Shell Global Solutions

California Low Carbon Fuel Standard

Discussion document : Coproducts

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Coproducts, Byproducts and Allocation

Some processes in a fuel lifecycle produce economically useful coproducts in addition to the fuel. Emissions from such a process are distributed over the product and coproducts in an LCA. How this allocation is done can significantly influence the carbon intensity of the product.

A Coproduct

- Is a useful product which is produced along with the main product
- Can also be an intermediate product

A Byproduct

- Is an product without economic value produced along with main product

Allocation

- Is the method by which input energy and material flows and output emissions are distributed among the product and coproduct(s)
- Distributes the GHG burden among all the economically useful products
- *There are many ways to allocate emissions*

ISO 14041 Guidance on Allocation

ISO 14040 Series is an internationally recognised standard on Life Cycle Assessment.

Options Listed in ISO Order of Preference

Option 1 – Increase Granularity to Avoid Allocation

- Subdivide the fuel lifecycle process into subprocesses not requiring allocation

Option 2 – Use Substitution to avoid Allocation

- Expand the system boundary of the fuel to include coproduct function
  - *System boundary expansion & substitution* ❖ *Displacement* ❖ *Coproduct credits* ❖

Option 3 – Allocate using physical criteria

Allocate the inputs and outputs of the system to the product and coproduct(s) in a way which reflects the underlying physical relationships between them.

However, physical relationships don't always reflect environmental impact.

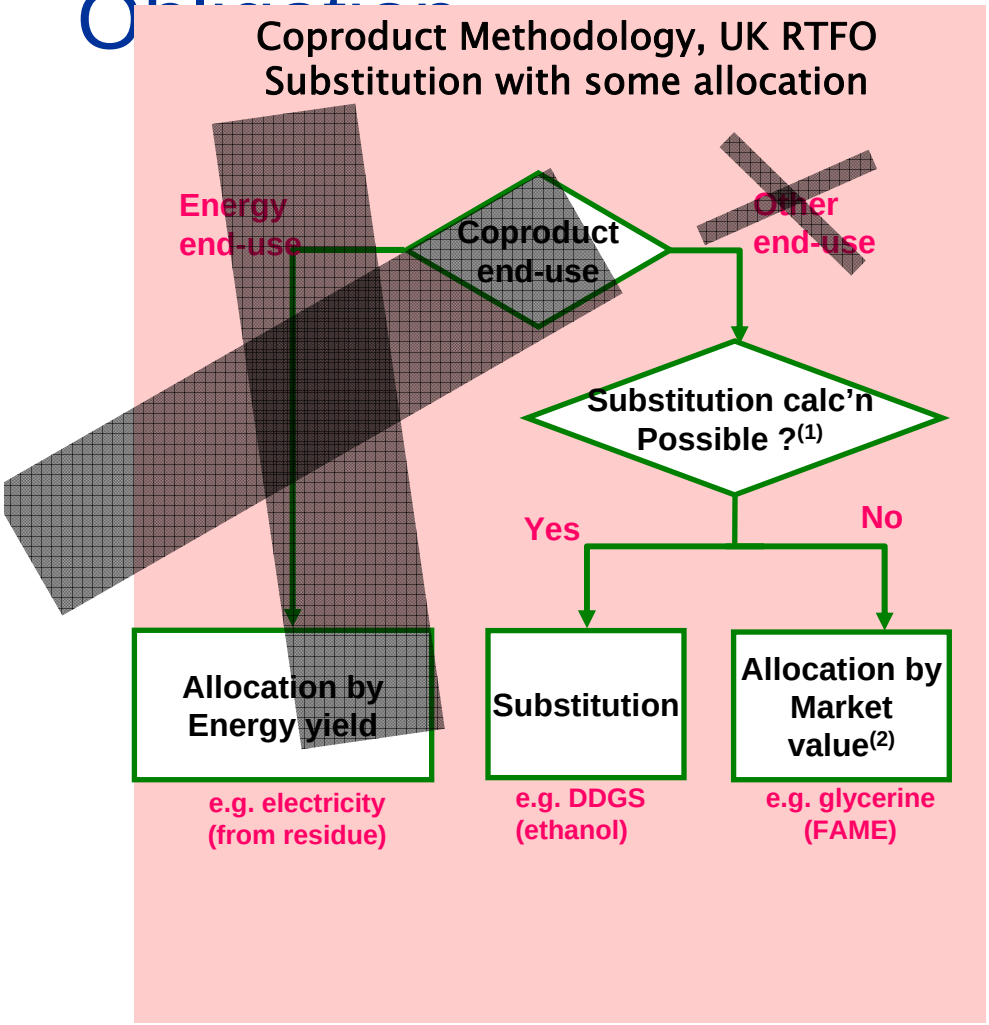
Option 4 – If Physical Criteria not feasible then allocate using alternative criteria

- Allocate inputs and outputs to the product and coproduct(s) in a way which reflects other relationships between them

"For example, … in proportion to the economic value of the products."

Substitution is better at measuring net GHG impact

UK : Renewable Transportation Fuel Obligation



- Covers biofuels only
- WtW Carbon & Sustainability Reporting from April 2008
- RTF certificates awarded from 2010 based on WtW GHG emission
- Biofuels to satisfy minimum sustainability criteria from 2011

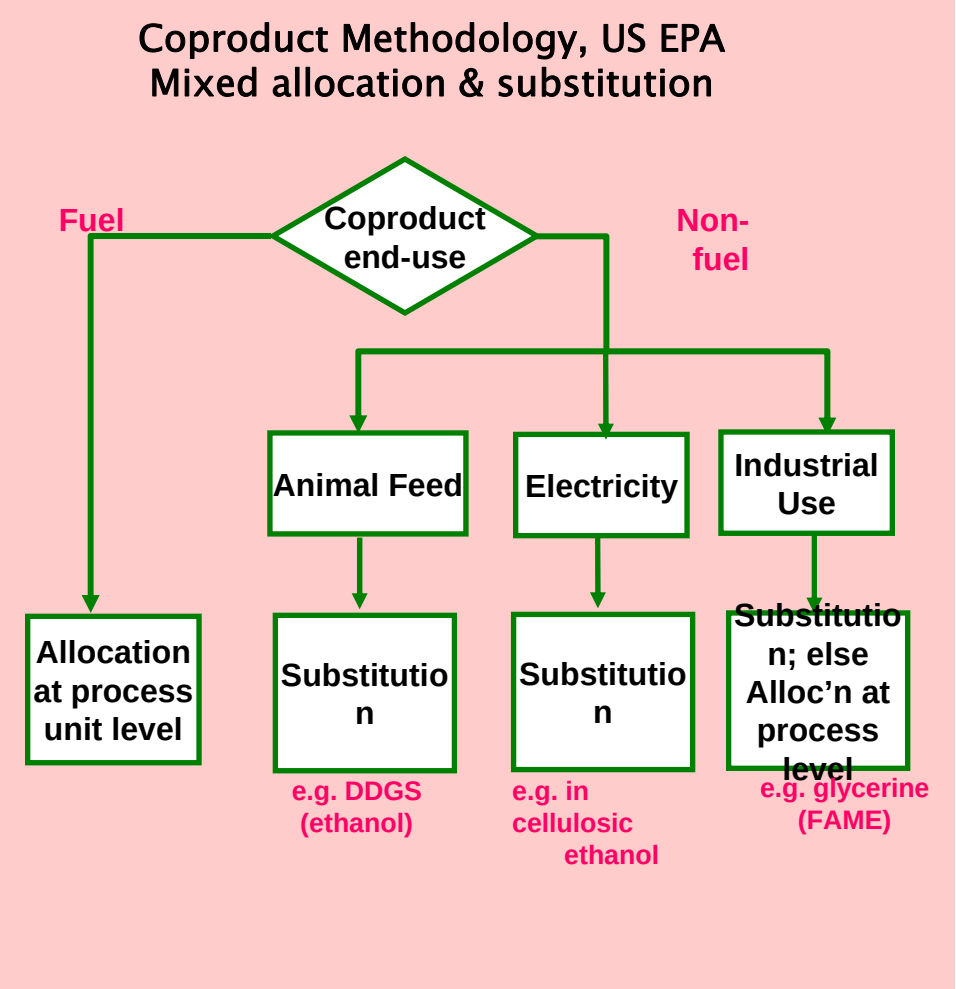
Coproduct Emissions

- Original proposal
  - Allocation for energy coproducts
  - Substitution for other coproducts
  - If Subst. not possible, Allocation by market value
- Energy Allocation dropped due to difficulties handling heat and power in CHP
- Current proposal
  - Substitution for all coproducts
  - If not possible , market value Allocation

(1) Calculation is possible if the following are known (a) existing market product which is displaced on economic margin, (b) displaced product's carbon intensity, (iii) amount being displaced

(2) Three-year rolling average market value

USA : EPA Draft Fuel GHG Proposal



- **Covers all fuels**
- **Details to be made available Dec 2007**

Coproduct Emissions

- **Proposed methodology**
  - **Allocation for fuel coproducts**
  - **Substitution for non-fuel coproducts**
  - **Allocation for industrial-use coproducts**
- **Allocation basis not specified**

Summary

No European or N. American consensus to date on treatment of coproducts.

Both substitution and allocation methods being discussed.

No method is perfect

- Alloc'n (mass; energy) is easier to operationalise but limited scientific basis
- Alloc'n (market value) is harder to operationalise but based on an economic rationale
- Substitution is more directly linked to GHG impact but may be hard to put into practice
- For simplicity consider establishing a de-minimus threshold that must be exceeded for a coproduct to be considered viable.

Input assumptions largely influence LCA results. Treatment of coproducts and system boundaries continues to be debated among LCA experts. Therefore emphasis on transparency in assumptions and results is critical.