Challenges for (Baltic) peat Industry, part 3

The hidden secrets of reporting peat's climate impact

Tallinn I 10. IIIV 2023

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Preface

In the beginning Man created the Industry and the Statistical System to describe that. And the system was without form, and purpose; and darkness was upon the face of our mind.

System

Statistics is a numeric description of „things“, i.e., a simplified mathematical model describing different aspects of life. When it comes to peat, the models describing peat’s climate impact, which has become a fundamental question, are simplified to the level; they no longer describe the actual life.

Reality

NATURE is the basis of all models. Most complicated but also the most precise. In the case of nature, it is not our wishes or opinions that count but the laws of nature, especially chemistry. Nature is brutally honest. It has no worldview preferences. Luckily, it seems to be in favour of peat.

Why peat's chemistry is essential, and what does peat consist of?

Peat

The chemical properties of peat include elemental composition, organic components, and ash. The five basic elements of peat are C, H, O, N and S. The elemental properties of peat are generally between that of wood and coal.

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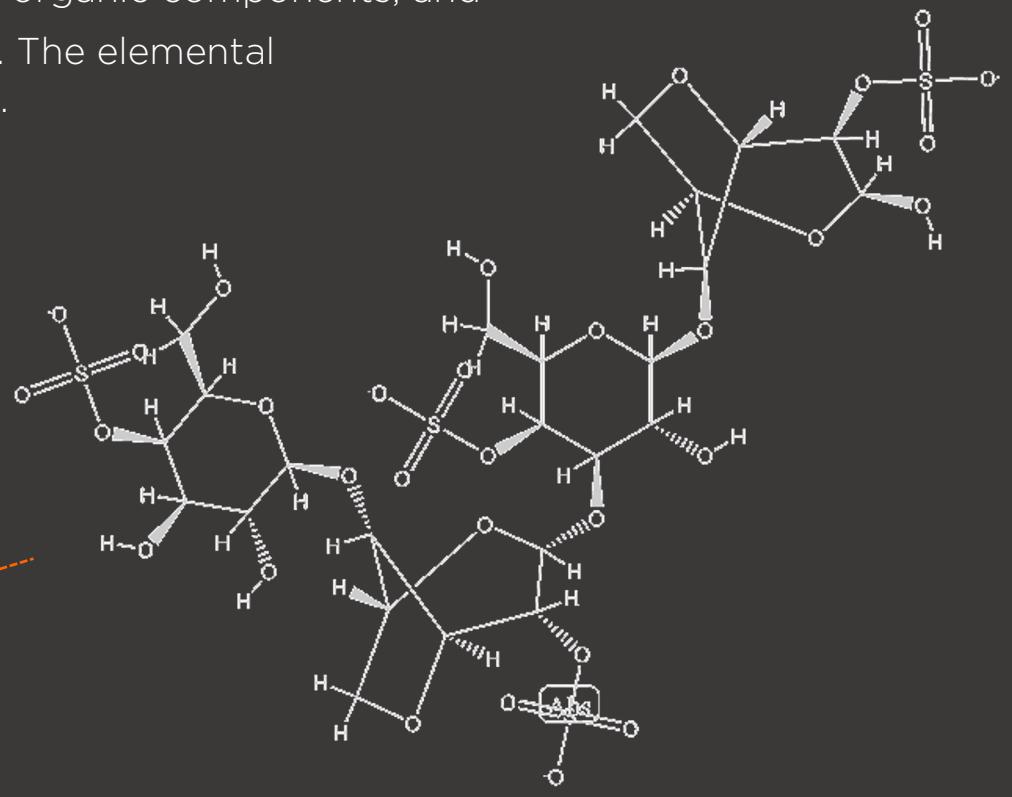
Element composition is important,
but molecules matter.

Very complicated, but essential to pay attention, peat consists, to a large extent, of very complex molecules like sugars, cellulose, hemicellulose, lignin etc.



Process

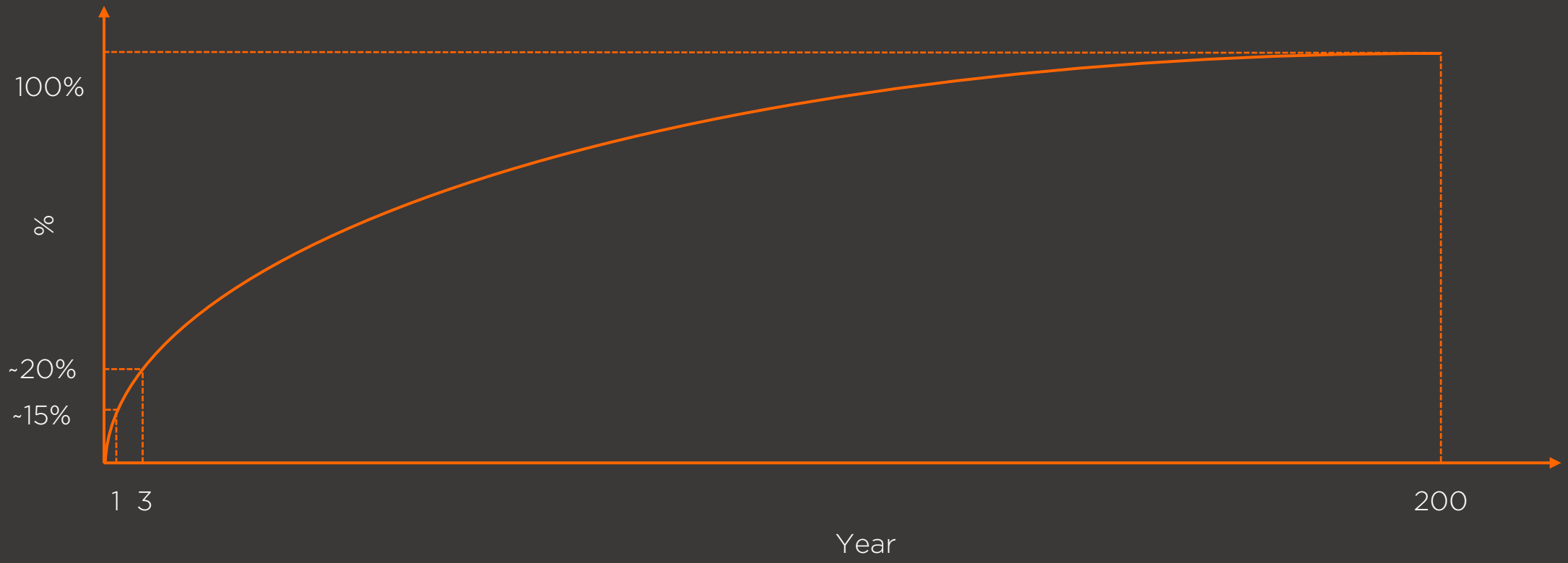
Peat is decomposing constantly. In aerobic conditions, faster, anaerobic, slower. Simply put, it is mostly a biochemical process where different enzymes produced by fungi, bacteria or arches break down complex hydrocarbons from which different plant parts are formed. In first-order sugars, last lignin.

As a result, different new compounds were formed, including gaseous CO_2 and CH_4. Quite the same as how yeast eats sugar, and as a result, alcohol and CO_2 are produced. Some carbon is also lost by DOC (dissolved organic carbon) with water in the form of different C-containing humic and fulvic substances.

After producing fresh biomass, the organic compounds that decompose faster decompose practically immediately – within a few months or years. Despite the anaerobic environment slowing down all decomposition, then already during its formation, peat is in larger proportion formed by those parts of the plant that are formed from chemically more stable compounds. Therefore, it takes time for peat to decompose even if exposed to the air. And even then, not all material decomposes nor forms gases or DOCs. For example, one solid compound is humus, which remains in the soil.

Time

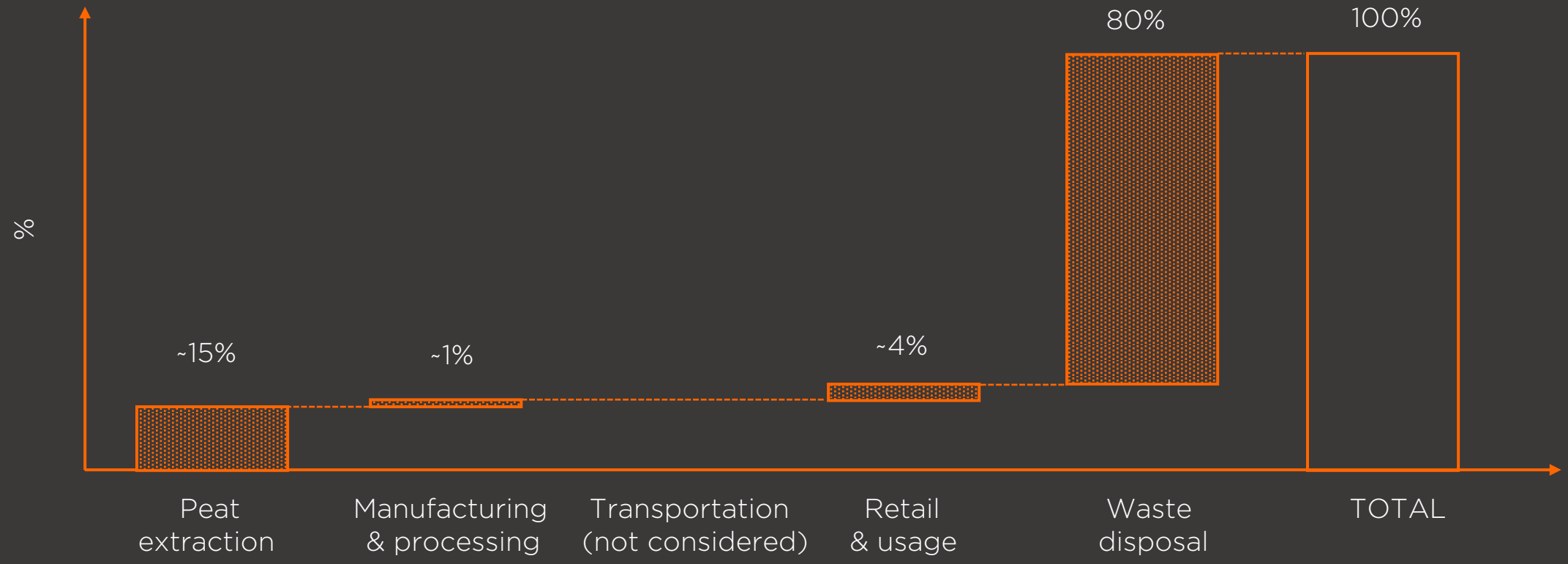
Principle distribution of peat emissions in time



NB! The numbers provided are estimates

Stages

Principle distribution of emission between stages



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Learnings

There are three critical learnings from the above:

1. Decomposition of biomass, especially in the case of peat, takes time. Often, a lot of time.

2. During the peat decomposition, CO_2, CH_4 etc., cannot be formed several times or in larger quantities than there is carbon in the peat.

3. Not all the carbon compounds in peat are decomposing to gaseous compounds or DOC. Some remain in solid form.

Model 1

NIR is a national inventory report based on the UN's common reporting format (CRF) of all Parties (2006). The NIRs contain detailed descriptive and numerical information, and the CRF tables contain all greenhouse gas (GHG) emissions and removals, implied emission factors and activity data.

Peat-related emissions and removals are reported by IPCC Wetland Supplement (2013), excl. emissions resulting from the consumption of energy peat. Wetland Supplement is voluntary until 2025. After that becomes obligatory.

Theory

NIRs are composed according to TACCC principles:

Transparency – assumptions and methodology are clearly presented; necessary documentation is available

Accuracy - uncertainty must be reduced as much as possible, appropriate methodologies must be used according to the IPCC guidelines

Consistency - throughout the entire time series same methodology must be used, to estimate emissions consistent dataset is needed

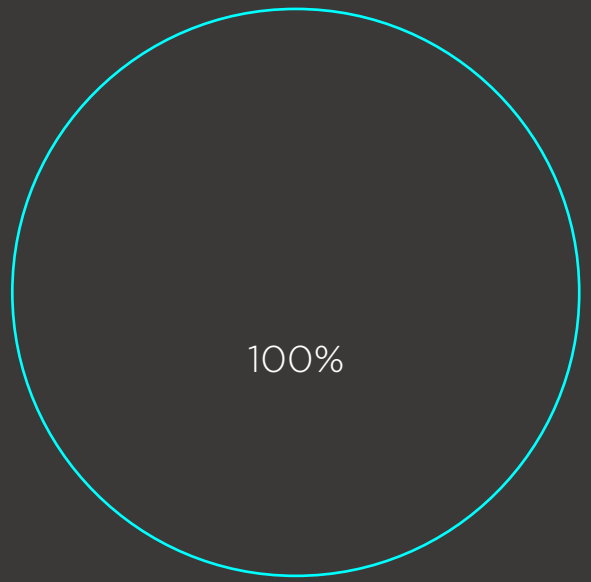
Comparability - data must be comparable between countries, methodology and format must be according to COP decisions, GHG sources and sinks according to IPCC 2006 methodology

Completeness – all gases and sources/sinks are reported within the entire country

All NIRs are audited every year 2 to 3 times alternately based on seven principles by different Parties. Non-conformities must be eliminated.

Reality

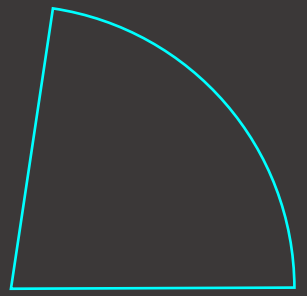
Number of countries



100%

195

Countries submitting NIR (2023)



22%

43 + EU

Submitting data about peat harvesting

9%

Belorussia, Canada, Denmark, Estonia, Finland, Germany, Hungary, Ireland, Latvia, Lithuania, Norway, Poland, Russia, Spain, Sweden, Turkey, UK, Ukraine, USA

18

Submitting peat data clearly and logically

3%

Estonia, Finland, Latvia, Norway, Russia, Ukraine

6

https://unfccc.int/ghg-inventories-annex-i-parties/2023

Learning

Compared with TACCC principles:

Transparency – assumptions and methodology are not often clearly presented; necessary documentation is often missing or incomplete

Accuracy – many uncertainties; most countries use IPCC 2006 default values, but we know that understanding of emissions dynamics and measurement accuracy were poor.

Consistency – mostly met.

Comparability – on-site and off-site emissions are reported very differently; often, they are not separated. For example, based on NIRs, in most cases, we can't say how much peat is produced in a specific country in a specific year, but we should.

Completeness – all gases and sources/sinks are not reported within the entire country. Peatland restoration is taken into account only in Russia and Malta.

Reminder - all NIRs are audited 2 to 3 times annually based on seven principles by different Parties. Non-conformities must be eliminated.

Mismatches

Horticultural peat-related climate impact is not estimated through the emission but trough the removal! In other words, removed carbon from the Earth's Crust in the form of peat, not the carbon in the composition of different gases emitted into the air.

Air dry peat's carbon content varies in different NIRs between 50% (Germany) to 100% (Denmark). Mostly between 66-85%. In Estonia, 66%. According to more than 100 years (including very recent ones) studies, it is at least in Estonia, average about 49%!

On top of the above, peat is expected to fully oxidize immediately after being produced, the so-called - instant oxidation principle. Clearly, it is not the case.

Evidently the IPCC method is highly simplistic and does not correspond to reality.

Model 2

LCA is a circular production model. Whatever the economic model, an LCA is a tool for identifying or comparing the environmental impacts of a product or industrial activity by quantifying all material flows and assessing how materials interact with the natural environment.

In our case, we talk about peat; so far best we have is GME's LCA tool.

https://ecochain.com/knowledge/life-cycle-assessment-lca-guide/

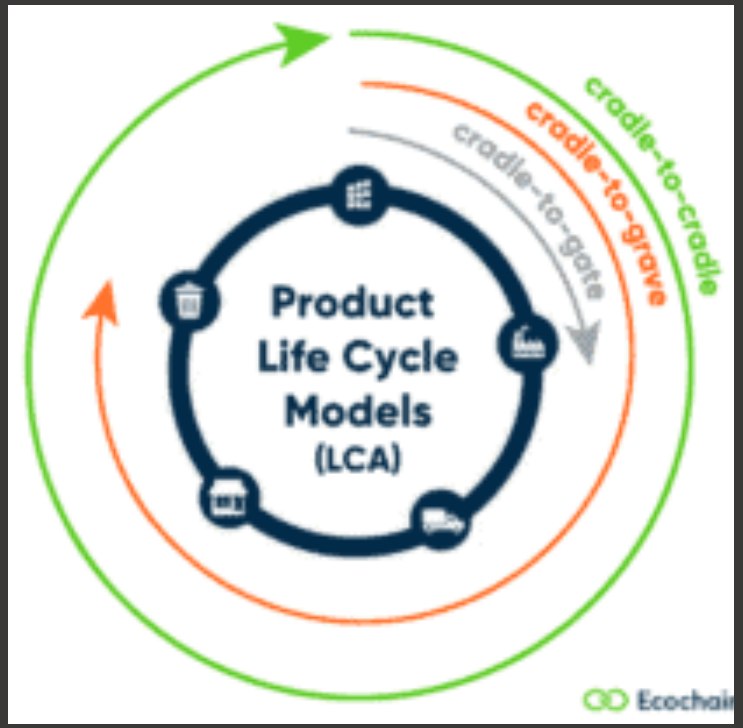
Theory

There are different principles for modelling products lifecycle (mentioning some):

Gradle-to-grave - product's impact is analyzed along the 5 product lifecycle steps. Cradle is the product's inception with the sourcing of the raw materials, grave being the disposal of the product.

Cradle-to-cradle – a concept often referred to within the Circular Economy. It is a variation of cradle-to-grave, exchanging the waste stage with a recycling process that makes it reusable for another product, essentially "closing the loop" – also called closed-loop recycling.

Cradle-to-gate - only assesses a product until it leaves the factory gates before it is transported to the consumer. This means cutting out the use and disposal phase. Gate-to-gate is sometimes used in product life cycles with many value-adding processes in the middle. Cradle-to-gate assessments are often used for environmental product declarations (EPD). EPD is standardized certification of a life cycle assessment, mainly used to verify impact data from business to business.



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Theory

Product life cycle from Cradle To Grave consists five phases:

Raw Material Extraction

Manufacturing & Processing

Transportation

Usage & Retail

Waste Disposal

Theory

Stages and principles of LCA preparation, which deserve to be highlighted in case of peat:

A Life Cycle Assessment Consists Of 4 Phases:

Definition of Goal and Scope
Inventory Analysis
Impact Assessment

Interpretation

Definition of Goal and Scope - define what exactly we want to analyze – and how deep we want to go with our analysis. Defining our goal and scope serves very important functions (presented rhetorically):

- What system will we be assessing in? Chosen system defines our product life cycle, and the implications we will be analyzing.
- What Will We Not Be Assessing? The value chain can go very deep.

Learnings

When it comes to peat in the composition of substrate, only Raw Material Extraction and Waste Disposal genuinely matter.

Despite the preparation of LCA models being standardized and should be done according to agreed principles, there is much more room for decision.

Both NIRs and LCAs often rely on the same data, even if presented differently.

Mismatches

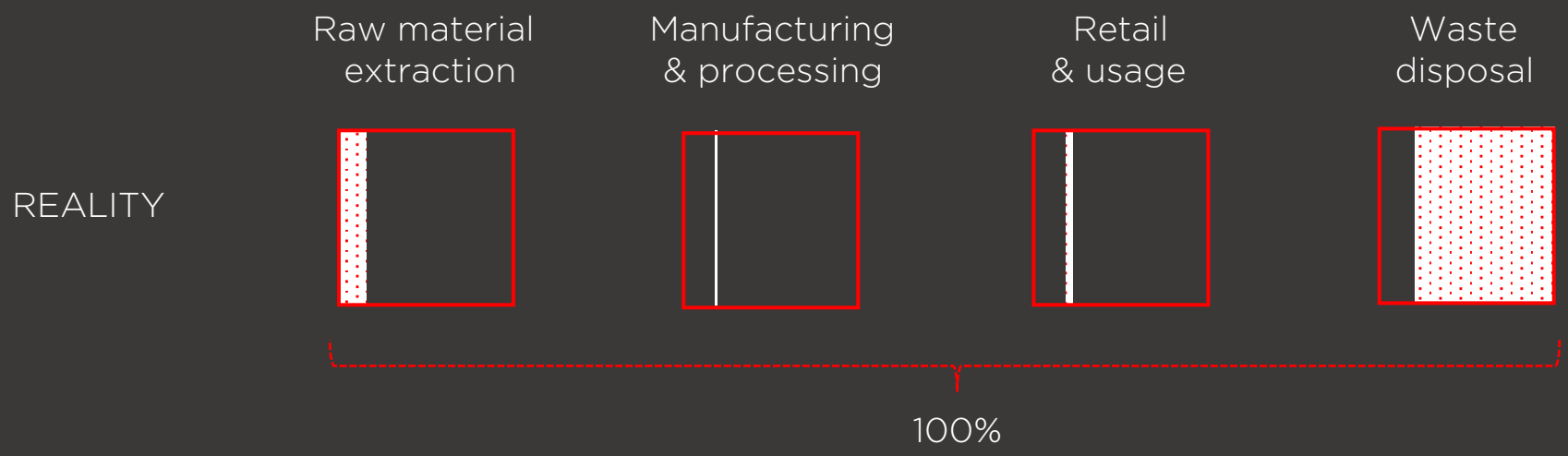
Horticultural peat-related climate impact is not considering the actual behaviour of the peat as it should! After-use practices are not appropriately considered. In most cases, the principles of the circular economy are already (unknowingly?) applied to substrates.

Peat is expected to fully oxidize immediately after being used. Clearly, it is also not the case.

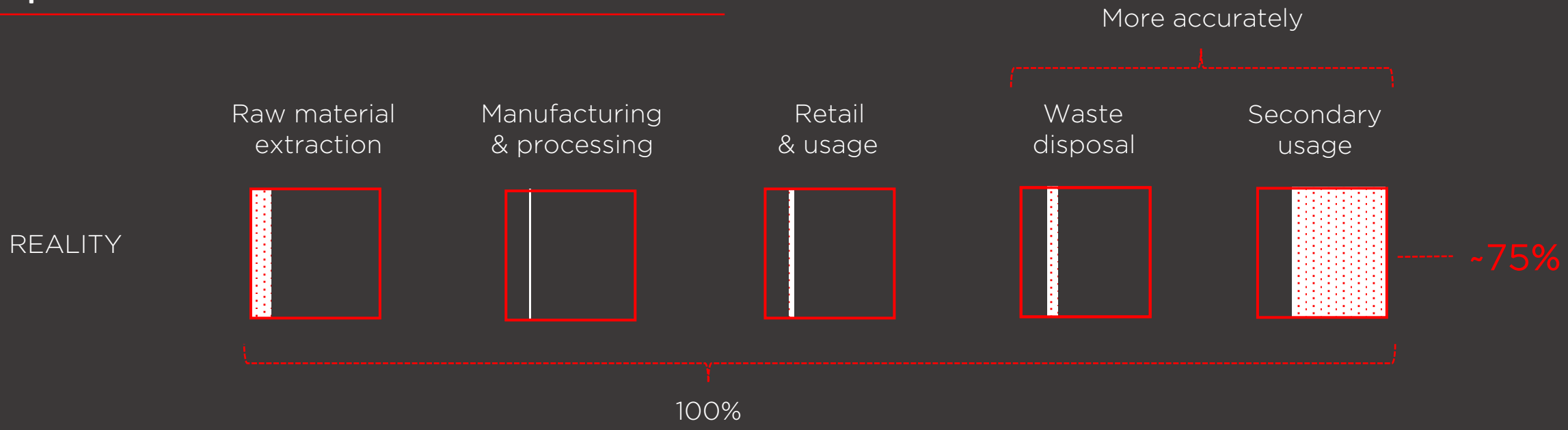
The GME LCA method is also simplistic and does not correspond to reality when it comes to peat.

In defence of the model, however, it must be mentioned peat is too complex to be described correctly with simple and standard models. Delineating the impact of peat use is much more complicated than with most other products. However, the peculiarities of peat should have been taken into account more. At present, it is like a dangerous tool that came without instruction, as users are not explained what one or another approach means.

Comparison

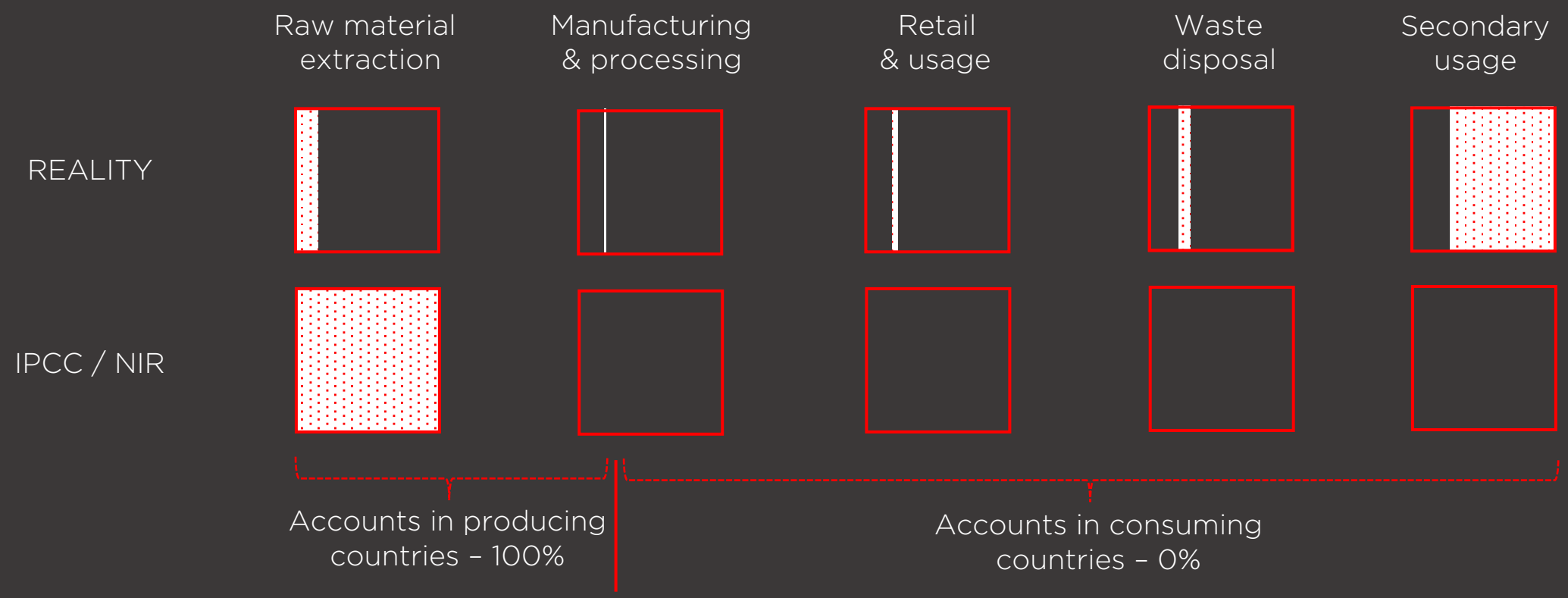

Raw material extraction
Manufacturing & processing
Retail & usage
Waste disposal
REALITY
100%
- CO_2 emission

Comparison

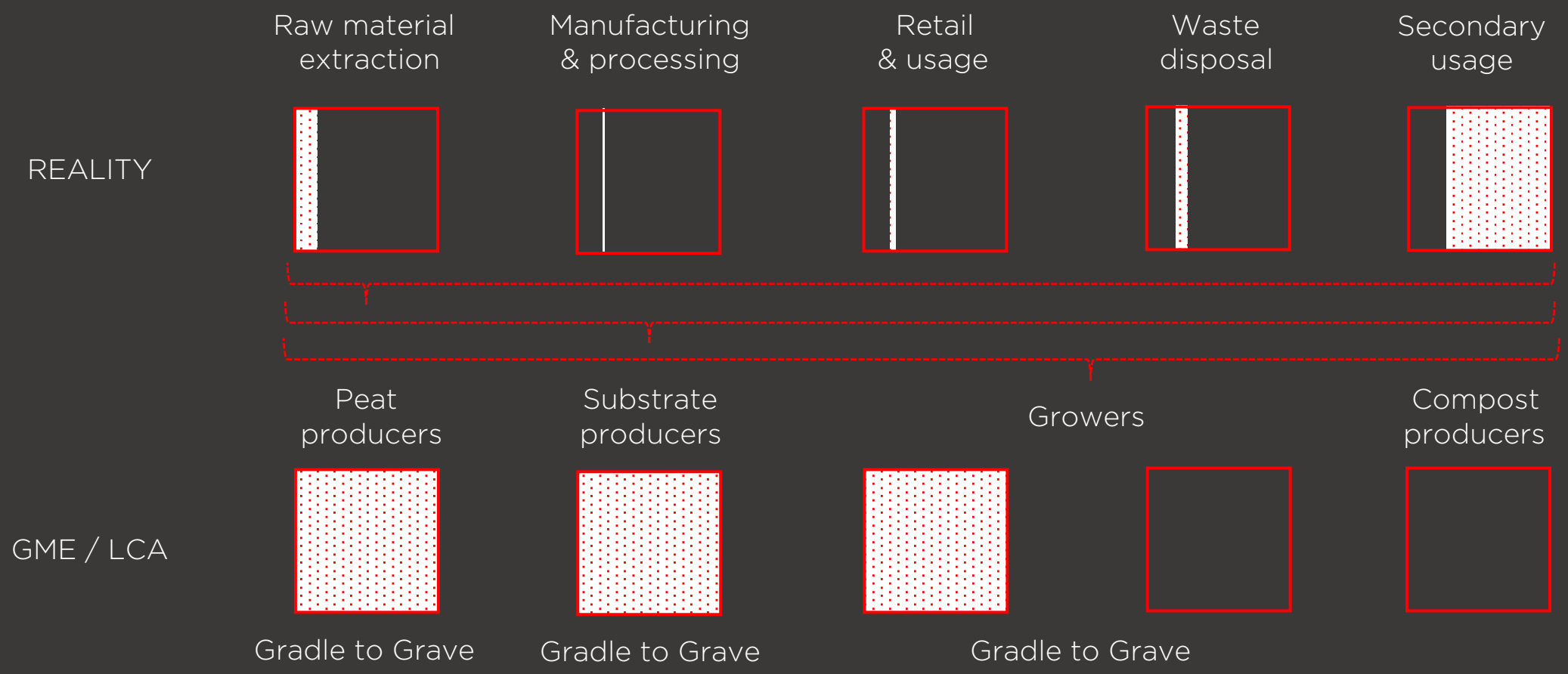


NB! The numbers provided are rough estimates

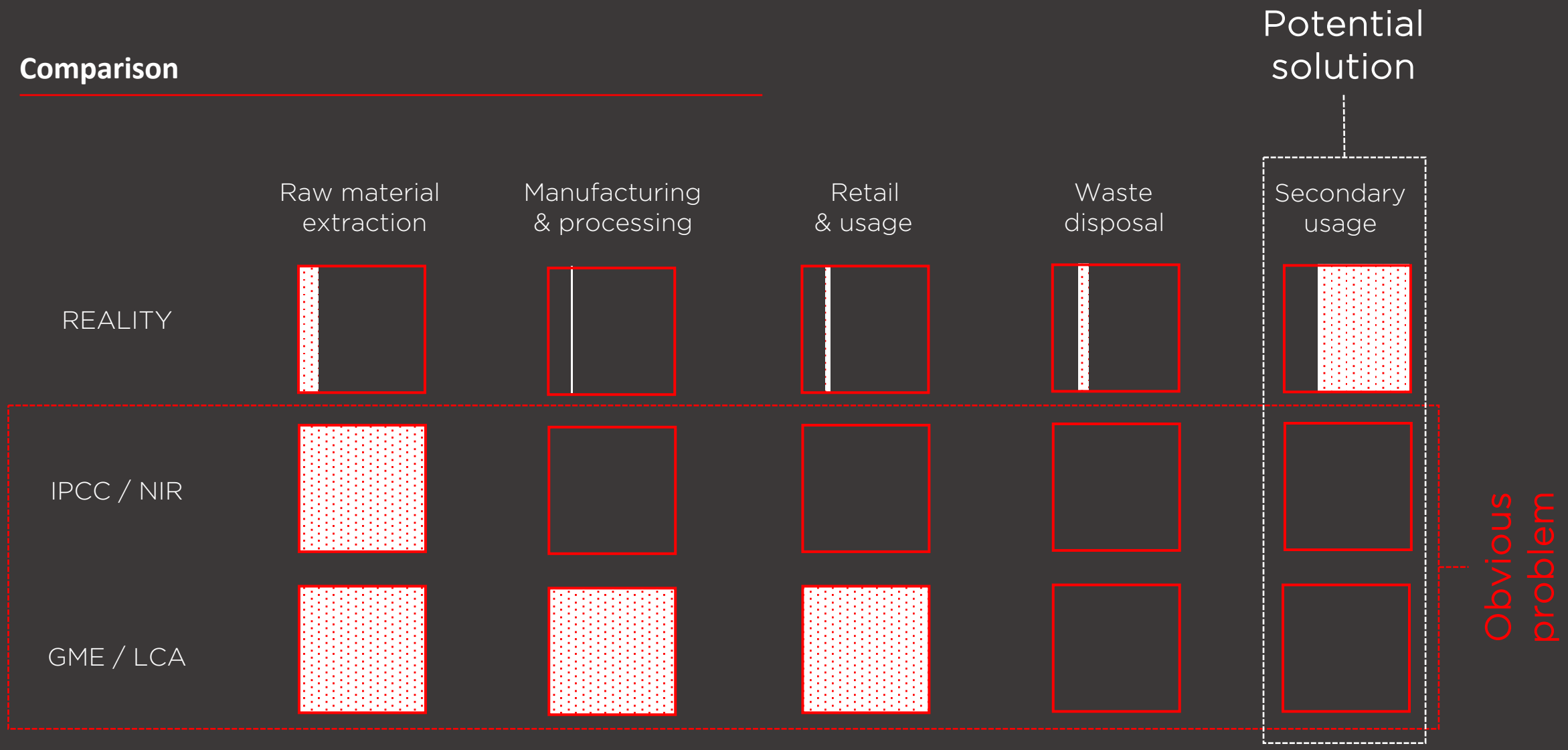
Comparison


Raw material extraction
Manufacturing & processing
Retail & usage
Waste disposal
Secondary usage
REALITY
IPCC / NIR
Accounts in producing countries – 100%
Accounts in consuming countries – 0%

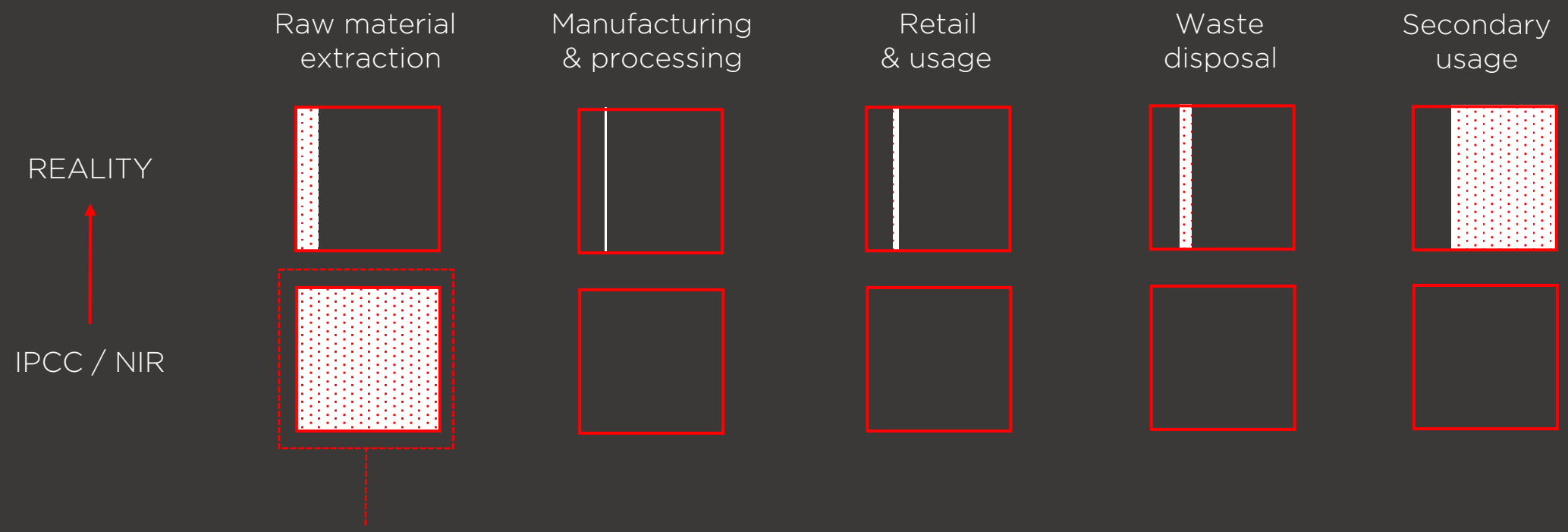
Comparison


Raw material extraction
Manufacturing & processing
Retail & usage
Waste disposal
Secondary usage
REALITY
Peat producers
Substrate producers
Growers
Compost producers
GME / LCA
Gradle to Grave
Gradle to Grave
Gradle to Grave

Comparison

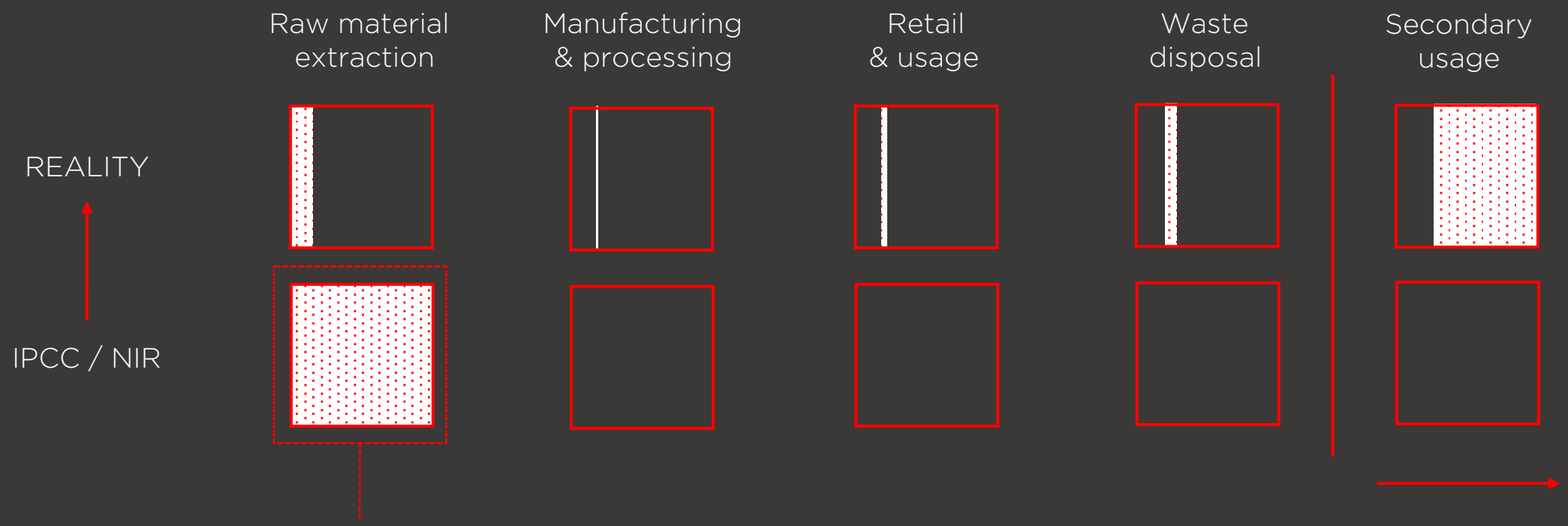

Potential solution
Raw material extraction
Manufacturing & processing
Retail & usage
Waste disposal
Secondary usage
REALITY
IPCC / NIR
GME / LCA
Obvious problem

Comparison



Complicated problem, as peat emissions are accounted as removals.

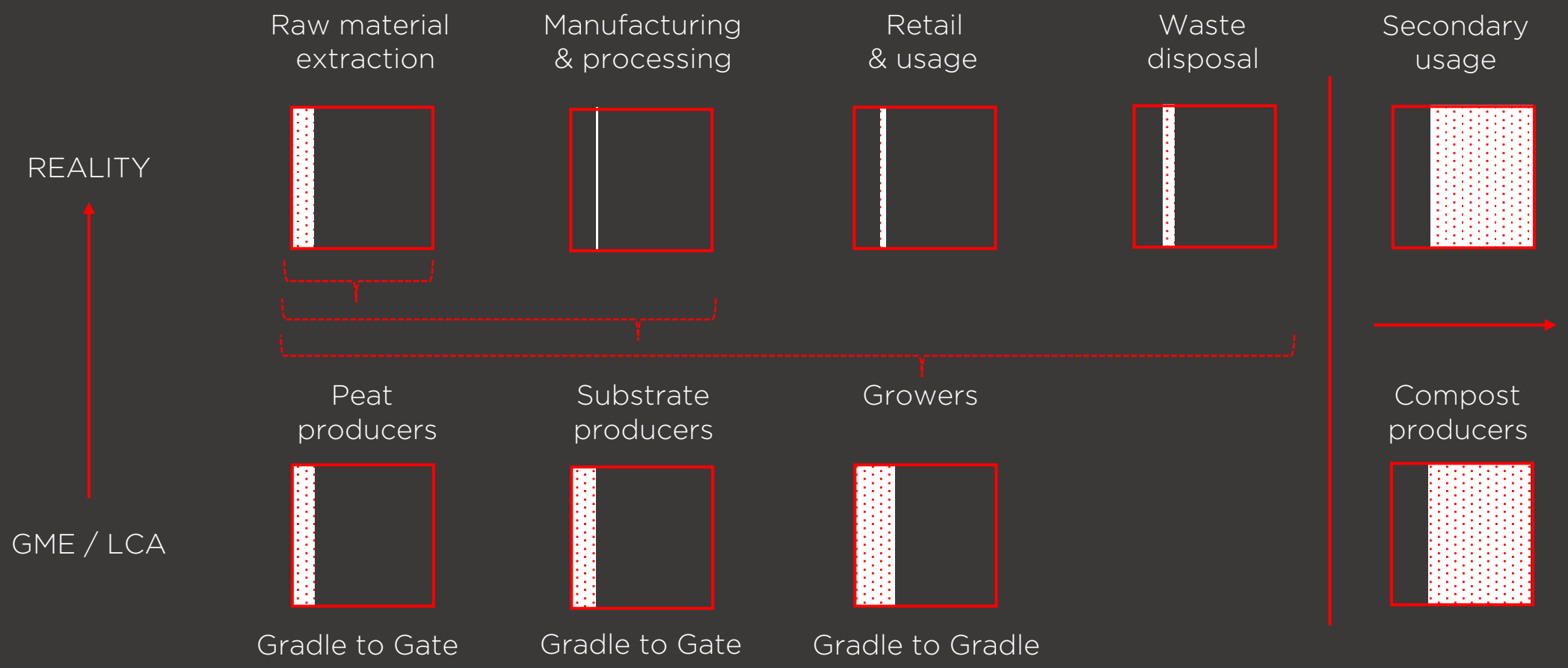
Comparison



Complicated problem, as peat emissions are accounted as removals.

The reduction seems possible if it can be proven that not all peat decomposes.

Comparison


Raw material extraction
Manufacturing & processing
Retail & usage
Waste disposal
Secondary usage
REALITY
GME / LCA
Peat producers
Substrate producers
Growers
Compost producers
Gradle to Gate
Gradle to Gate
Gradle to Gradle

Conclusions

IPCC and LCA models do not describe peat's behavior or emissions correctly. Devil is in details and chemistry.

IPCC rules are based on knowledge that is more than 20 years old. Since then, science has developed, and understanding has improved. However, there is still much to research. It must be implemented.

For the peat, the principal problem in IPCC is calculation through removals. Removals do not equal emissions. When we talk about climate change, emissions matter. Despite the challenge, the system can be improved.

In the LCA model, peat was approached in a standard, that is unsuitable way. A more comprehensive approach is needed. So far, it is a dangerous tool without proper instruction. We must to do better.

Both IPCC and LCAs are often based on the exact science. By improving one, we improve both.

Actual emissions from peat usage in horticulture are much smaller than presented. That gives hope.

Thank you!

Peat is not a problem but part of the solution!