# Trading greenhouse gas emission benefits from biofuel use in US transportation: Challenges and Opportunities

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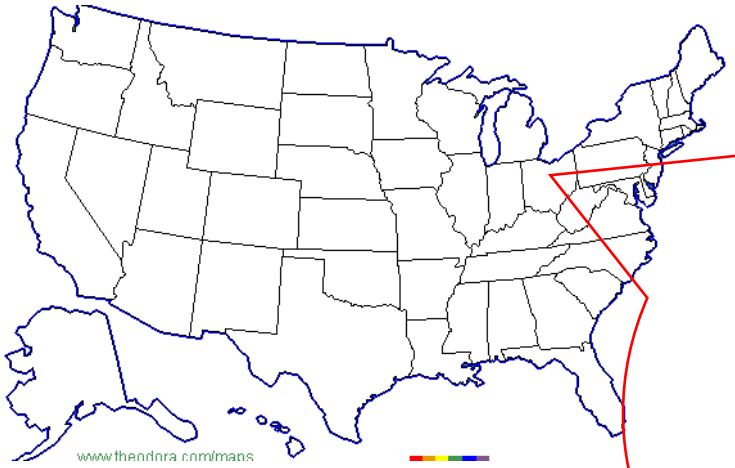
# Outline

1. Carbon (GHG) markets
2. Overview of GHG benefits of biofuels
3. Trading the benefits – associated issues
4. Proposed Carbon Trading Framework
   - Challenges and opportunities

# 1. Carbon Market




**Offset Projects – Agri, Forestry, renewable energy, methane capture, energy efficiency**

**Voluntary – demand is low**

**CCX: $1-$7 per metric tonne (RGGI: $3 / MT)**

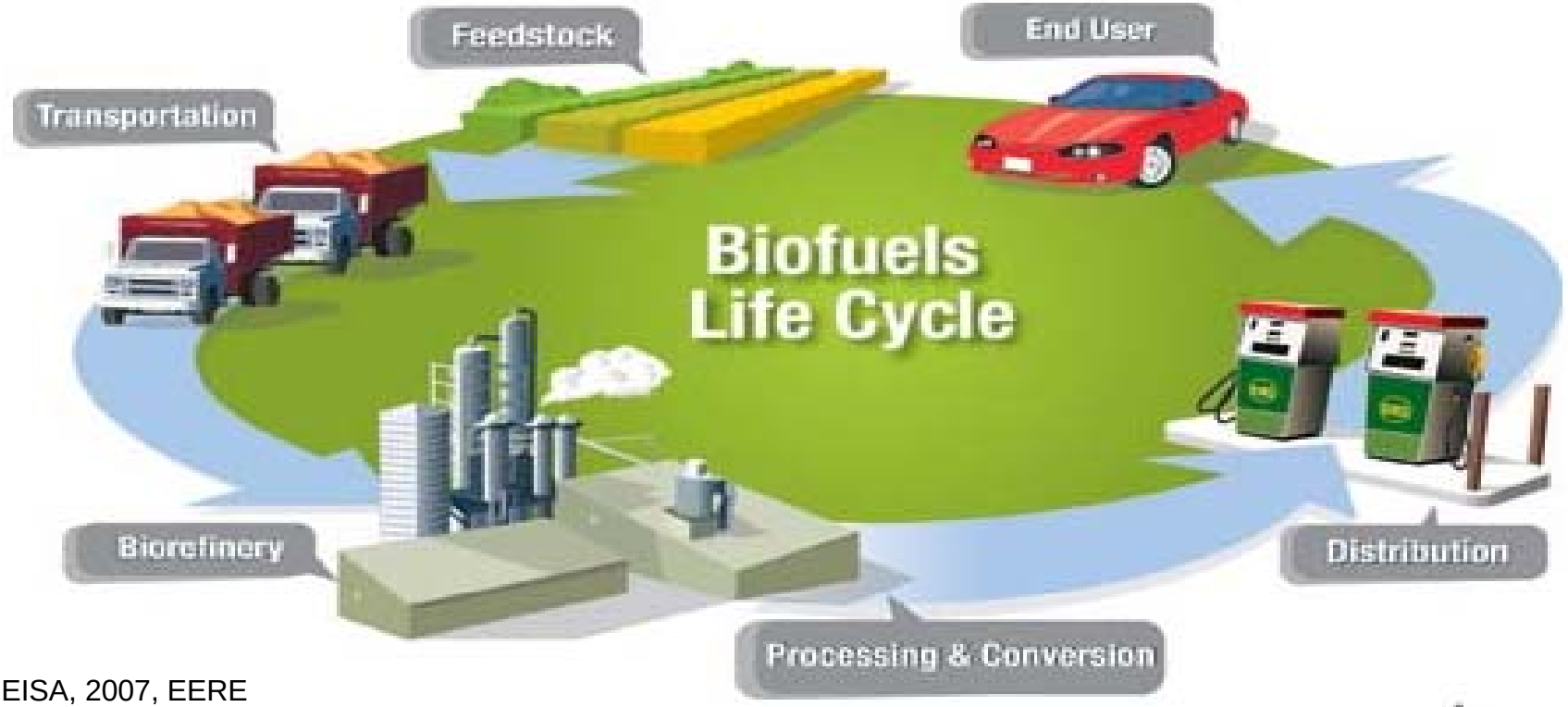
**Variety of projects**

**European carbon prices**
**$1 - $45/MT**
**Latest - $30/MT**

# 2nd Generation Biofuels

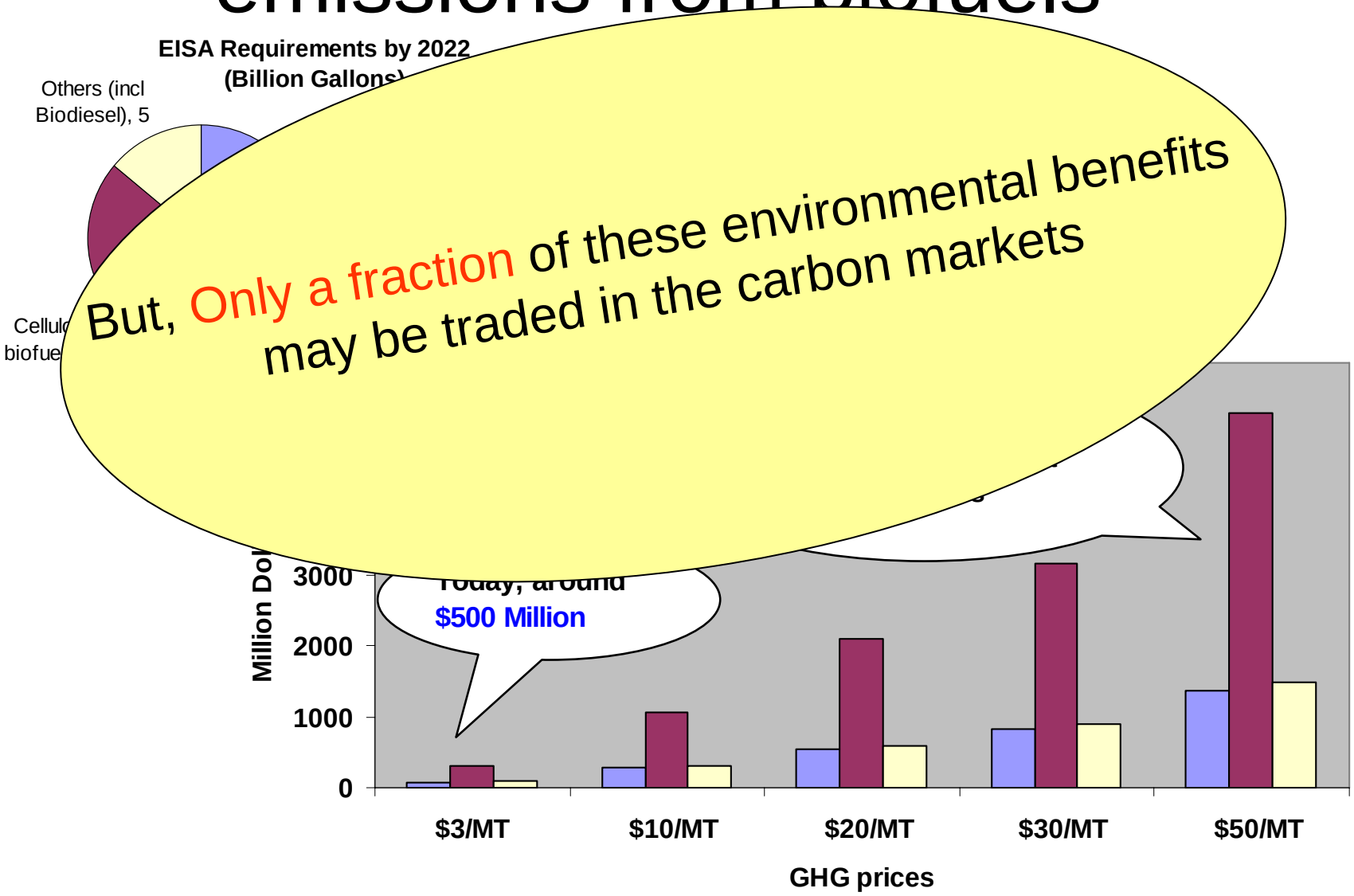
- Definition based on Lifecycle GHG savings

| Type of biofuel | Amount of GHG savings |
|---|---|
| Cellulosic | 60% |
| Advanced | 50% |




Source: EISA, 2007, EERE

# Value of GHG emissions from biofuels



# 2. Major Question

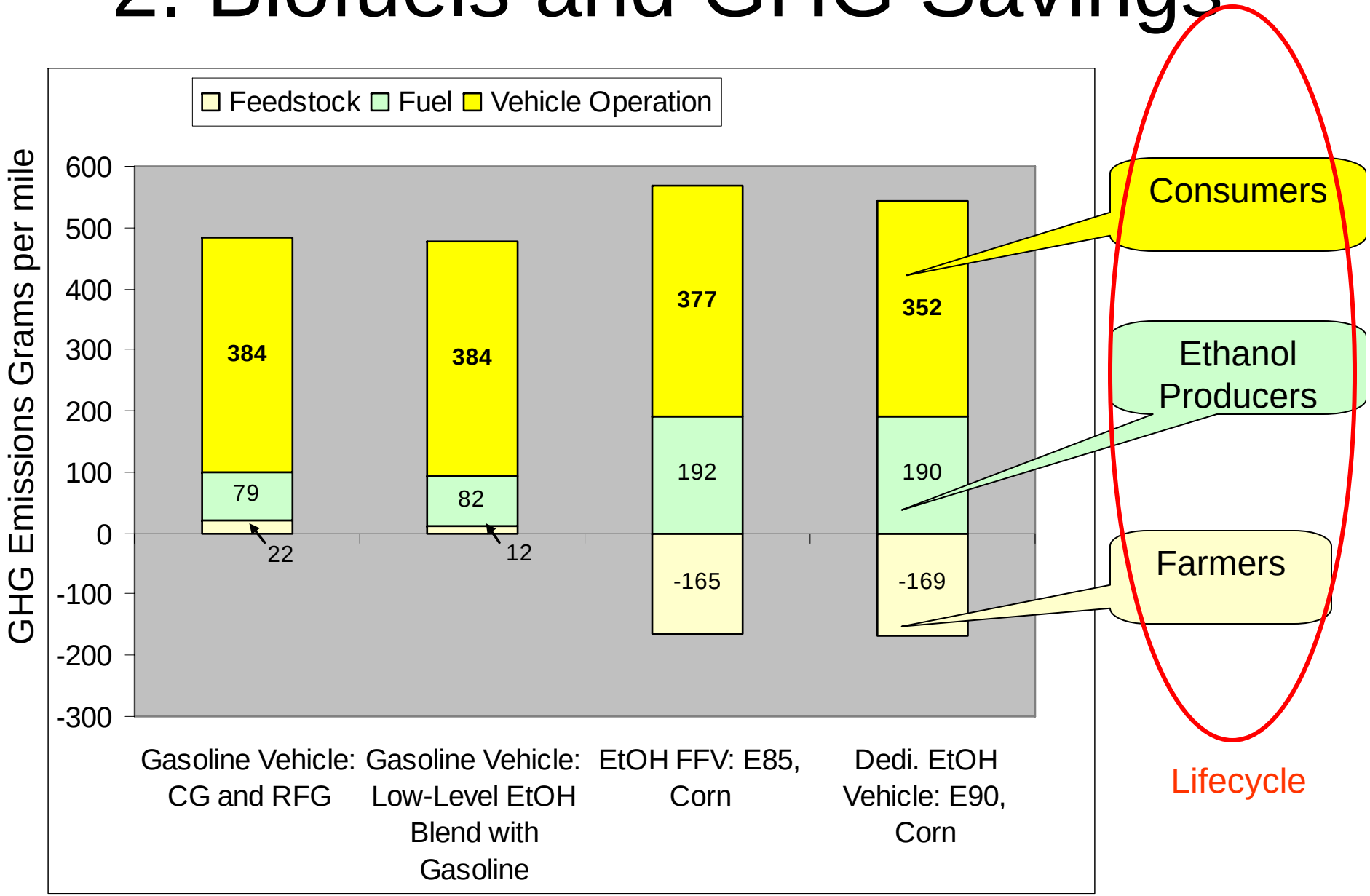
- How much of GHG savings due to biofuels, how to calculate the amount?
  - Mandates, addi
  - Bas
- Who has the right to trade?
  - # of participants, where does savings occur, institutional set-up
- How to verify, monitor and calculate leakages

Objective: Designing a carbon trading framework compatible with the contributions of LCA participants

gy

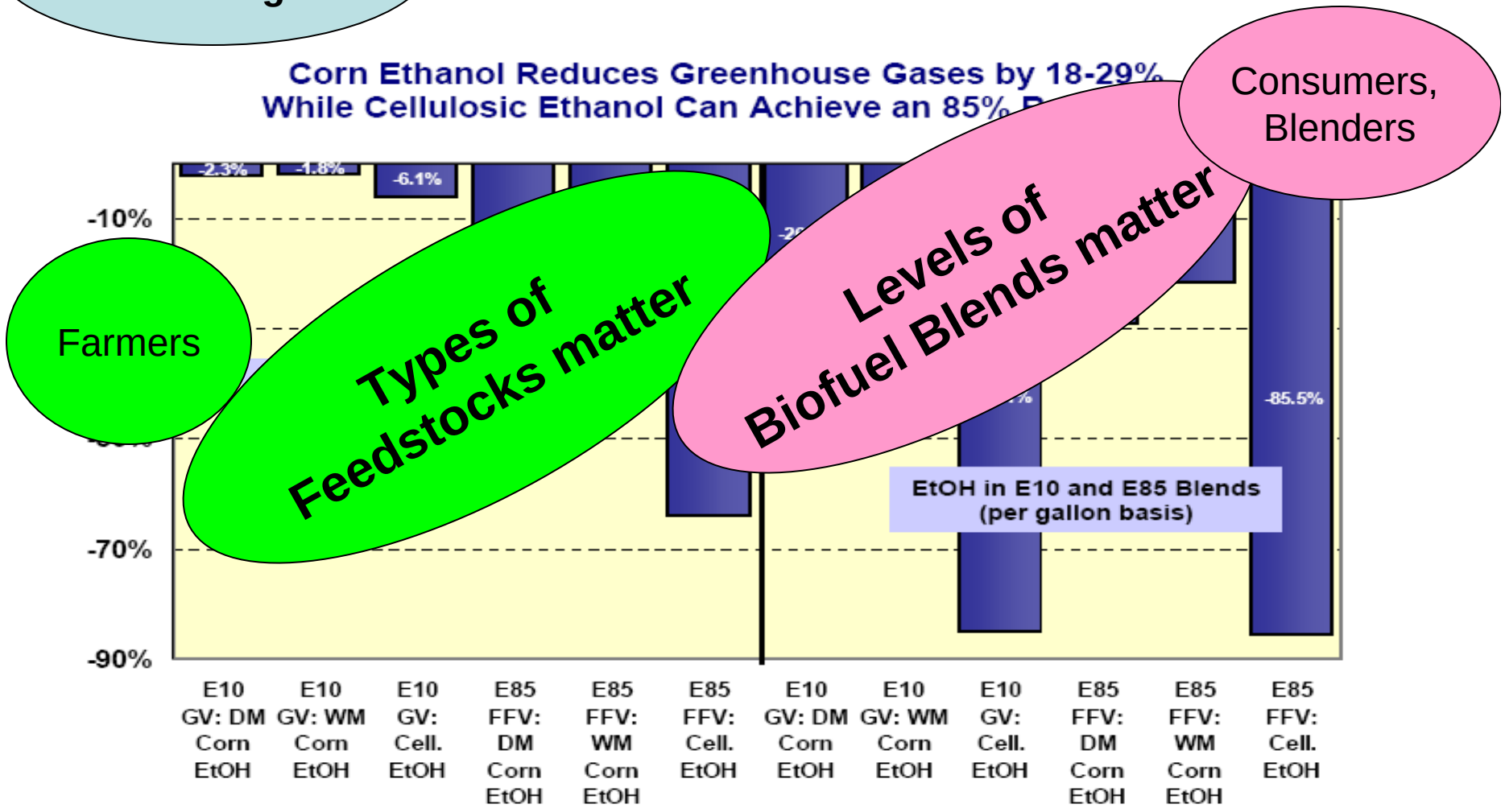
their efficiency

# 2. Biofuels and GHG Savings



# 2. Carbon savings from biofuels
# Eg Ethanol

**Baseline: Conventional gasoline**




Consumers, Blenders

Farmers

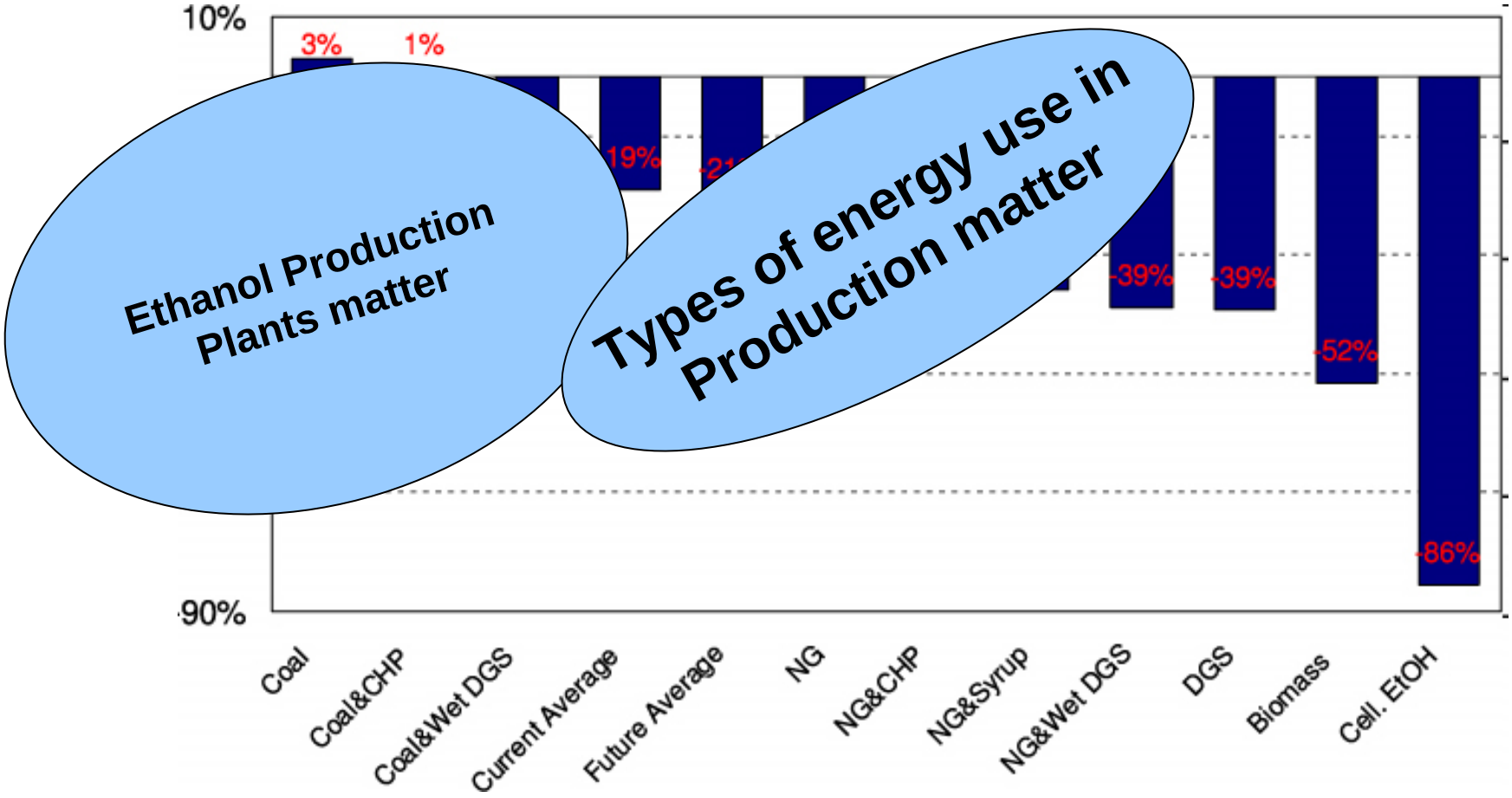
**Types of Feedstocks matter**

**Levels of Biofuel Blends matter**

Source: Wang et al (2003)

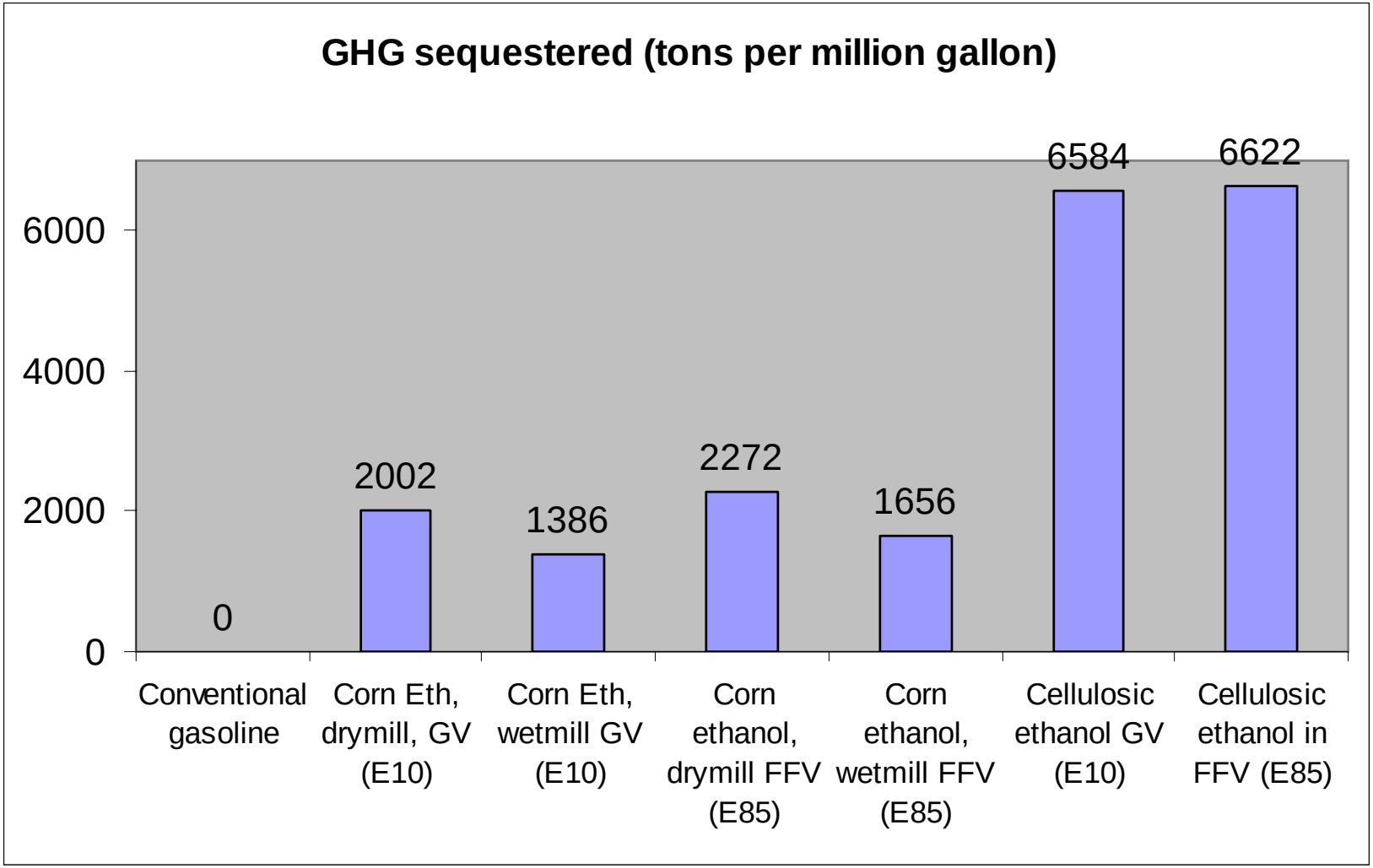
# 2. Biofuels and GHG savings

- Production processes affect GHG emissions

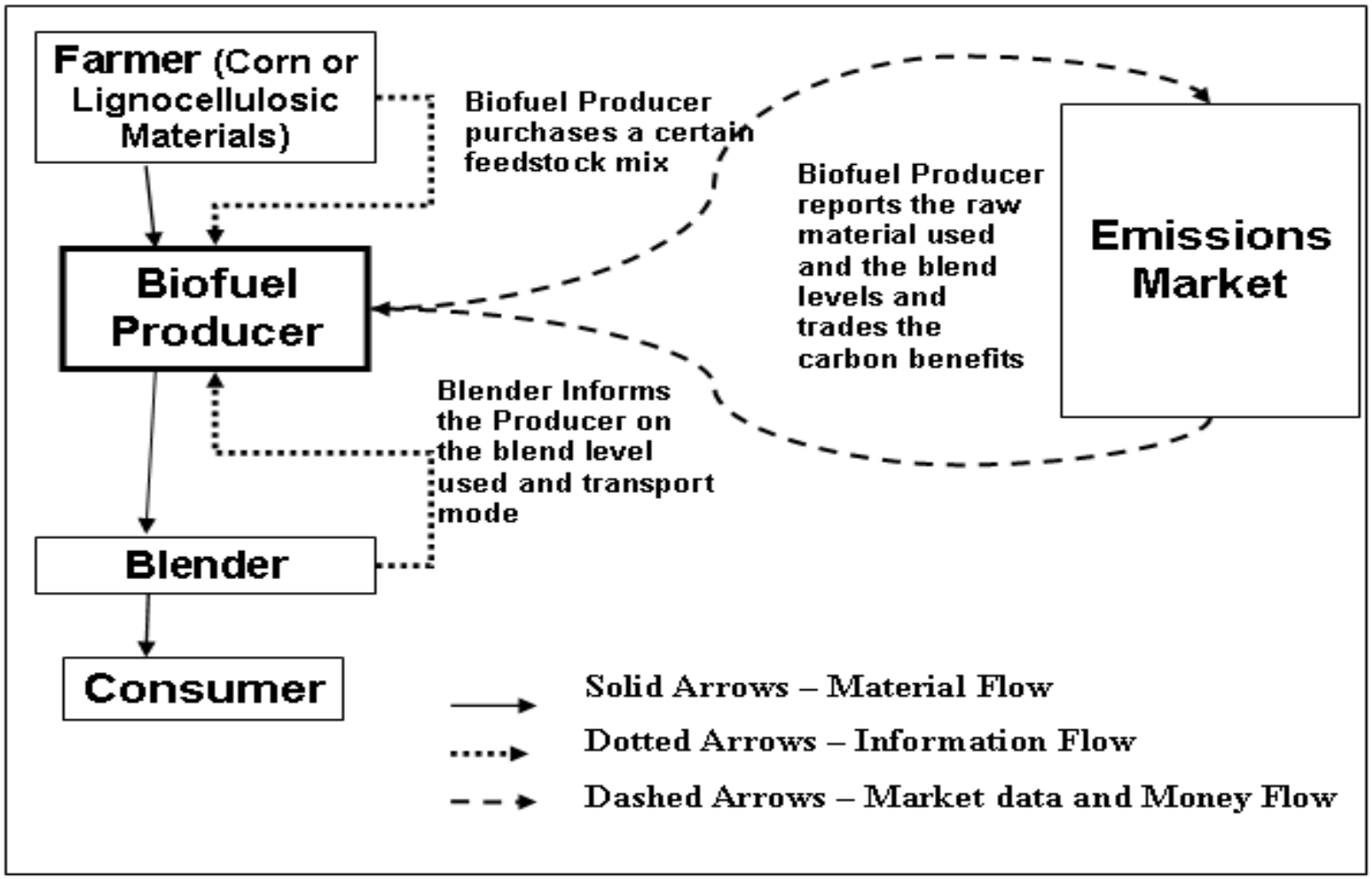



Source: Wang et al (2007)

# 3. How many tons of GHG sequestered?



# 4. Proposed Life Cycle based Carbon Trading Framework for Biofuels




Source: Our proposed framework

# Proposed Carbon Trading Framework

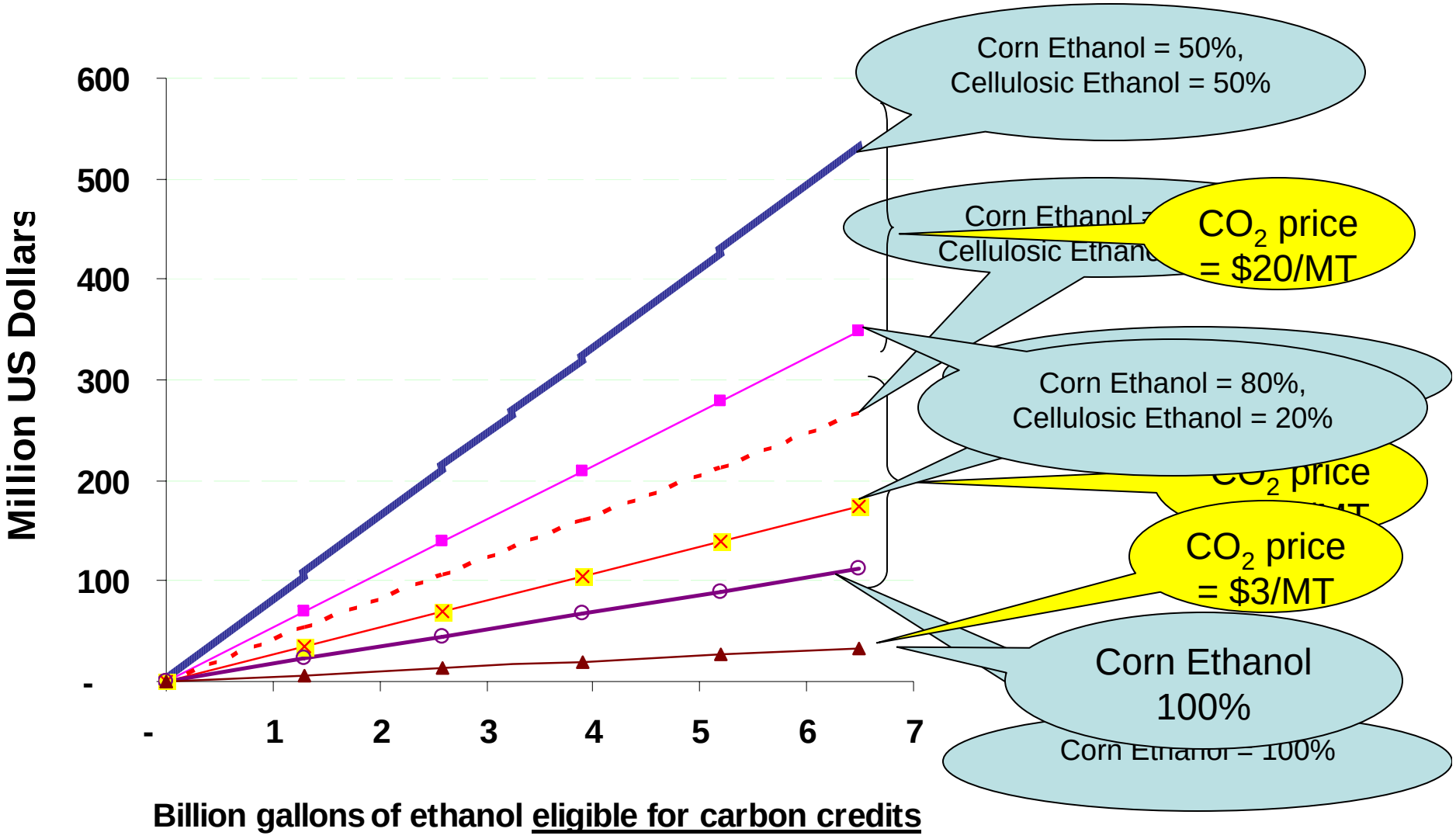
- Implementation:
  - Biofuel plants retain the carbon benefits of fuels, farmers sell the sequestered carbon rights to producers (implicitly)
- GREET model of Argonne National Labs
- Farmers, Consumers – Regional averages to be used
- Producers, Blenders – Project specific standards to be used
- Issues/Challenges
  - Industry wide norm has to be developed
  - Additionality over the mandates has to be established
  - Same framework applicable for other biofuels
  - Annual verification, carbon pools

Questions

and

Comments!

# 3. Value of GHG sequestered



# 3. Value of GHG sequestered