

# Choosing a criterion for biofuels and fuel policy

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## GWI in the LCFS

- For producer  $j$  in year  $t$  who blends  $Q_j$  units of fuel with GHI index  $G_j$ , the fine (or sale of credits)  $C_{jt}$  when the standard is  $S_t$  will be:

$$AFCI_{jt} = G_p Q_p + G_b Q_b$$

$$C_{jt} = (S_t - APCI_{jt}) P Q_t$$

$p$  = petroleum,  $b$  = biofuel

$P$  = price of credits (+/- sold or bought) (or fine)

***Much of the current debate is about the operational definition of  $G_b$***

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## Operational Definition

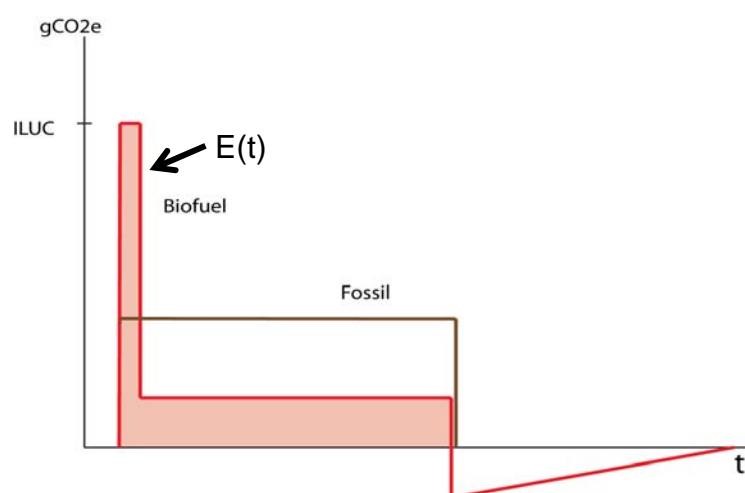
The *operational definition* of a quantity or measurement includes the protocol by which it is observed.

eg: the “height” of a building can be determined (**with different results for each**) by

- *altimeter*
- *tape measure*
- *trigonometry*
- *dropping a clock from the top*

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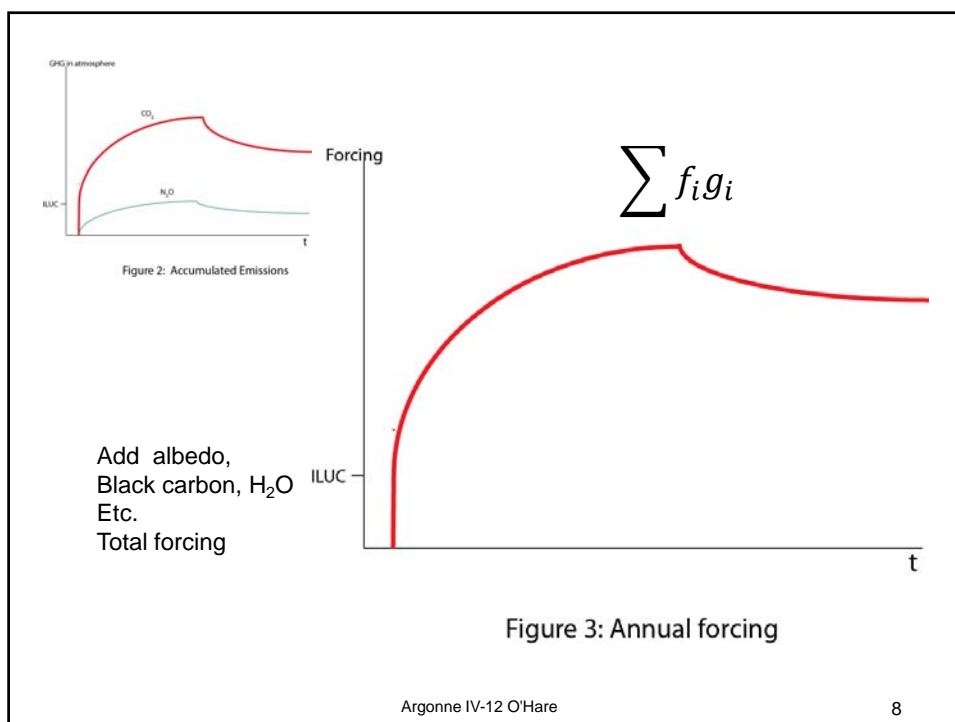
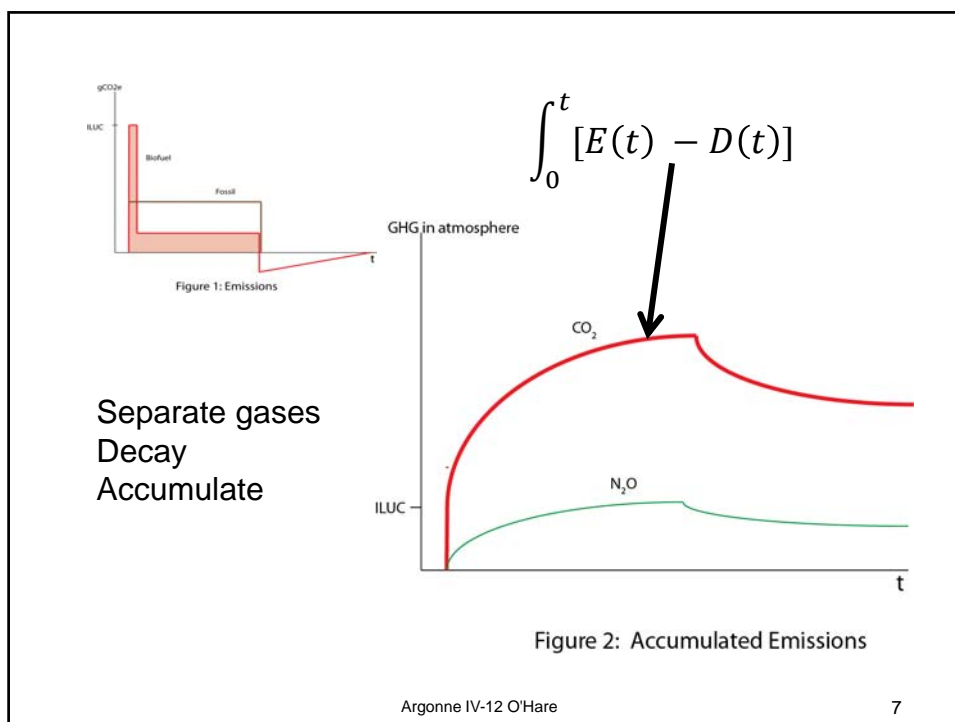


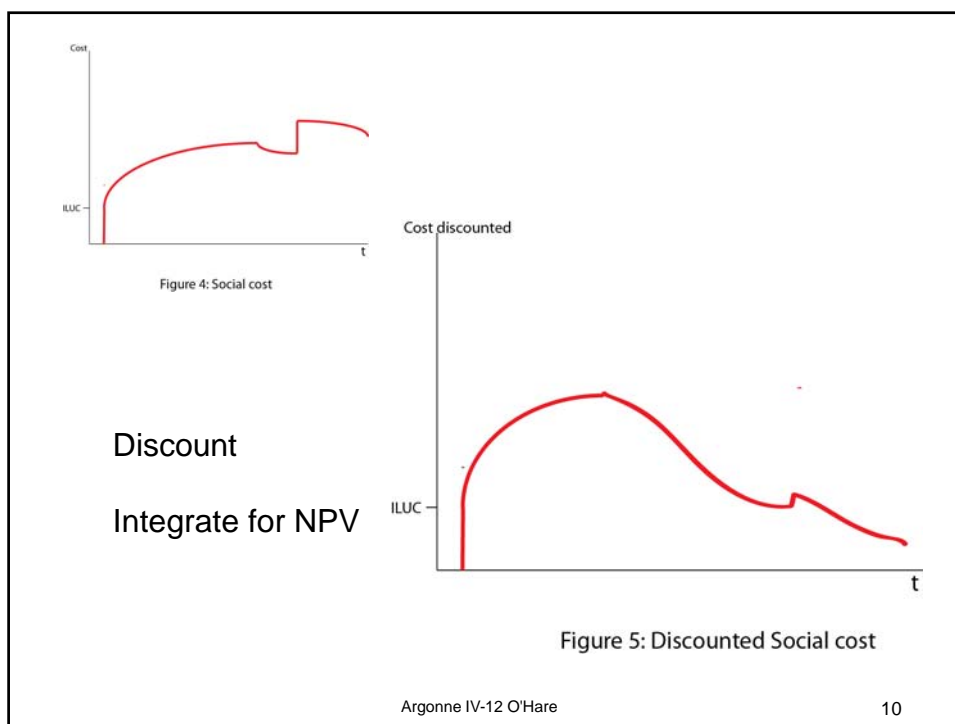
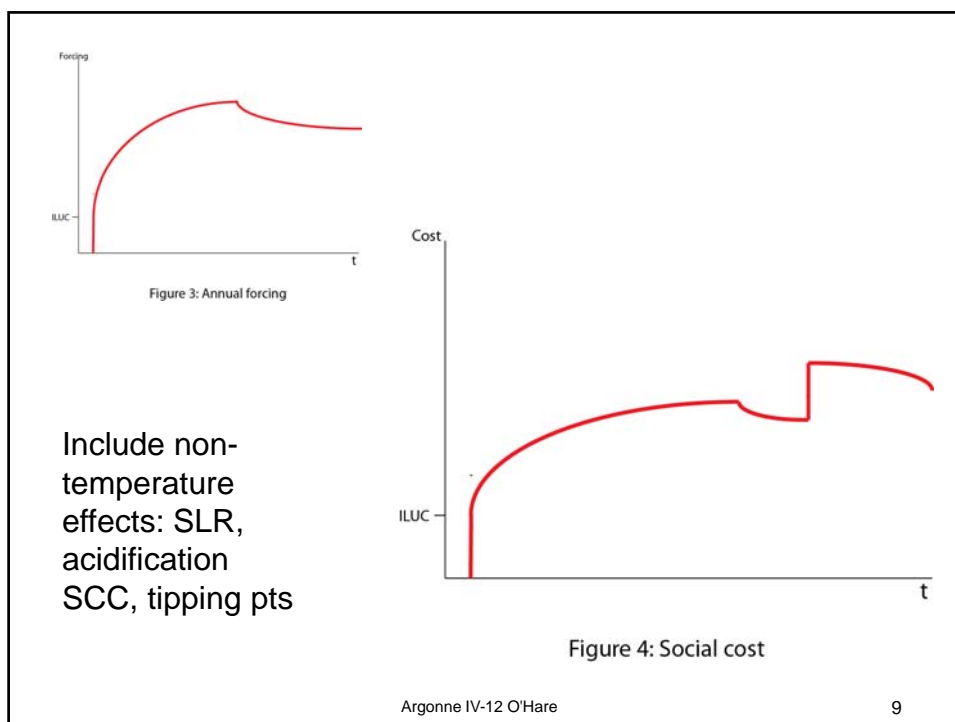
**Figure 1: Emissions**

(adapted from O'Hare, M. et al, Proper accounting for time increases crop-based biofuels'greenhouse gas deficit versus petroleum, *Env. Res. Lett.* 4 (2009)

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## Mapping profile to criterion

- Integral...
  - Total (to a date?)
  - Discounted?
- vs. point value
  - Maximum
  - Value at a date
- Analytic period
- Probability criterion?

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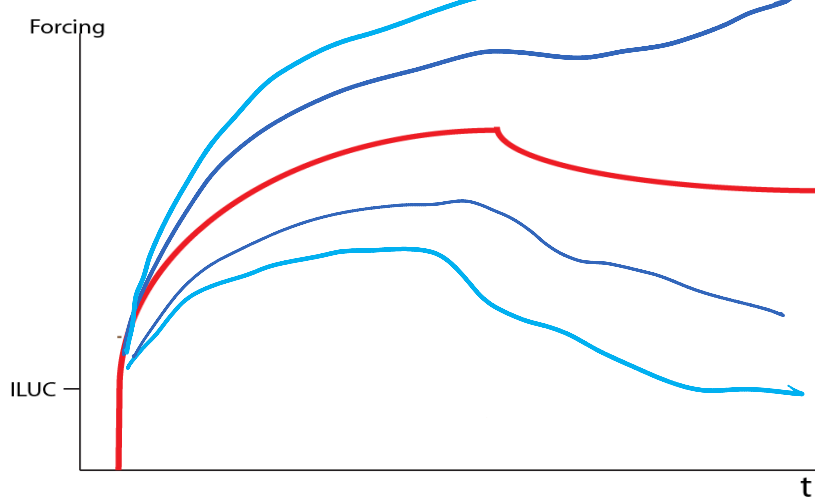


Figure 3: Annual forcing  
**Confidence limits**

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## Decision Theory

- Act: 'Implement' a vector of values  $\{G_i\}$  for fuels  $i$ , that blenders will respond to.

*What LCFS doesn't recognize yet:*

- State of world:  $[\{G_i^*\}, R\{G_i\}]$ , where
  - $G^*$  is actual value,
  - $R$  is response of system.
- Max  $E(V(\{G_i\}, [\{G_i^*\}, R\{G_i\}]))$ , where
  - $V$  is net benefit
  - $G^*, R$  have probability distributions

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### Decision Theory

- Act: 'Implement' a vector of values  $\{G_i\}$  for fuels  $i$ , that blenders will respond to.

*What policy doesn't recognize (yet?):*

- State of world:  $[\{G_i^*\}, R\{G_i\}]$ , where
  - $G^*$  is **actual value**,
  - $R$  is response of system.
- Max  $E(V(\{G_i\}, [\{G_i^*\}, R\{G_i\}]))$ , where
  - $V$  is net benefit
  - $G^*, R$  have **probability distributions**

$V, R$   
*What should policy maximize?*  
*What kind of cost matters?*  
*What is the cost of being "wrong" about  $G_i^*$  in each direction?*

$E$   
*How should policy recognize uncertainty?*

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## Key decision questions

- Are high values of  $G_i^*$  more likely than small ones (long right tail)?
- Is it worse to **overestimate**  $G_i^*$  by 10 g than to **underestimate** it?
  - Irreversible ILUC releases
  - Biodiversity
  - **Future biofuel infrastructure development**
  - Undercut advantage for greener [bio]fuels
  - Etc.

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