product in a way that will not affect comfort and mood.
   d. Create solutions with leveraging and diversification effects.
   e. Do more functions with less components.

[5] Brad S. et al. TRIZ to support blue design of products. Procedia CIRP, 39 (2016), 125-131, 2016.

f. Do not design the "blue" solution in isolation; make it connected with other systems of the ecosystem and share the risk with the other systems.

g. Design the solution using at maximum possible local resources (materials, technologies, etc.)

2. **Manufacture :**

*a.* Use gravity and/or solar energy as driving sources.

*b.* Avoid the use of toxic materials and exploit rapid renewable natural materials.

*c.* Manufacture the product considering biodegradable materials (where natural materials are not available/accessible, not technically possible or fewer).

*d.* Conceive the solution of manufacture such as to make easy replaceable any element, when a new one, more advanced is available.

*e.* **Conceive the solution such as to be easy, fast and cost-effective scalable.**

*3.* **Use :**

a. Does your product can be connected with other systems of the ecosystem and share the risk with the other systems?

b. Can the product be down - or upcycled and for what cost?

4. **End of life:**

Make a list of what kind of materials can be recycled

# 4. QUESTIONS & ANSWERS

## 4.1. QUIZ – QUESTIONS

1. What is blue economy?

Introducing innovations inspired by nature

Offering more with less and living in harmony with nature

Respond to basic needs with what you have, generating multiple benefits, including jobs and social capital.

2. `What is the vision of Blue Economy?`

Using resources in a cascade system: the waste resulting from the consumption of a product, becoming the raw material for cash flow.

Opposite to green economy.

I don't know

3. Do you consider Blue Economy is an alternative to Green Economy?

   Yes

   No

   I don't know

4. What is the philosophy of blue design?

   Design blue components

   I don't know

   A "gray" component is not replaced by a "green" component, but rather by a novel system that does not rely on that component.

5. Is Blue Economy a solution to the crisis?

   Yes, it should be

   No, is not necessary

   I do not know

## 4.2. QUIZ – SOLUTIONS

1. What is blue economy?

   x Introducing innovations inspired by nature

   x Offering more with less and living in harmony with nature

   x Respond to basic needs with what you have, generating multiple benefits, including jobs and social capital.

2. What is the vision of Blue Economy?

   x Using resources in a cascade system: the waste resulting from the consumption of a product, becoming the raw material for cash flow.

   Opposite to green economy.

I don't know

3. Do you consider Blue Economy is an alternative to Green Economy?

x Yes

No

I don't know

4. What is the philosophy of blue design?

Design blue components

I don't know

x A "gray" component is not replaced by a "green" component, but rather by a novel system that does not rely on that component.

5. Is Blue Economy a solution to the crisis?

x Yes, it should be

No, is not necessary

I do not know

## 5. GLOSSARY

- **Bio-based material:** ""Bio-"is Greek for life. Bio-based material refers to a products main constituent consisting of a substance, or substances, originally derived from living organisms. These substances may be natural or synthesized organic compounds that exist in nature. This definition could include natural materials such as leather and wood, but typically refers to modern materials. Many of the modern innovations use bio-based materials to create products that biodegrade. Some examples are: cornstarch, derived from a grain and now being used in the creation of packaging pellets; bio-plastics created with soybean oil, now being used in the creation of many modern products like tractors, water bottles, and take away cutlery." [6] **Biodegradable material**: "A material which microorganisms can break down into natural elements (i.e. water, biomass, etc.)."[7]
- **Biological metabolism** - The natural processes of ecosystems are a biological metabolism, making safe and healthy use of materials in cycles of abundance[8]
- **Biological Nutrient** - A material used by living organisms or cells to carry on life processes such as growth, cell division, synthesis of carbohydrates and other complex functions. Biological Nutrients are materials that can biodegrade safely and return to the soil to feed environmental processes[9]
- **Cascading**: see MOVECO fact sheet "Circular Economy: Terms & Definitions"
- **Compostable material**: "Materials that can be disposed with biological materials and decay into nutrient-rich material."[10] **Circular economy** - regenerative economy in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing energy and material loops
- **Cradle-to-Cradle®:** see MOVECO fact sheet "Supporting Tools for a Circular Economy"
- **Cradle to Grave** – "A Cradle to Grave system is a linear model for materials that begins with resource extraction, moves to product manufacturing, and, ends with a "grave" – when the product is disposed of in a landfill or incinerator"[11]
- **Decision** – "shall be binding in its entirety. A decision which specifies those to whom it is addressed shall be binding only on them"[12]
- **Directive** – "shall be binding, as to the result to be achieved, upon each Member State to which it is addressed, but shall leave to the national authorities the choice of form and methods"[13]

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[6] https://sustainabilitydictionary.com/2006/02/17/bio-based-material/ (26.03.2018) // "A material that is partially, or entirely made of biomass." https://www.ceguide.org/Glossary (26.03.2018)
[7] https://www.ceguide.org/Glossary (26.03.2018)
[8] Cradle to Cradle terminology – MBDC-http://www.c2cproducts.com/detail.aspx?linkid=1&sublink=26
[9] Cradle to Cradle terminology – MBDC-http://www.c2cproducts.com/detail.aspx?linkid=1&sublink=26
[10] https://www.ceguide.org/Glossary (26.03.2018)
[11] Cradle to Cradle terminology – MBDC-http://www.c2cproducts.com/detail.aspx?linkid=1&sublink=26
[12] European Network of Environmental law Organizations 2012 Implementation of the Waste Framework Directive in the EU Member States

- **Down-cycle** - to recycle (something) in such a way that the resulting product is of a lower value than the original item : to create an object of lesser value from (a discarded object of higher value)[14] see: MOVECO fact sheet "Circular Economy: Terms & Definitions"
- **Eco-Effectiveness** – "The central strategy in the cradle-to-cradle development method and seeks to create industrial systems that emulate healthy natural systems. The central principle of eco-effectiveness is that "waste equals food." The concept was developed in response to some of the perceived limitations of eco-efficiency which critics claim only slow down the rate of environmental depletion and don't reverse the production of unused or non-recycled waste".[15]
- **Eco efficiency** – "Management philosophy that aims at minimizing ecological damage while maximizing efficiency of the firm's production processes, such as through the lesser use of energy, material, and water, more recycling, and elimination of hazardous emissions or by-products."[16]
- **Ecological sustainability** – "a bio-centric school of sustainability thinking that, based on ecology and living systems principles, focuses on the capacity of ecosystems to maintain their essential functions and processes, and retain their biodiversity in full measure over the long-term contrasts with technological sustainability based on technical and engineering approaches to sustainability"[17]
- **Ecosystem** - the interactive system of living things and their non-living habitat[18]
- **Ecosystem redesign** - a coherent framework for redesigning our landscapes, buildings, cities, and systems of energy, water, food, manufacturing and waste through the effective adaptation to and integration with nature's processes[19]
- **Energy efficiency**: "Energy efficiency improvements refer to a reduction in the energy used for a given service (heating, lighting, etc.) or level of activity. The reduction in the energy consumption is usually associated with technological changes, but not always since it can also result from better organization and management or behavioral changes ("non-technical factors")."[20]
- **Energetic use**: incineration of waste material that includes the use of the generated heat and energy for other processes

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[13] European Network of Environmental law Organisations 2012 Implementation of the Waste Framework Directive in the EU Member States

[14] Merriam Webster dictionary

[15] https://sustainabilitydictionary.com/2005/12/03/eco-effectiveness/visited 26/02/2018

[16] http://www.businessdictionary.com/definition/eco-efficiency.html -visited 01.03.2018

[17] Orr D (1992) Ecological literacy: education and the transition to a post-modern world. State University of New York Press, Albany.

[18] Tansley AG (1935) The use and abuse of vegetational concepts and terms. Ecology 16:284–307 doi:10.2307/1930070

[19] with adaptations from https://www.researchgate.net/publication/301966198_Regenerative_Development_regenerative_development_and_Design (26.06.2018)

[20] https://hub.globalccsinstitute.com/publications/energy-efficiency-recipe-success/definition-and-scope-energy-efficiency (26.03.2018)

- **(Final) disposal**: see MOVECO fact sheet "Circular Economy: Terms & Definitions"
- **Incineration**: Waste destruction in a furnace by controlled burning at high temperatures. Incineration removes water from hazardous sludge, reduces its mass and/or volume, and converts it to a non-burnable ash that can be safely disposed of on land, in some waters, or in underground pits. However, it is a highly contentious method because incomplete incineration can produce carbon monoxide gas, gaseous dioxins, and/or other harmful substances.[21]
- **Innovation** - production or adoption, assimilation, and exploitation of a value-added novelty in economic and social areas[22]
- **Landfilling**: "The disposal and burying of solid waste. The degradation of the waste results in the creation of local air and water pollution."[23]
- **Lean production** - approach to management that focuses on cutting out waste, whilst ensuring quality[24]
- **Life-cycle** - series of stages in form and functional activity through which a system passes between successive recurrences of a specified primary stage[25]
- **Life-cycle analysis**: see MOVECO fact sheet "Supporting Tools for a Circular Economy"
- **Life-time** - the duration of the existence of a given particular system[26]
- **Locational patterns** - the patterns that depict the distinctive character and potential of a place and provide a dynamic mapping for designing human structures and systems that align with the living systems of a place[27]
- **Negative externality** - occurs when production and/or consumption imposes external costs on third parties outside of the market for which no appropriate compensation is paid[28]
- **Optimization** - finding an alternative with the most cost effective or highest achievable performance under the given constraints, by maximizing desired factors and minimizing undesired ones[29]
- **Permaculture** - a system of agricultural and social design principles centered around simulating or directly utilizing the patterns and features observed in natural ecosystems[30]
- **Place** - the unique, multi-layered network of ecosystems within a geographic region that results from the complex interactions through time of the natural ecology (climate, mineral and other deposits, soil, vegetation, water and wildlife, etc.) and culture (distinctive customs,

[21] http://www.businessdictionary.com/definition/incineration.html (27.06.2018)
[22] with adaptations from http://www.ericshaver.com/the-many-definitions-of-innovation/ (27.06.2018)
[23] https://www.ceguide.org/Glossary (26.03.2018)
[24] with adaptations from https://www.tutor2u.net/business/reference/introduction-to-lean-production (27.06.2018)
[25] https://www.merriam-webster.com/dictionary/life%20cycle (26.06.2018)
[26] With adaptations from https://en.wikipedia.org/wiki/Lifetime (26.06.2018)
[27] https://www.researchgate.net/publication/273379786_Regenerative_Development_and_Design (25.06.2018)
[28] with adaptations from https://www.economicshelp.org/micro-economic-essays/marketfailure/negative-externality/ (26.06.2018)
[29] http://www.businessdictionary.com/definition/optimization.html (26.06.2018)
[30] https://en.wikipedia.org/wiki/Permaculture (27.06.2018)

expressions of values, economic activities, forms of association, ideas for education, traditions, etc.)[31]

- **Recommendations and opinions** - shall have no binding force [32]
- **Recycling:** see MOVECO fact sheet "Circular Economy: Terms & Definitions"
- **Refurbishment:** "The refurbishment of something is the act or process of cleaning it, decorating it, and providing it with new equipment or facilities."[33]
- **Regenerative design** - a system of technologies and strategies, based on an understanding of the inner working of ecosystems that generates designs to regenerate rather than deplete underlying life support systems and resources within socio-ecological wholes[34]
- **Regenerative development** - a system of technologies and strategies for generating the patterned whole system understanding of a place, and developing the strategic systemic thinking capacities, and the stakeholder engagement/commitment required to ensure regenerative design processes to achieve maximum systemic leverage and support, that is self-organizing and self-evolving[35]
- **Regulation** - shall have general application. It shall be binding in its entirety and directly applicable in all Member States. – Source - Article 288 TFEU, [36]
- **Remanufacturing:** "The process of cleaning and repairing used products and parts to be used again for replacements."[37]
- **Restorative design** - sometimes called restorative environmental design; a design system that combines returning polluted, degraded or damaged sites back to a state of acceptable health through human intervention[38]
- **Resource efficiency**: "A percentage of the total resources consumed that make up the final product or service."[39] re-use: see MOVECO fact sheet "Circular Economy: Terms & Definitions"
- **Secondary resource/ secondary raw materials:** "Waste materials that are recovered, recycled and reprocessed for use as raw materials."[40]
- **Servitization** - refers to industries using their products to sell "outcome as a service" rather than a one-off sale[41]
- **Source to sink** - simple linear flows from resource sources (farms, mines, forests, watershed, oilfields, etc.) to sinks (air, water, land) that deplete global sources and overload/pollute global sinks[42]

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[31] https://www.researchgate.net/publication/273379786_Regenerative_Development_and_Design (25.06.2018)
[32] http://eur-lex.europa.eu/summary/chapter/environment.html?root_default=SUM_1_CODED%3D20,SUM_2_CODED%3D2003&locale=en
[33] https://www.collinsdictionary.com/de/worterbuch/englisch/refurbishment (26.03.2018)
[34] Mang, Pamela & Reed, Bill. (2017). Update Regenerative Development and Design 2nd edition.
[35] https://www.sciencedirect.com/science/article/pii/S2212609015300327 (26.06.2018)
[36] http://eur-lex.europa.eu/legal-content/en/TXT/HTML/?uri=CELEX:12016E288
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[41] https://www.k3syspro.com/servitization/ (24.06.2018)

- **Stewardship** - ethic of companies, organizations and individuals that embodies the responsible planning and management of resources[43]
- **Sourcing:** "the act of getting something, especially products or materials, from a particular place"[44]
- **System thinking** - holistic approach of analysis and planning that focuses on the way the parts of a system interrelate each other and how systems work over time and within the context of larger systems[45]
- **Technical metabolism** - "Modelled on natural systems, the technical metabolism is MBDC's term for the processes of human industry that maintain and perpetually reuse valuable synthetic and mineral materials in closed loops"[46]
- **Technical nutrient** – "A material that remains in a closed-loop system of manufacture, reuse, and recovery called the technical metabolism, maintaining its value through infinite product life cycles "[47]
- **Upcycle** – "to recycle (something) in such a way that the resulting product is of a higher value than the original item: to create an object of greater value from (a discarded object of lesser value)"[48]
- **Upcycling**: see MOVECO fact sheet "Circular Economy: Terms & Definitions"
- **Waste**: see MOVECO fact sheet "Circular Economy: Terms & Definitions"

More: https://www.ceguide.org/Glossary

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https://youtu.be/1af08PSlaIs - visited on 30.04.2018

2. Marc Heddes. Stone paper.

https://youtu.be/ykVIkXyq9hQ and https://youtu.be/oEmv0sRFlu8 -visited on 30.04.2018

## Picture Credits

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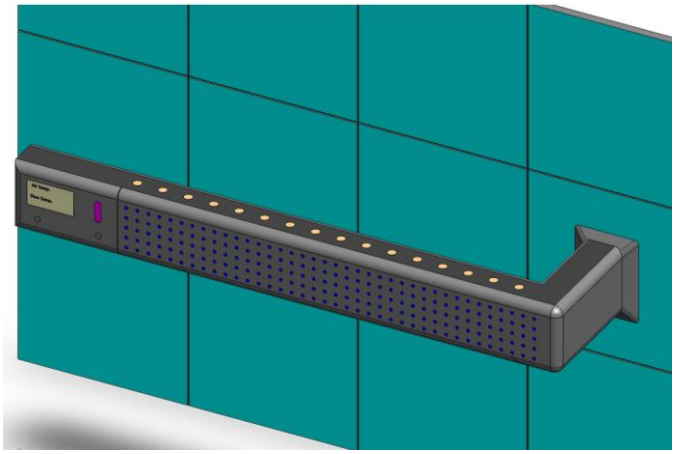

**Page 5: Figure 2.** The body concept of a bluer hair dryer[49]

**Page 6: Figure 3.** Micro hydro-turbine

[49] https://ac.els-cdn.com/S221282711600192X/1-s2.0-S221282711600192X-main.pdf?_tid=a080aead-7b9f-4b1d-95ab-553c62ee28c1&acdnat=1523263082_a430bc680d13b209fb03f232e01aa02c visited on 30.04.2018

# 7. IMPRINT

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