Carbon Sequestration via Biomass

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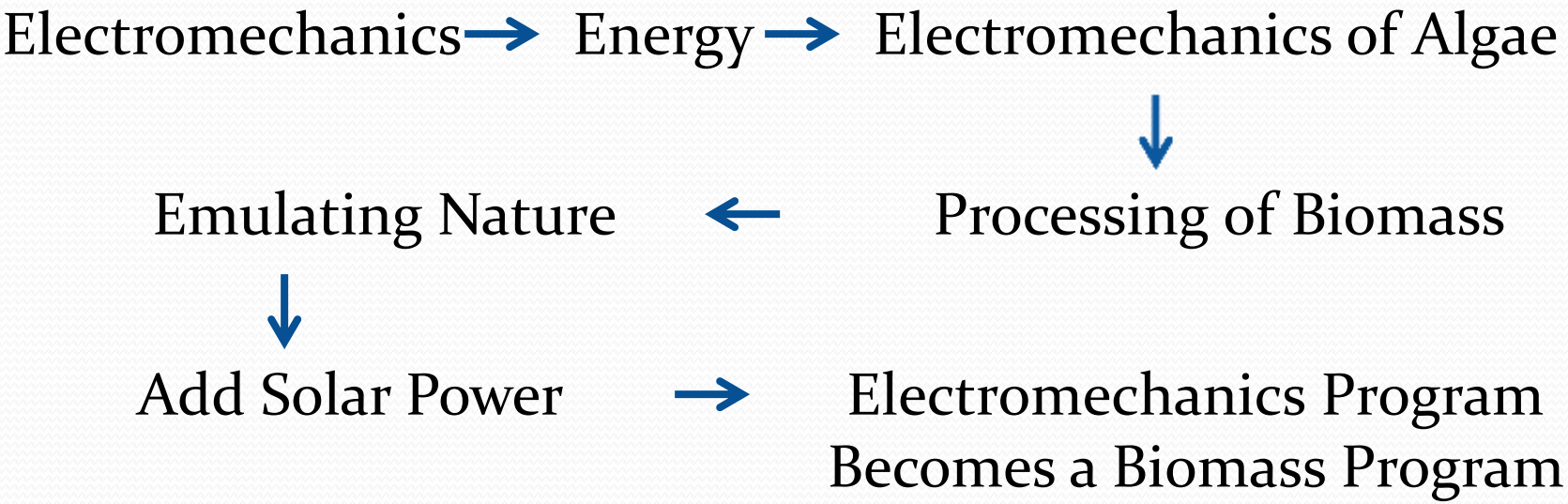
Biomass

- Can mean
  - Total mass of organisms in an area or a volume
  - Organic materials used for fuel
- Both meanings will be discussed

Electromechanics & Biomass

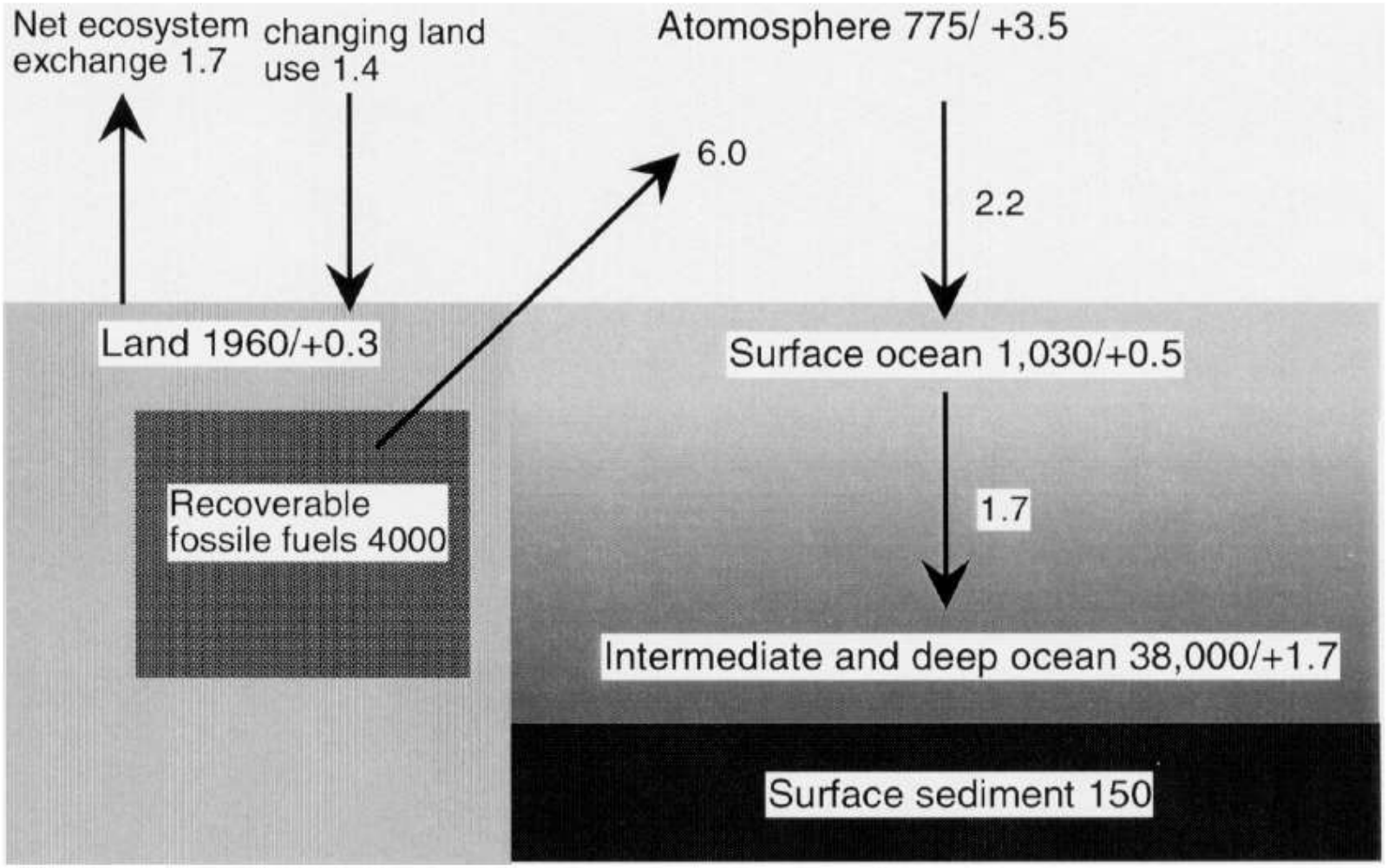


Fundamental Biomass Benefit

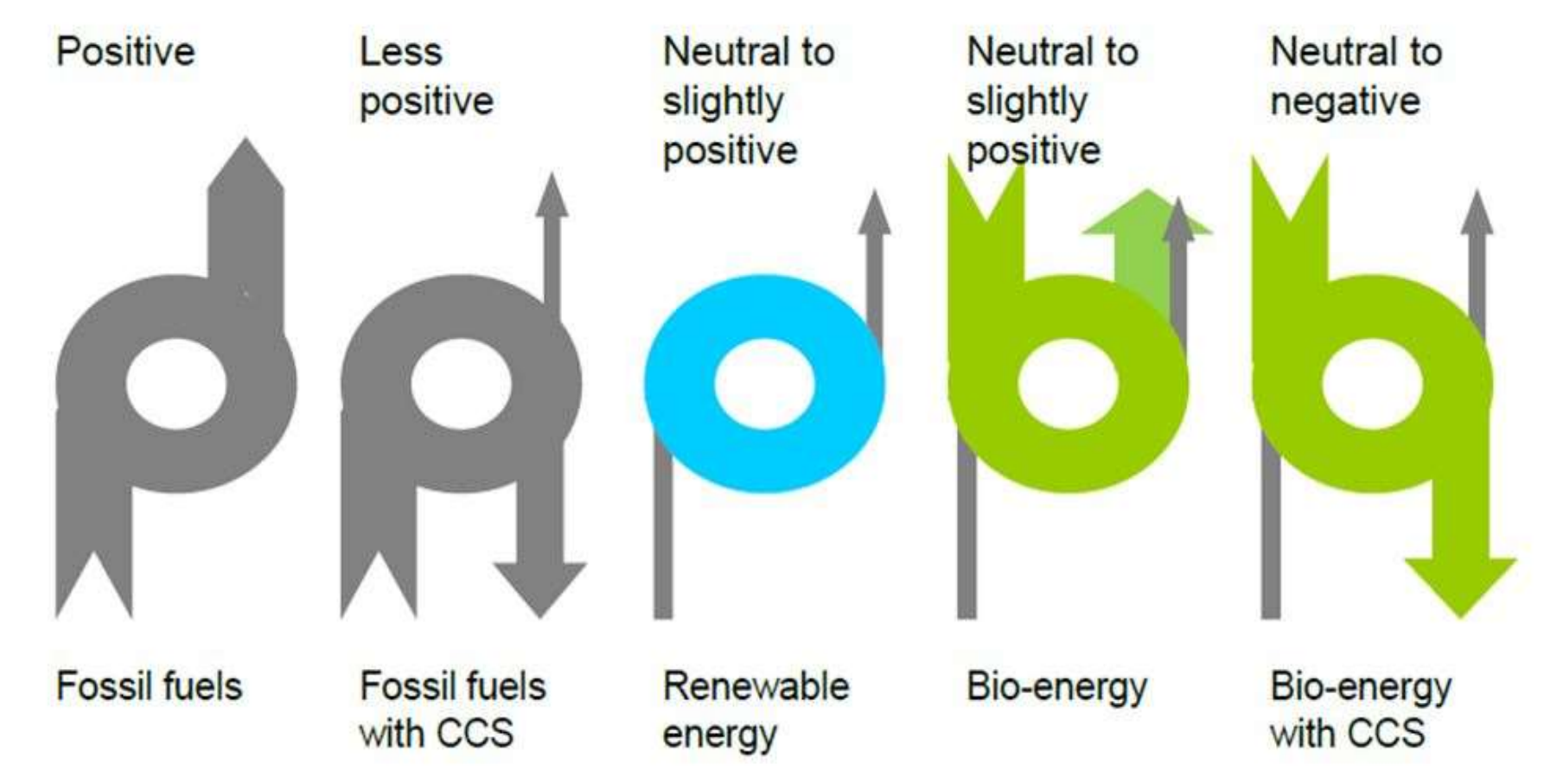
Mimics Nature

But nature's process produces fuel

Land and Sea CO_2 Exchange



Why Biomass and CCS – the net carbon balance



Koornneef, ECOFYS 2010

Need for Biomass CCS

- Everything else may not be enough
- Technical feasibility is proven
- Large scale

Policy Obstacles

- Lack of a price on CO_2 emissions
- Carbon storage easily reversed
- Lack of baseline measurement
- Measurement of amount of carbon sequestered
- Property rights and decision-making

Incentives that May Help

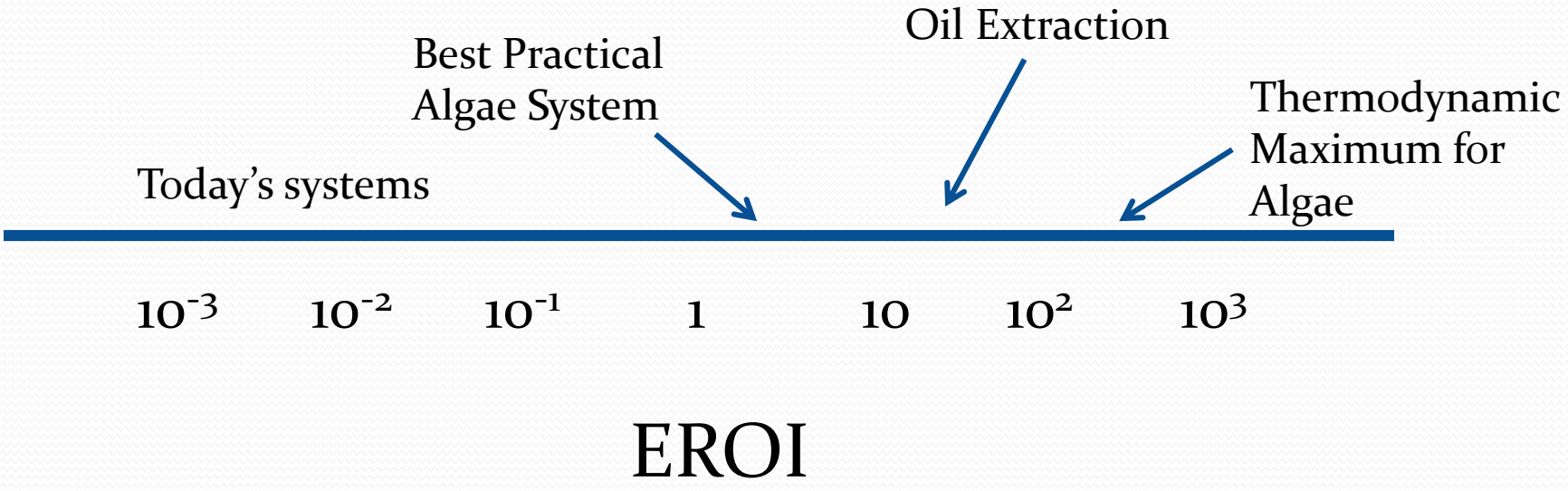
- Practice-based incentives
- Performance-based incentives

Technology Obstacles

- Algae example
  - Algae is ubiquitous
  - Algae produces crude oil
    - Milk
    - Split
    - Thermally process
  - Rapid growth rate has detrimental effects
  - Recycle CO_2 on a weekly or biweekly basis

Energy Return on Investment (EROI)

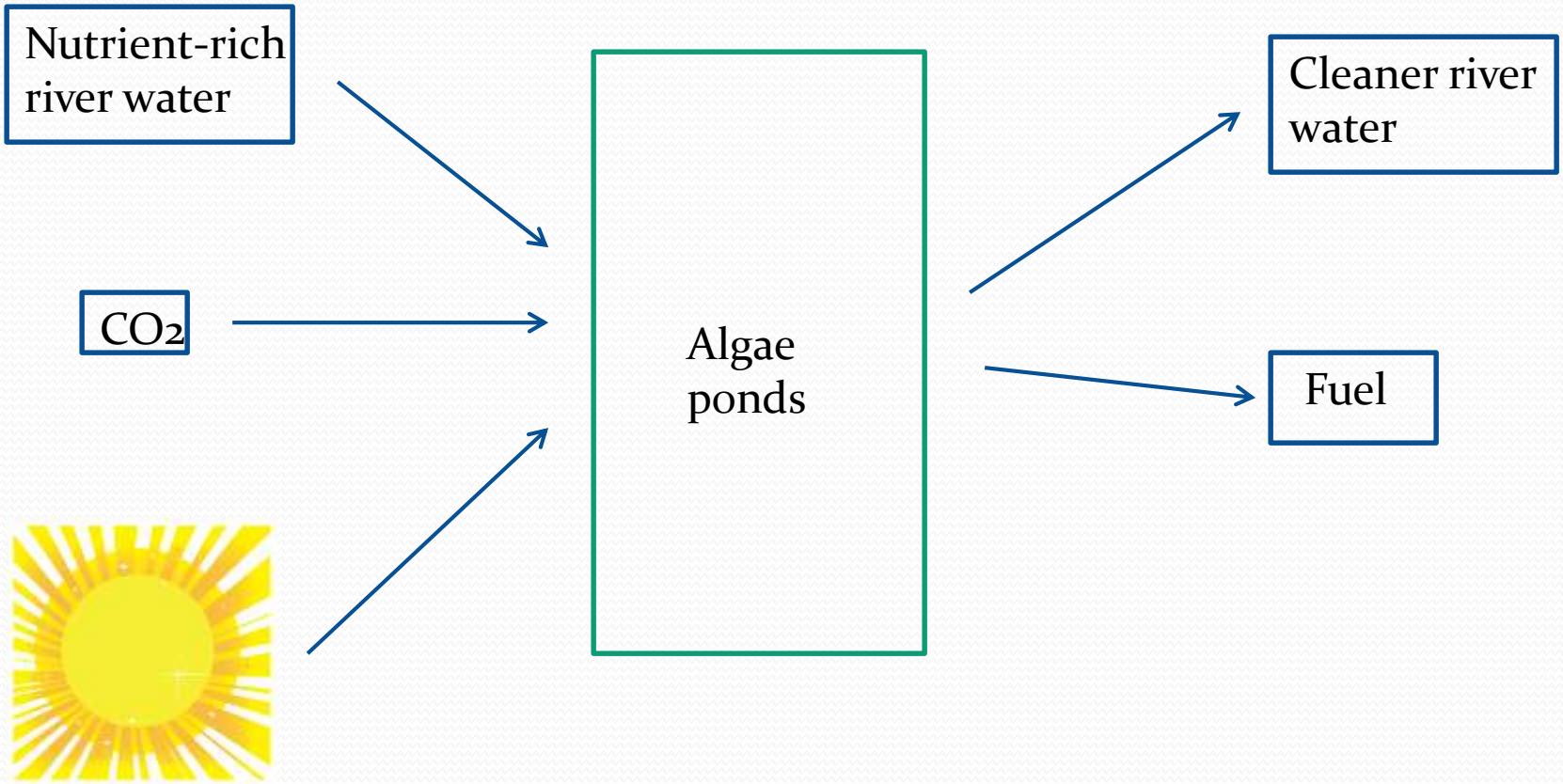
- EROI = (Energy Produced)/(Energy Required)
  - Achilles heel of biofuels



EROI Challenges

- Perceived need to augment growth
  - Nutrients
  - Water
- Practical solution
  - Link to sewage treatment plant
- Audacious solution
  - Divert Mississippi river

Mississippi River Approach



Success Leads to

- Sequestration
  - Or at least significant reduction of net CO_2 emitted
- A cleaner ocean
- Organic fertilizer

An audacious recycling program

Takeaways

- Biomass is nature's sequestration approach
  - Sequestration can be fragile
- We can easily diminish sequestration capability
- Increasing it is difficult
- Biomass can produce fuel
  - May be temporally better