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Development of a conceptual framework to take the dissipation of non-energetic abiotic resources into account within Life Cycle Assessment (LCA)

Alexandre Charpentier Poncelet, Philippe Loubet,
Bertrand Laratte, Guido Sonnemann



CONTENT

- Context
- Research question & Method
- Dissertation approach
 - Overview
 - Key considerations
 - Methodological developments
- Conclusions & future works



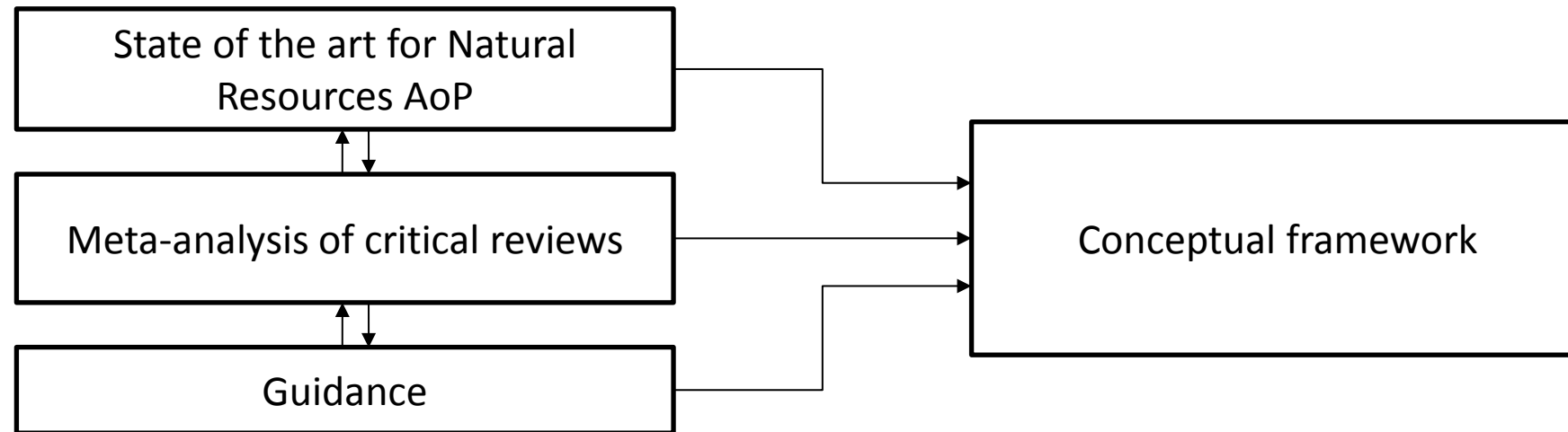
CONTEXT

- Recent developments for the Natural Resources Area of Protection (AoP) in Life Cycle Assessment (LCA) (eg. Dewulf et al. (2015); Sonderegger et al. (2017))
- Existing methods for abiotic resource use have been discussed and criticized by many in recent years (eg. Swart, Alvarenga, & Dewulf (2015); Drielsma et al. (2016); Sonderegger et al. (2017))
- Safeguard subject for non-energetic abiotic resources has been defined as “*the potential to make use of the value that mineral resources, as embedded in a natural or anthropogenic stock, can hold for humans in the technosphere*” (Berger et al., 2018)
- Damage to the safeguard subject happens when abiotic resources are dispersed in a way which make them unavailable for future use or when they are rendered inaccessible in technosphere through different mechanisms
- Dissipation approach is a promising way forward to account for this damage, and should be investigated further (Zampori & Sala (2017); Berger et al. (2018))



RESEARCH QUESTION & METHOD

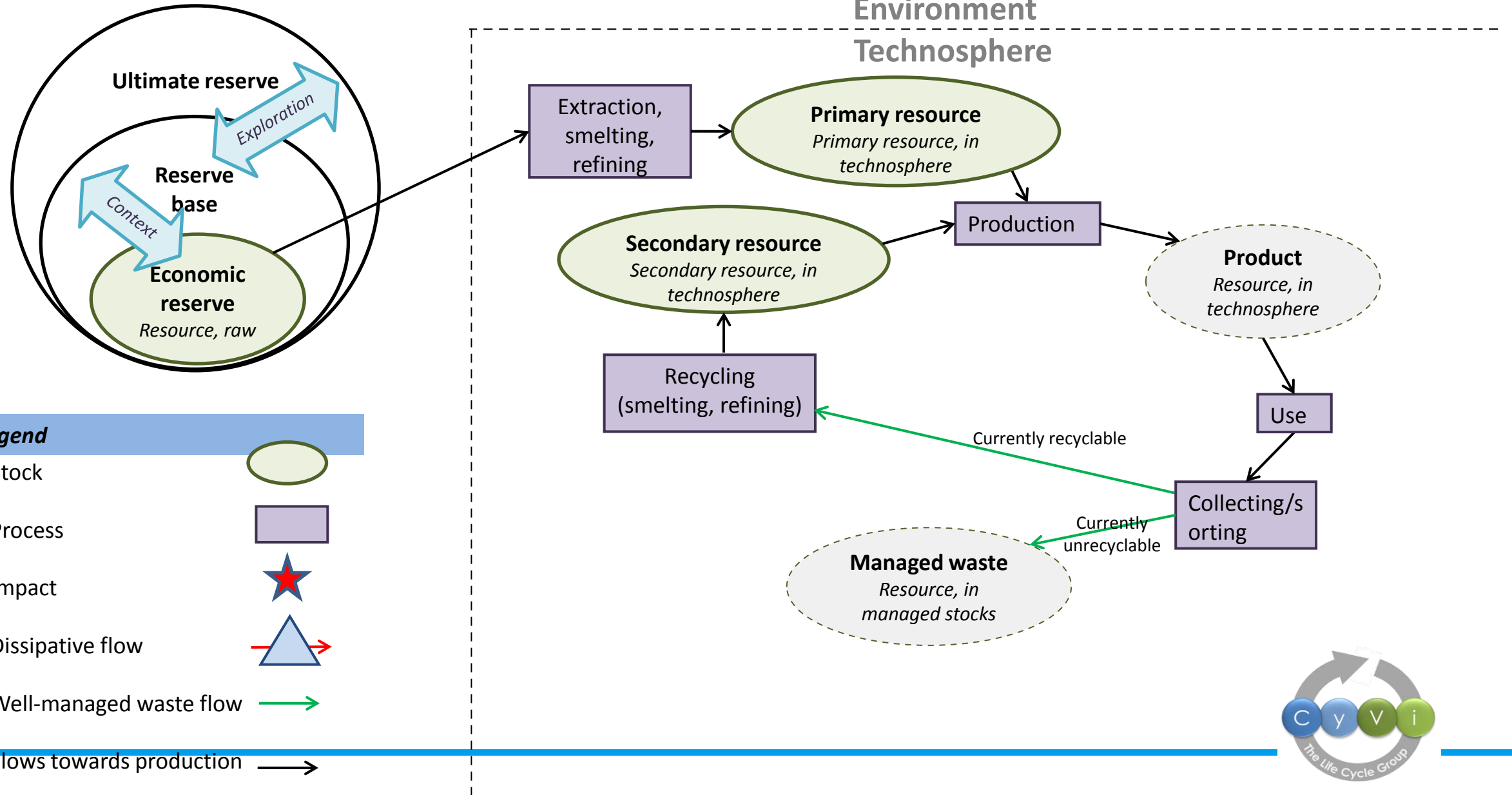
- **Research question:** In light of most actual knowledge, what has to be considered in a conceptual framework to account for abiotic resource dissipation in LCA?
- **Method:**



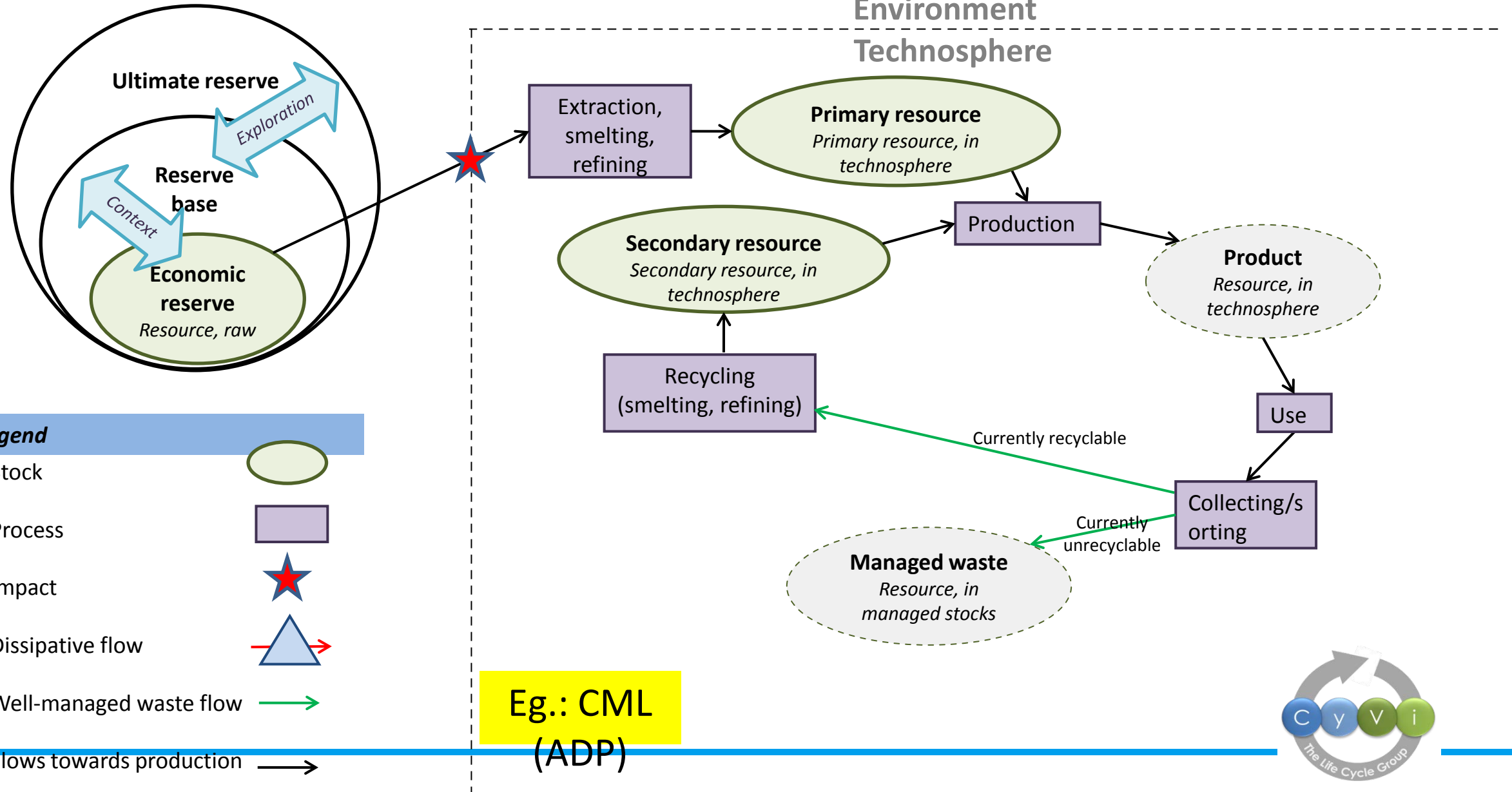
- Define abiotic resource use and Natural resource AoP
- Identify perspective for abiotic resources based on Dewulf et al. (2015)
- Critique existing methods
- Identify relevant guidance for method development
- Identify research needs for dissipation approach

- Take position on methodological choices
- Define key words and concepts
- Build conceptual framework
- Identify data collection needs / cross-sectoral complementary research

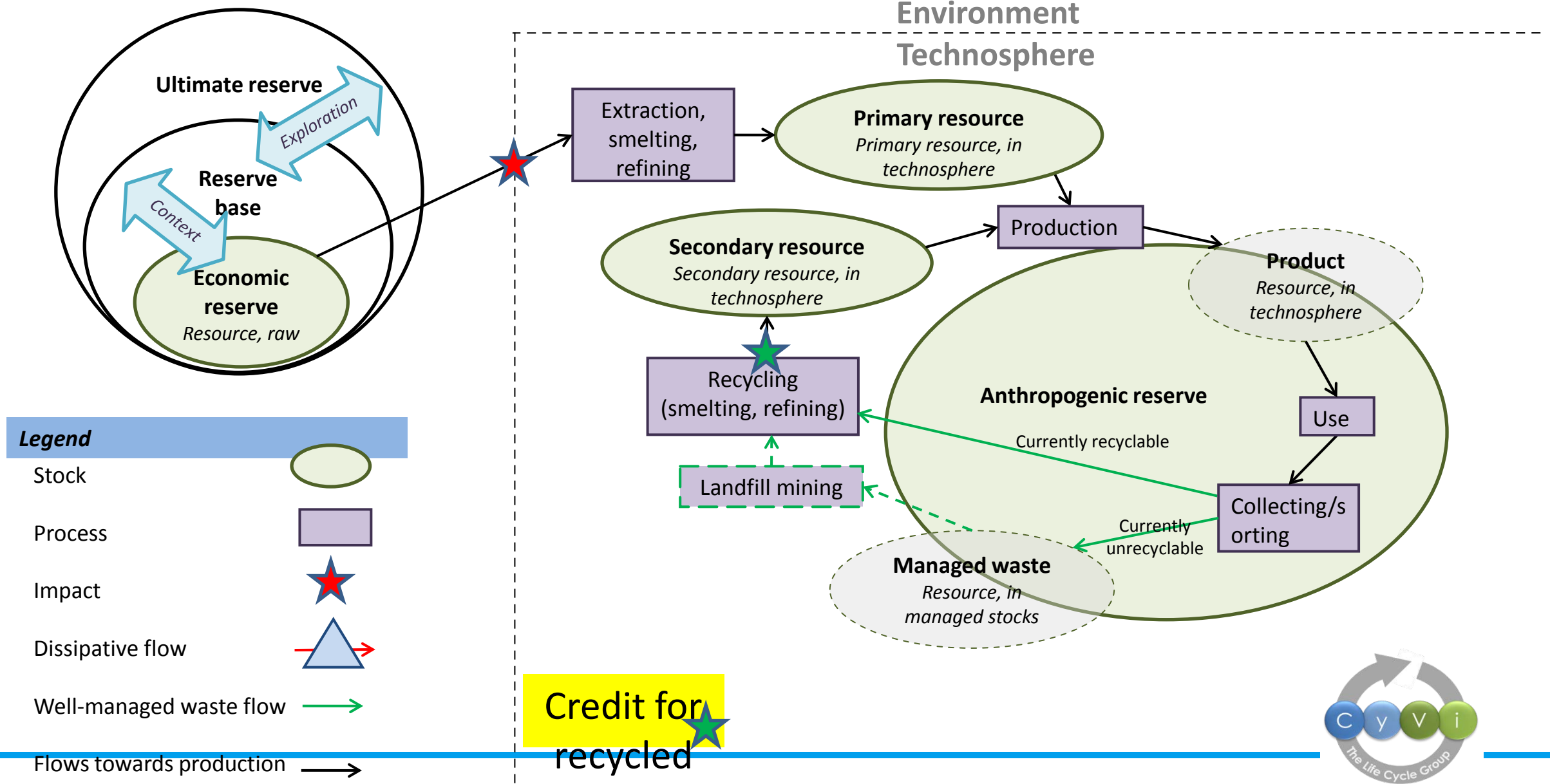
DISSIPATION APPROACH - OVERVIEW



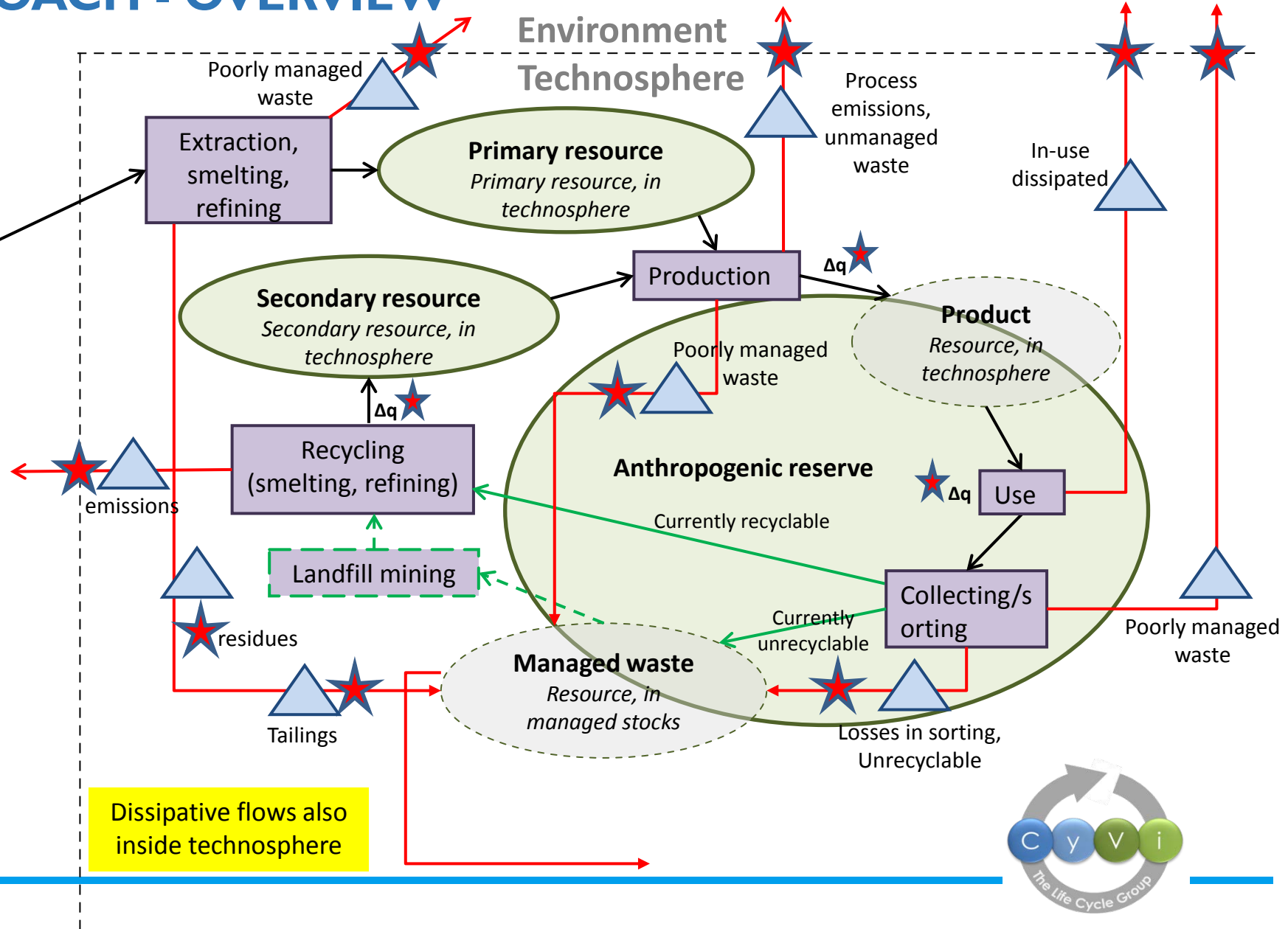
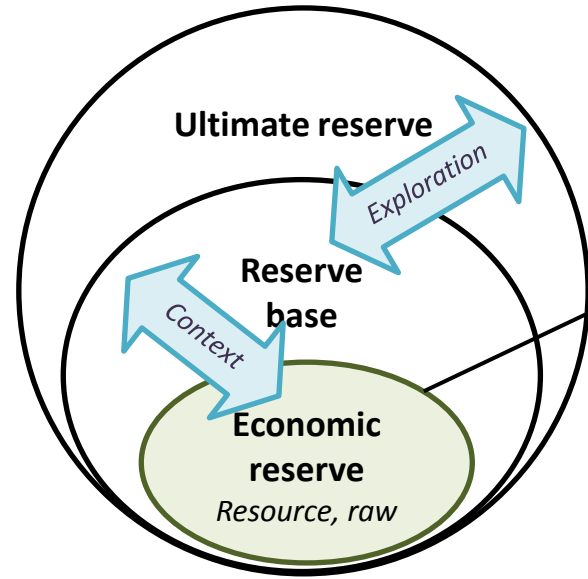
DISSIPATION APPROACH - OVERVIEW



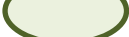





DISSIPATION APPROACH - OVERVIEW



DISSIPATION APPROACH - OVERVIEW



Legend

- Stock 
- Process 
- Impact 
- Dissipative flow 
- Well-managed waste flow 
- Flows towards production 



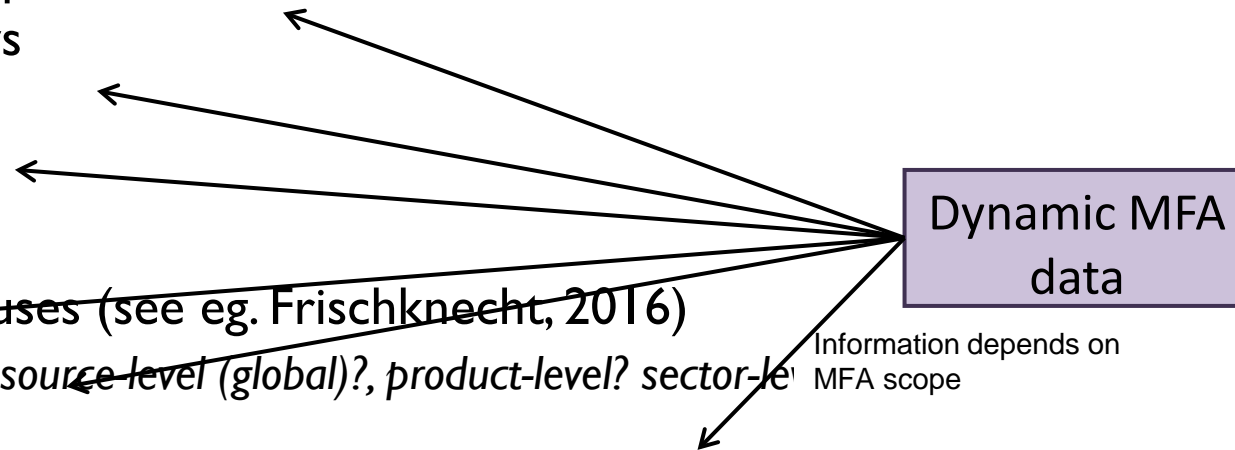
DISSIPATION APPROACH – KEY CONSIDERATIONS

- Dissipation (permanent loss of mass and/or quality) over the whole life cycle
 - Dissipation based on use type/design (eg. Lost by Design, Ciacci et al. (2015))
 - Dissipation in environmental compartments
 - Dissipation in technosphere (loss of quality, dissipated in managed waste, etc.)
- Time
 - Timeframe (*how long?*)
 - Resource occupation/borrowing uses (see eg. Frischknecht, 2016)
 - Dissipation patterns over time. *Resource-level (global)?, product-level? sector-level?*
- Geographical scale
 - Recycling rates
 - Product lifetimes variations



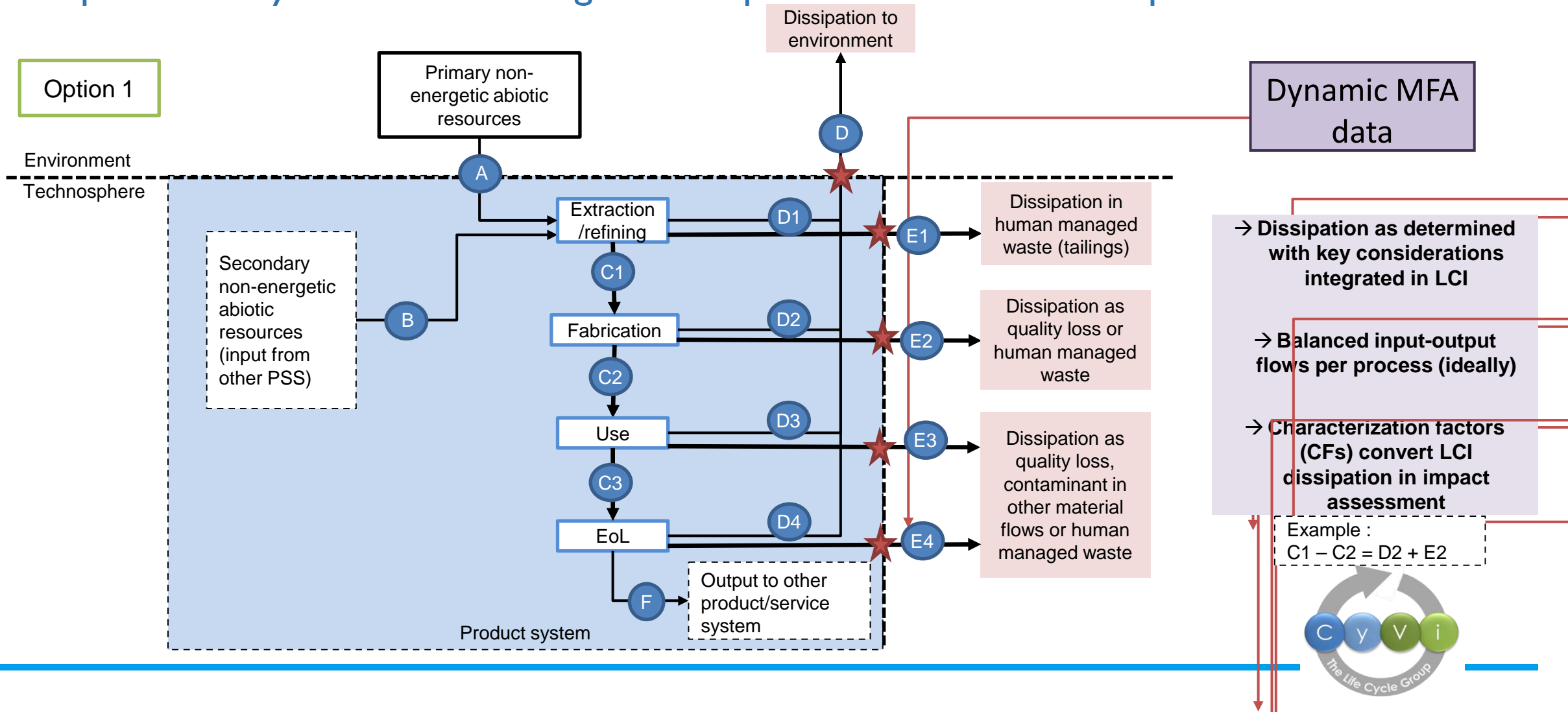
DISSIPATION APPROACH – KEY CONSIDERATIONS

- Dissipation (permanent loss of mass and/or quality) over the whole life cycle
 - Dissipation based on use type/design (eg. Lost by Design, Ciacci et al. (2015))
 - Dissipation in environmental compartments
 - Dissipation in other material flows
 - Dissipation in managed waste
- Time
 - Timeframe (*how long?*)
 - Resource occupation/borrowing uses (see eg. Frischknecht, 2016)
 - Dissipation patterns over time. Resource-level (global)?, product-level? sector-level?
- Geographical scale
 - Recycling rates
 - Product lifetimes variations



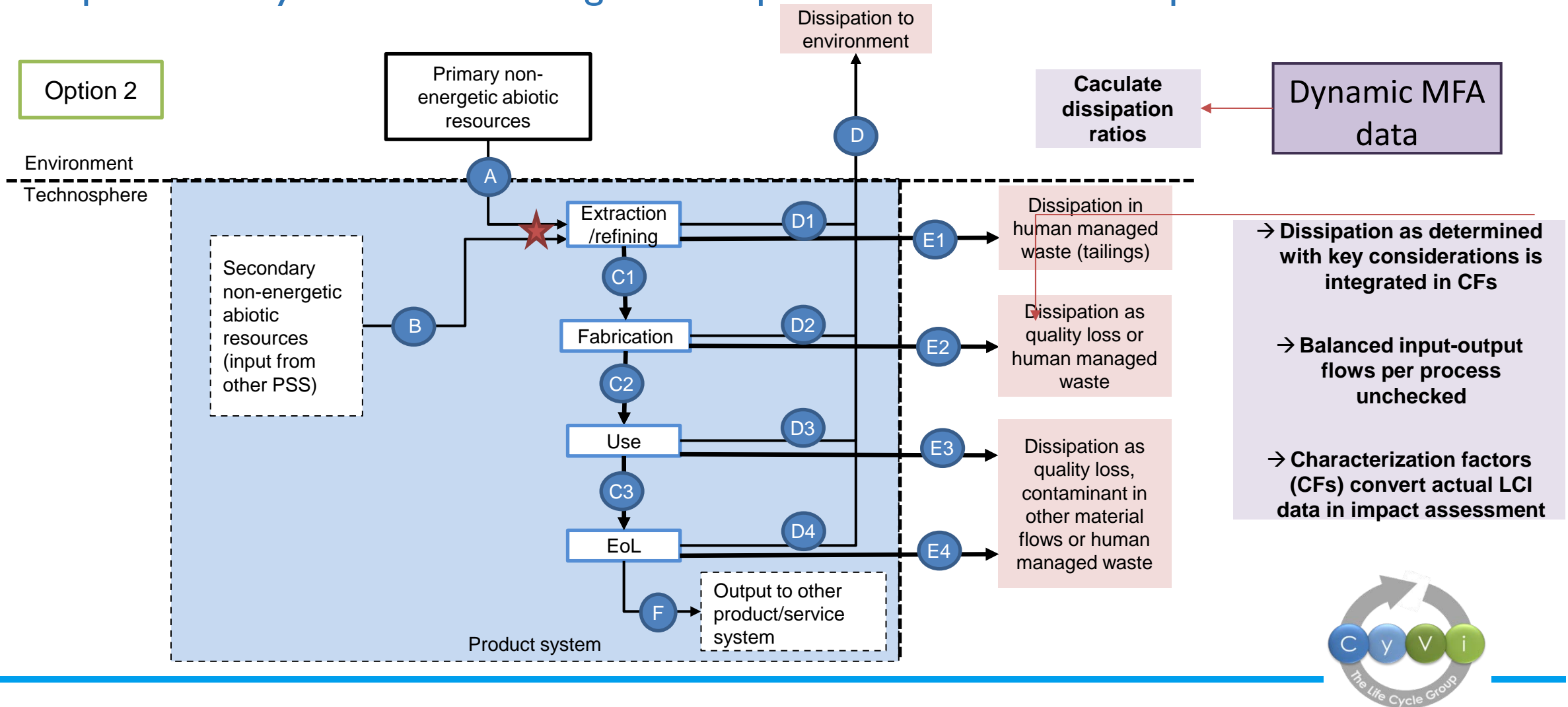
DISSIPATION APPROACH – METHODOLOGICAL DEVELOPMENTS

- Two possible ways forward to integrate dissipation data in the conceptual framework



DISSIPATION APPROACH – METHODOLOGICAL DEVELOPMENTS

- Two possible ways forward to integrate dissipation data in the conceptual framework





CONCLUSIONS

- More definite parameters have been selected to ameliorate abiotic resource use considerations in LCA using a dissipation approach
- Dynamic MFA can serve as a basis to calculate dissipation pattern over time
- 2 possible paths forward to implement dissipation in a conceptual framework have been presented

FUTURE WORKS

- Chose resource-centric perimeter for data collection (product-level, sector-level or global) and geographical granularization for different parameters
- Determine how to integrate quality considerations
- Make methodological decision between integrating data in LCI or LCIA (CFs) or mix of both
- Determine whether reserve size and/or dissipation curve is appropriate for the selected timeframe to include in CF calculations in order to account for availability (or loss of availability)
- Develop final conceptual framework and calculate CFs based on coherent inventory modelling



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