

# Optimum use of energy resources

*Jean-François Larivé*  
*CONCAWE, Brussels*

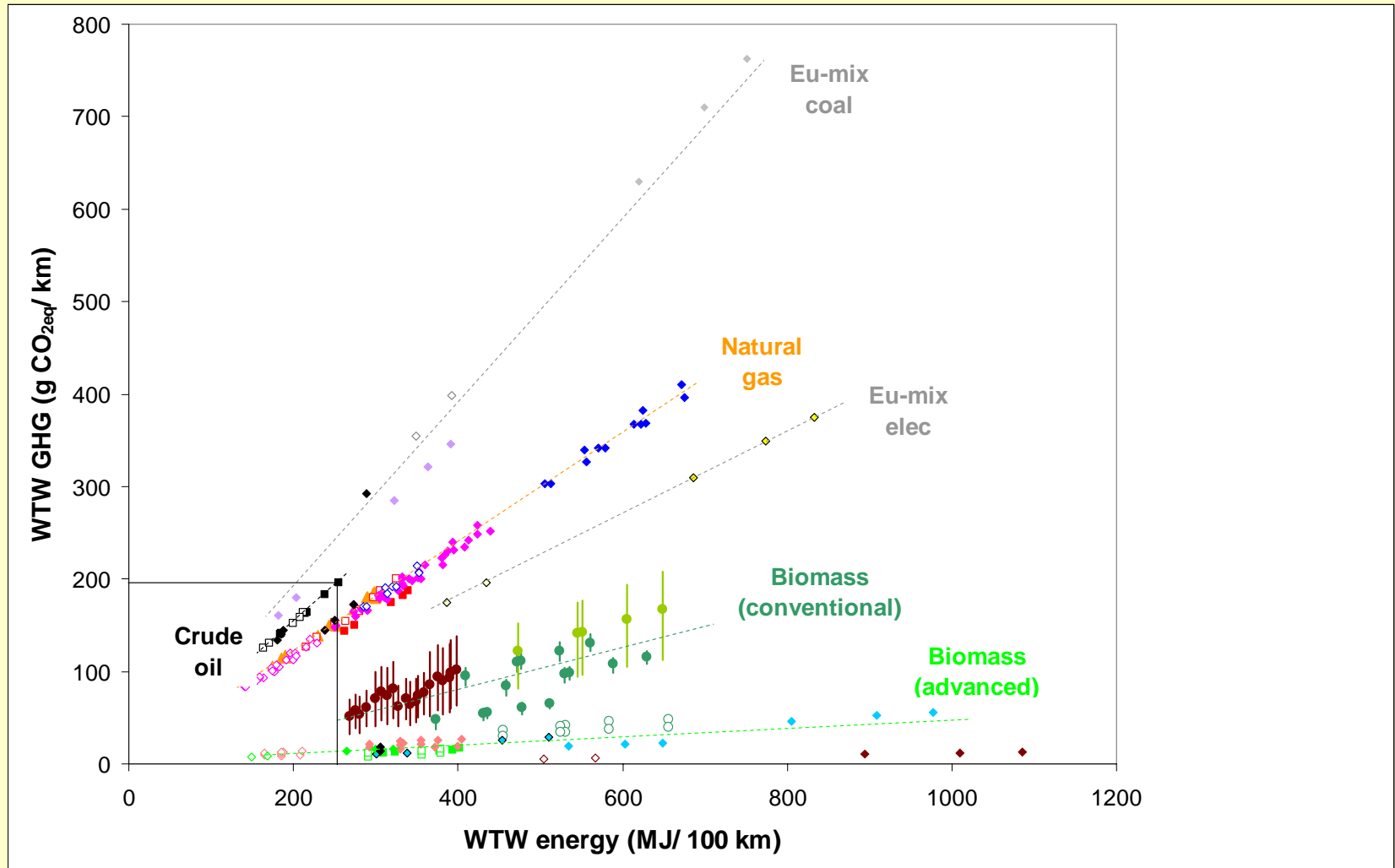
# All energy resources are limited

- Energy from the sun can be considered as inexhaustible but...
- Fossil energy is available in limited quantities
- And so are renewable resources
  - ❑ Biomass needs land
  - ❑ Solar energy needs receptors
  - ❑ Wind energy needs wind turbines

**The world is unlikely to run out of wind  
but will certainly run out of places to build windmills**

**Therefore what energy is available should be used wisely  
It is not only about less CO<sub>2</sub> but also about minimum energy**

# Less CO<sub>2</sub>, more energy?

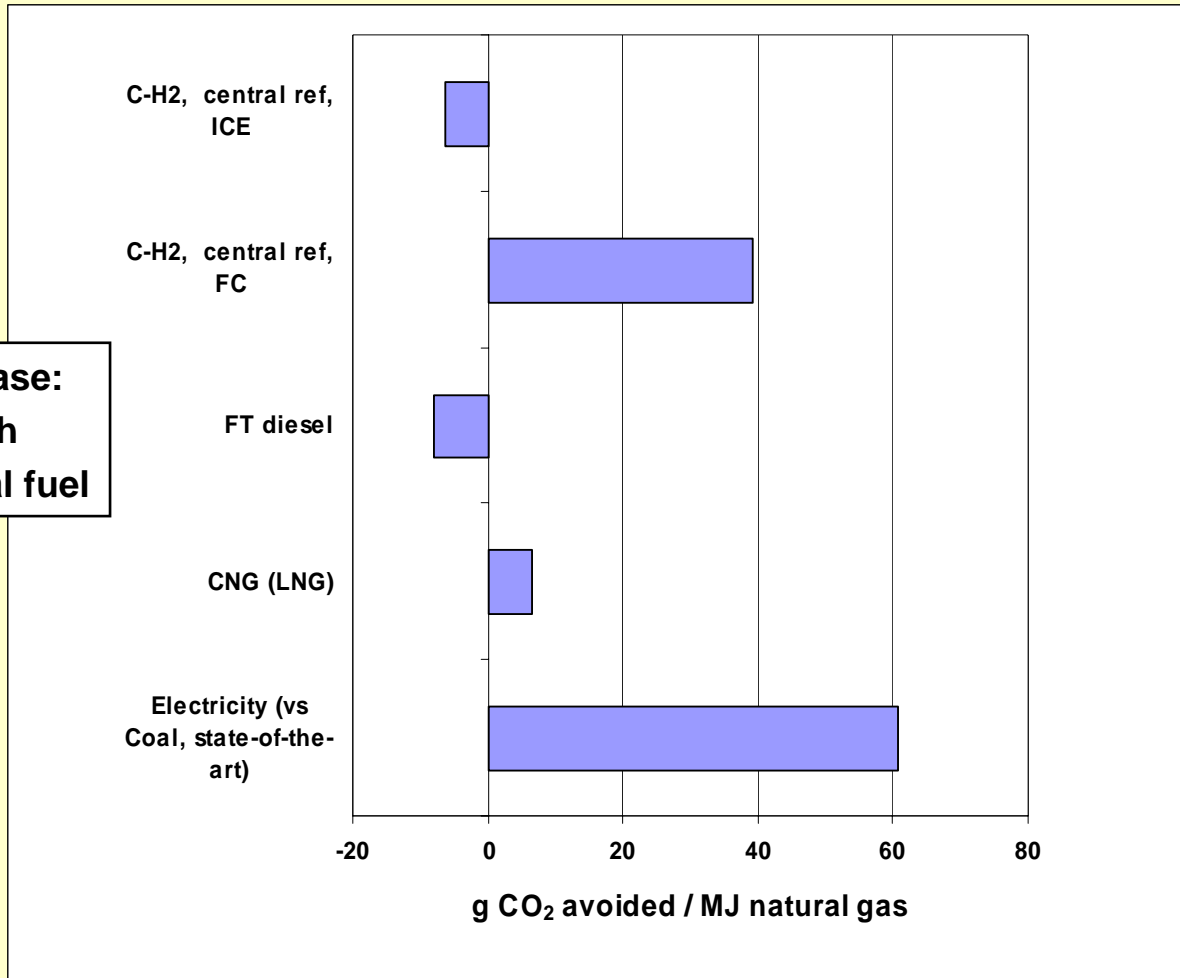


Source: Joint EUCAR/JRC/CONCAWE European WTW study

# There are many ways of using gas

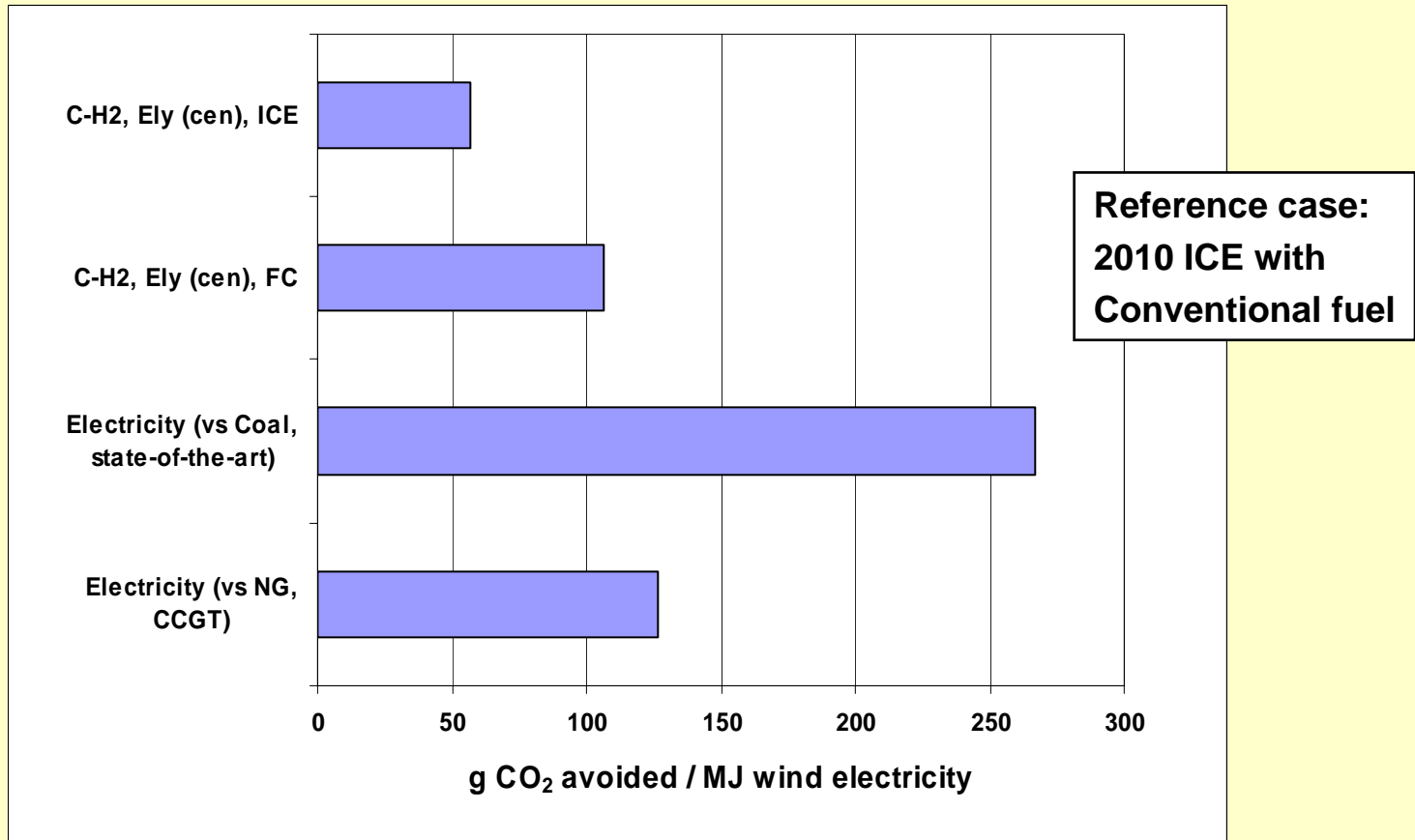
## Potential for CO<sub>2</sub> avoidance from 1 MJ extracted gas

**Reference case:  
2010 ICE with  
Conventional fuel**



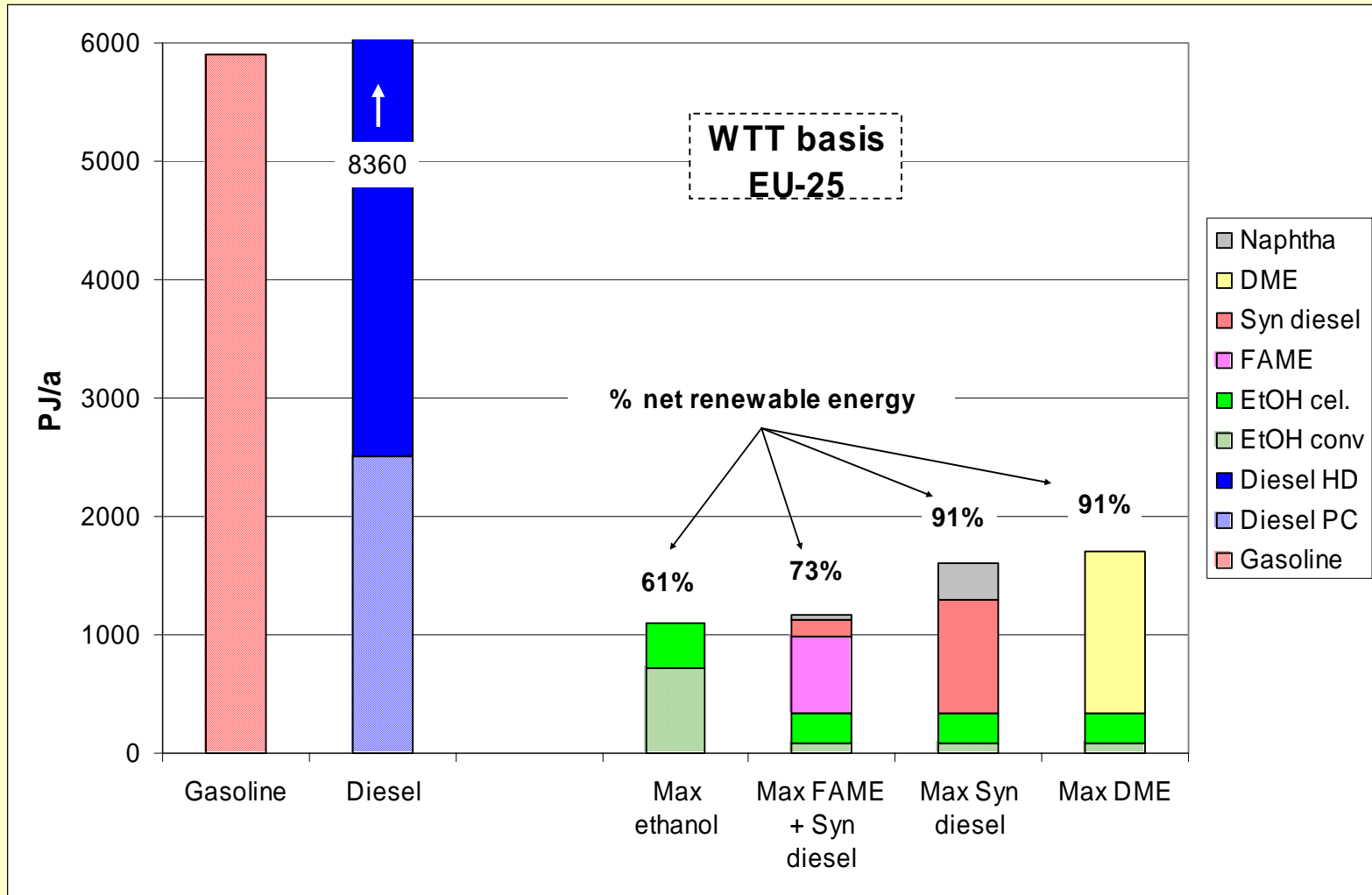
# There are many ways of using wind power

## Potential for CO<sub>2</sub> avoidance from 1 MJ wind electricity



# There are many ways of using land (1)

## Potential for conventional fuels substitution with biomass-derived liquid fuels

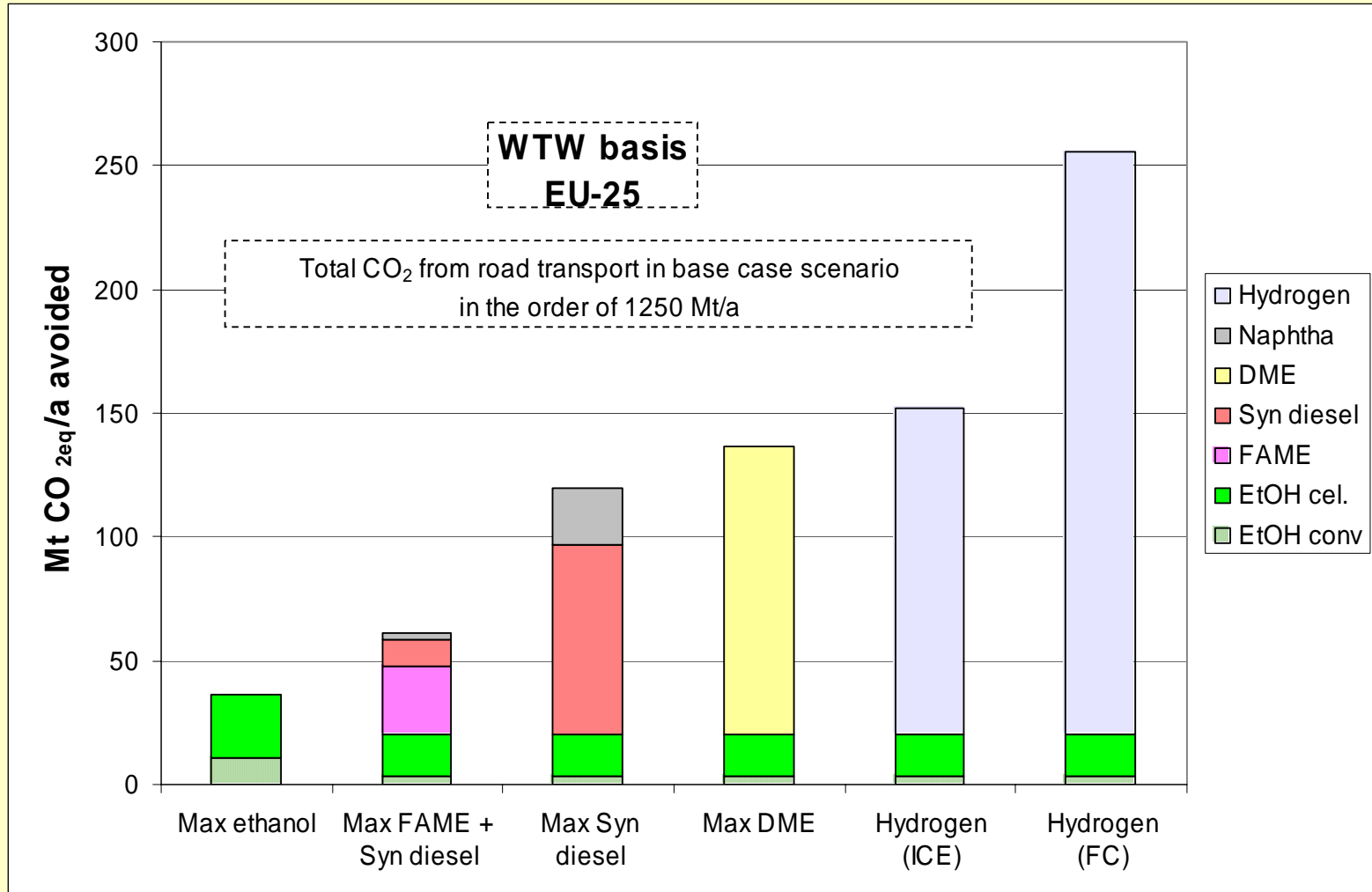


Source: Joint EUCAR/JRC/CONCAWE European WTW study

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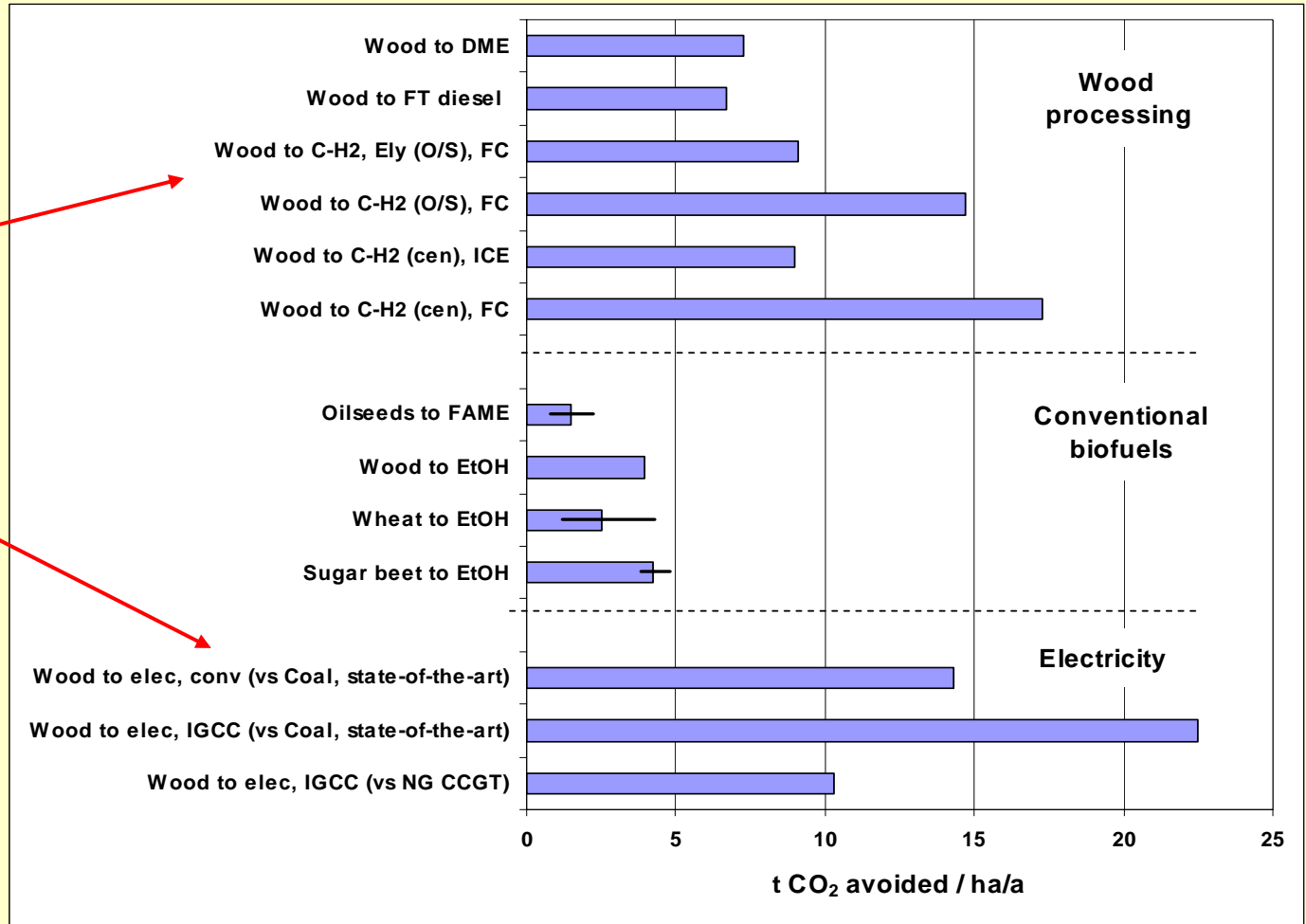
# There are many ways of using land (2)

## Potential for CO<sub>2</sub> avoidance with biomass-derived fuels



# There are many ways of using land (3)

## Potential for CO<sub>2</sub> avoidance from 1 ha of land



CO<sub>2</sub> savings per hectare are better for advanced biomass than ethanol or biodiesel

Using biomass for electricity generation offers even greater savings

Reference case:  
2010 ICE with  
Conventional fuel