



Potential and realizable cost reduction of 2nd generation biofuels

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refuel



Introduction and research question

- First generation biofuels
 - Biodiesel from oil crops, used fats
 - Bioethanol from sugar crops, starch crops
 - Biogas from liquid manure
- Second generation biofuels
 - Bio-SNG, Bio-DME, Bio-Fischer-Tropsch, Bioethanol
From woody crops, grassy crops,
agricultural, wood processing and forestry residues
- Competition between 1st and 2nd generation biofuels
- What are the chances for large scale production of 2nd generation biofuels?
- How can policy measures influence the competition?



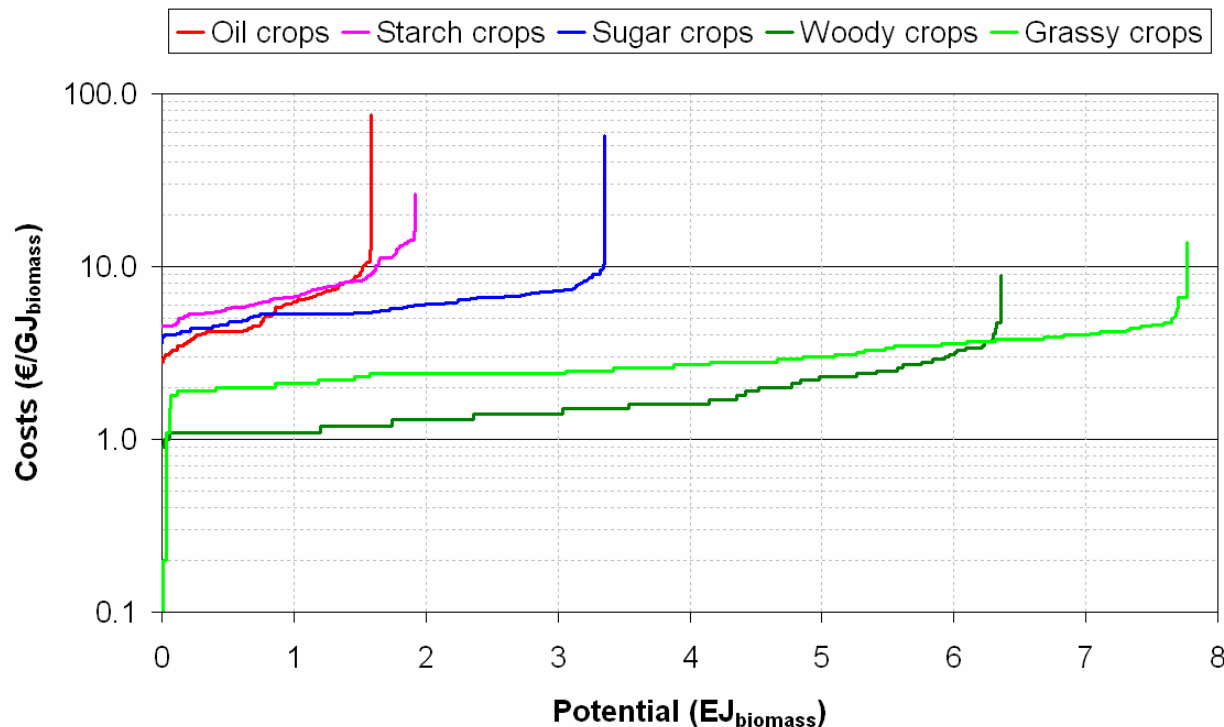
Methodology, endogenous learning

- The model BioTrans assesses
 - the least cost production mix of biofuels in Europe
 - by modeling the logistics of biofuel production
- BioTrans uses costs, not (fluctuating) prices
- Cost categories:
 - *Crop production, Residues & Waste,*
 - *Conversion,*
 - *Transport, Distribution,*
 - *End use (e.g. vehicle modifications).*
- *Production costs decline as function of time*
- *Conversion costs decline as function of biofuel production*



Cost-supply curves of feedstock (2010)

- Biodiesel: limited resources (low productivity)
- 2nd generation fuels: cheaper crops, more potential
- ...but conversion costs differ as well...

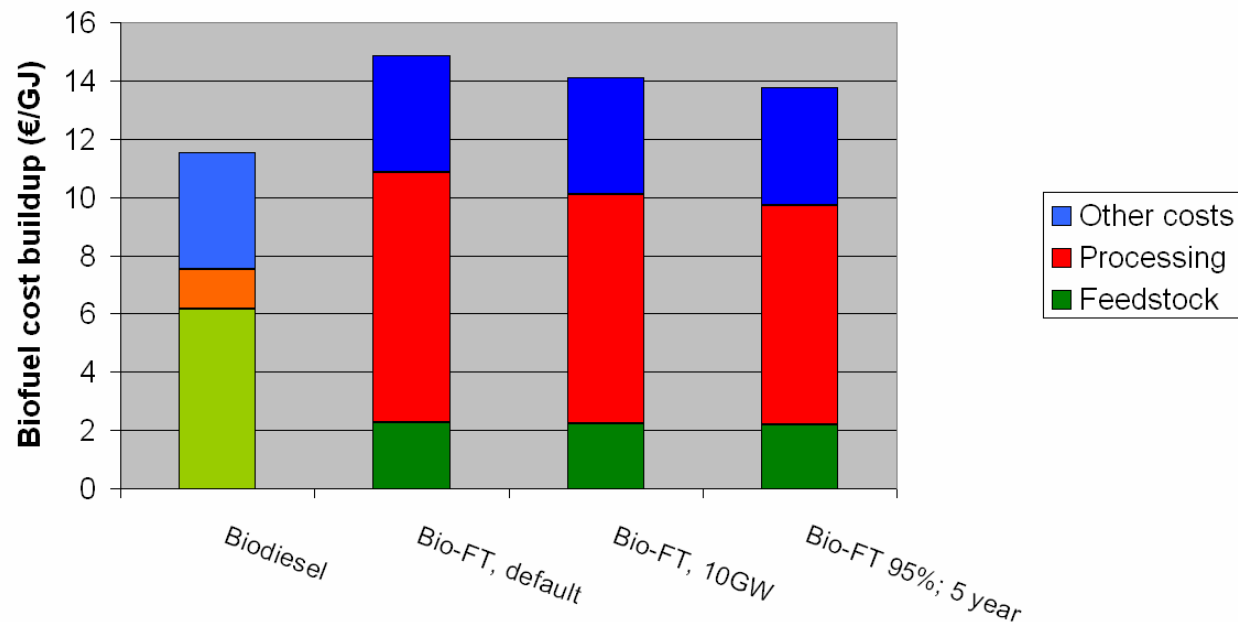




Crop costs versus conversion costs

- 1st generation fuels: high feedstock costs
- 2nd generation fuels: high conversion costs
larger uncertainty

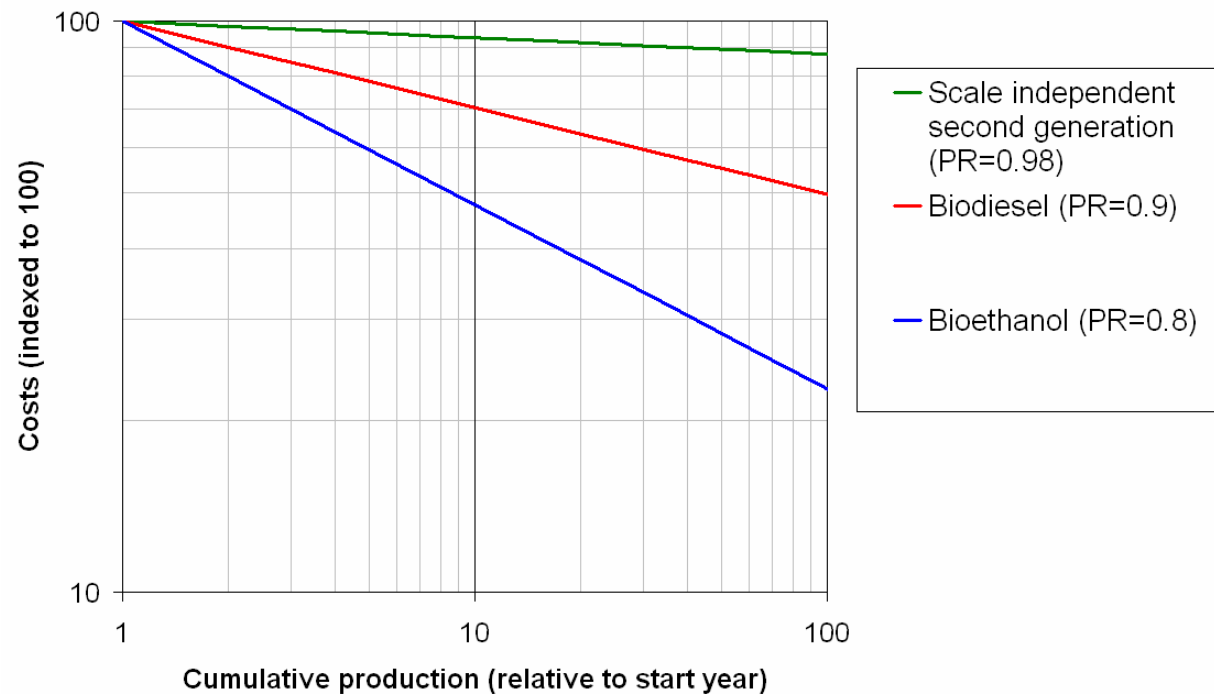
Biofuel cost buildup in 2030





Conversion cost reduction: learning curves

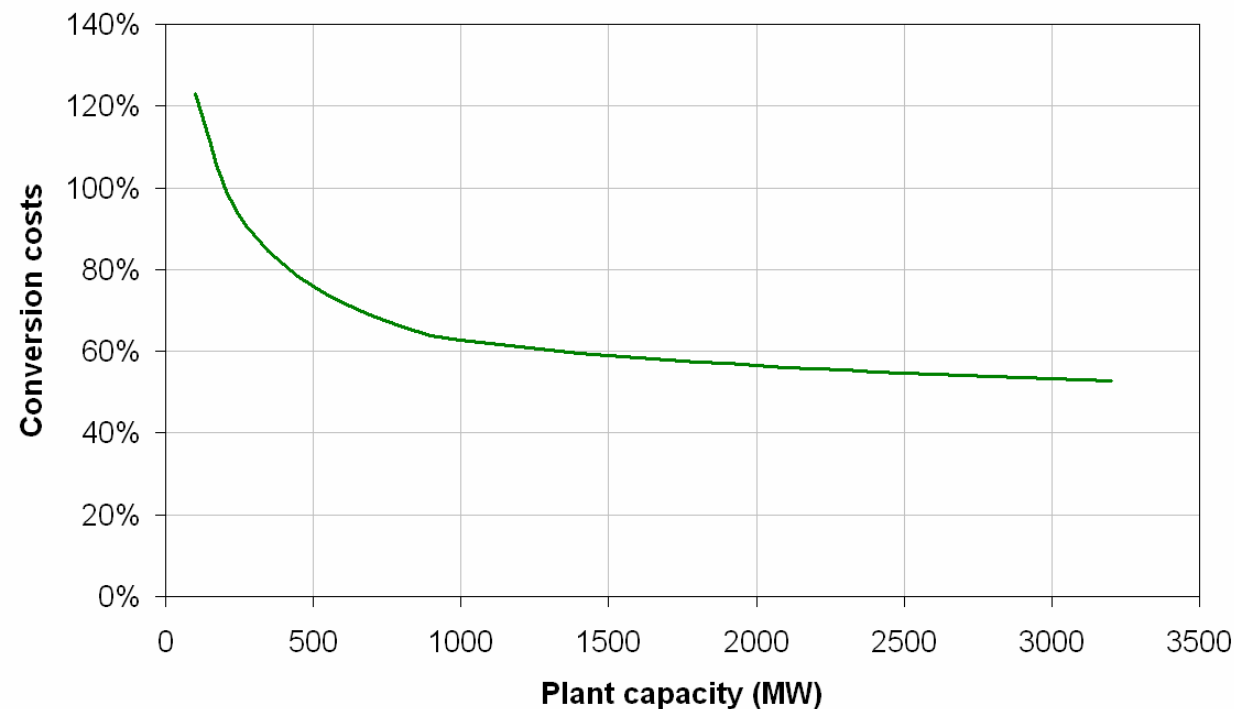
- Bioethanol: cumulative volume already large (alcohol)
- 2nd generation fuels: economy of scale more important





2nd generation: scale dependent learning

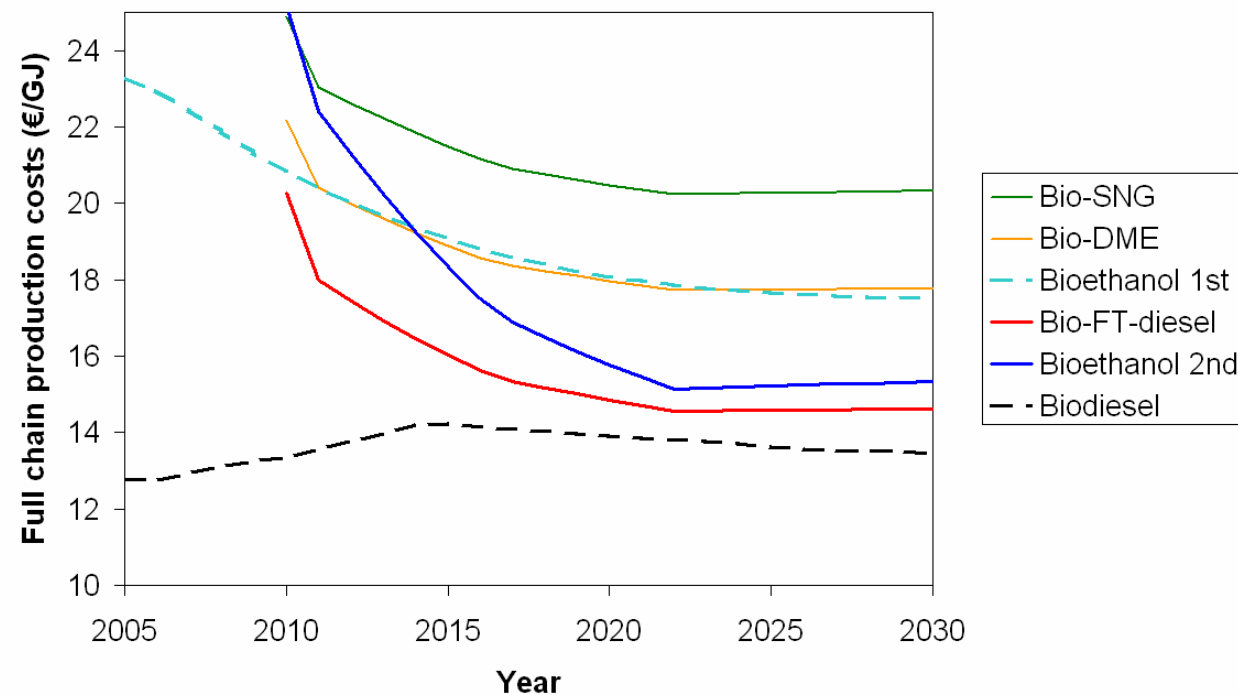
- Typical scale in 2010: 200 MW
- Plant size can double every 3 years to max of 3200 MW
- Single plant can serve up to 5% of total biofuel market





Maximum cost reduction given biofuel targets CN

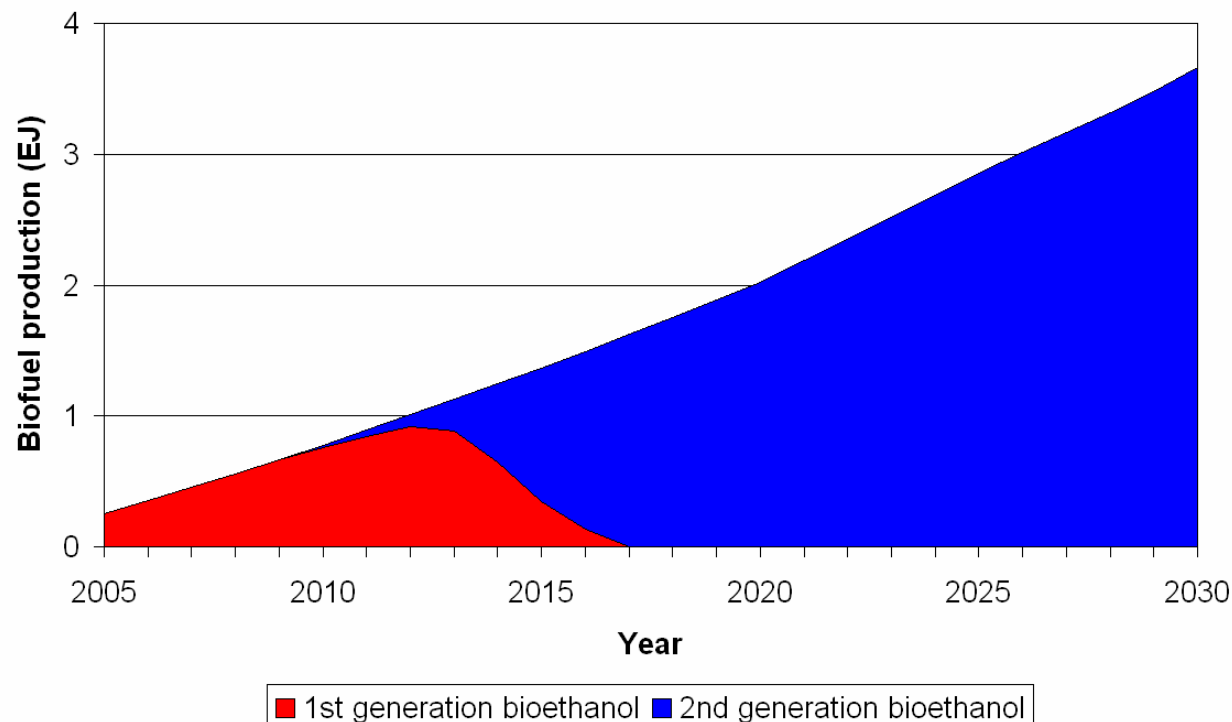
- Biodiesel will remain fuel with lowest production costs
- High initial costs in 2005-2010 implies lock-in effects





Example: all bioethanol with subtarget

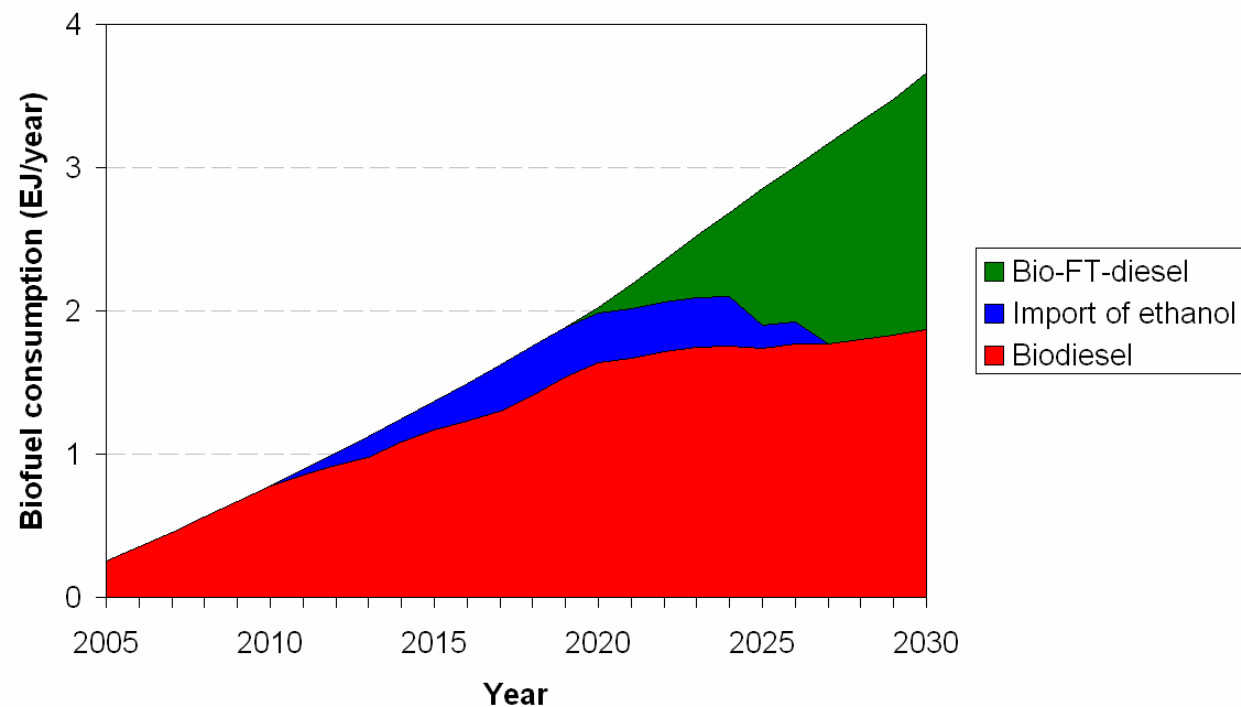
- Policy option: 2nd generation biofuel subtarget
 - Can remove lock-in of 2nd generation in ethanol market
 - But biodiesel from oil crops remains lowest-cost option





System dynamics of allowing ethanol import ECN

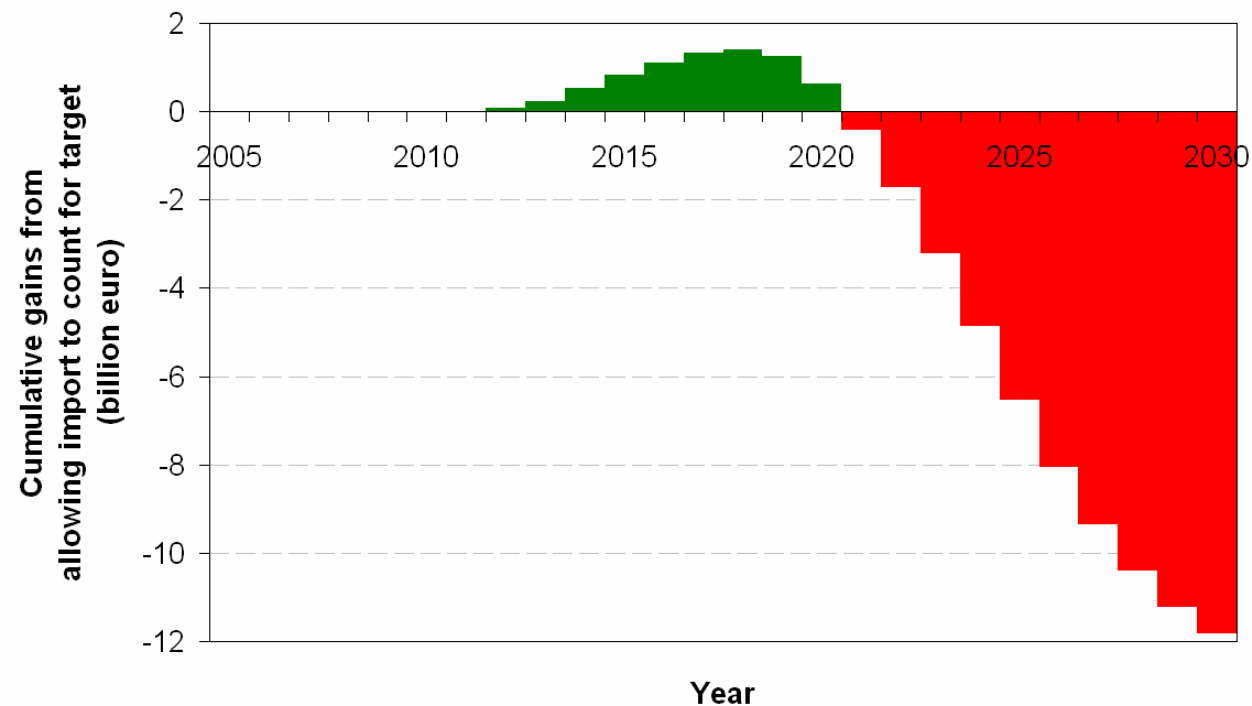
- Policy choice: how to deal with ethanol import?
 - Ethanol import might be temporarily cost-effective
 - Could delay the inevitable introduction of 2nd generation





Brazilian ethanol import and cost reduction

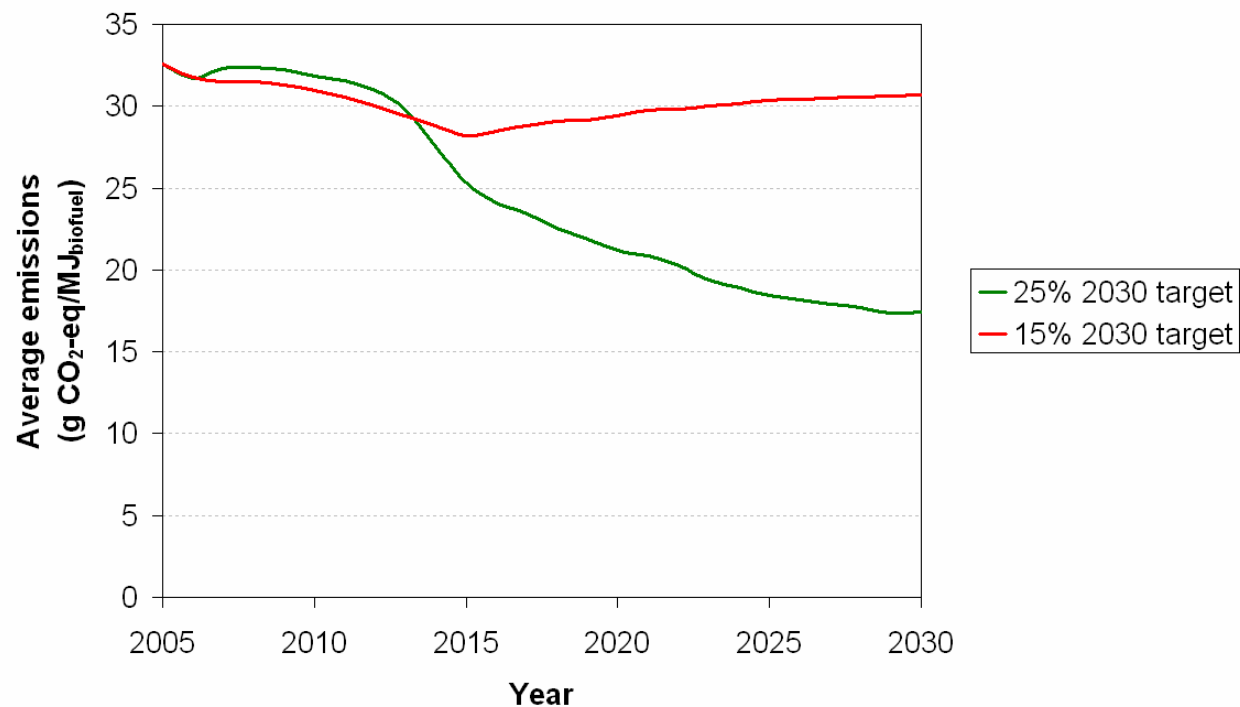
- Policy option: allow import up to 13 Mton ethanol/year
 - Delays introduction of second generation biofuels
 - Delays cost reduction of second generation
 - Pennv-Wise. Pound-Foolish?





Target ambition: effects on GHG emissions

- 2nd generation biofuels
 - have generally lower GHG emissions
- Low target of 15% in 2030 can be met with oil crops only
- Substantial emission reduction requires ambitious target





Conclusions

- First generation biodiesel remains cheap
 - Oil crops have insufficient potential for 25% target
 - 2nd generation biofuels: too close to call “the winner”
 - Policy options of
 - Ambitious biofuel targets
 - Specific 2nd generation (sub)targets
 - Inclusion of GHG characteristics in biofuel targetare different means to the same end...
- ... that is to encourage the introduction of 2nd generation