



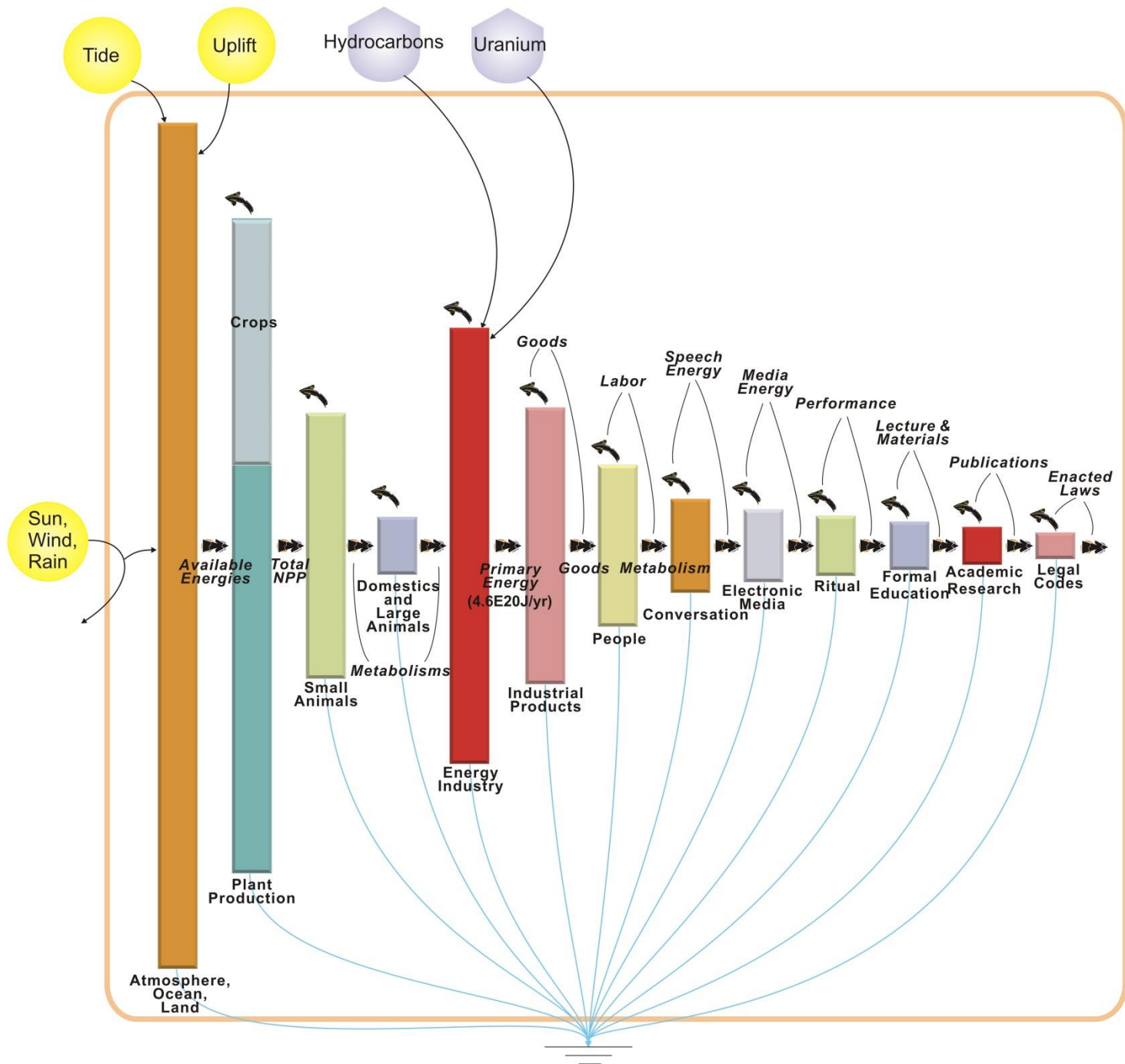
# Natural and Cultural Energy

## Hierarchy

Tom Abel

# Natural and Cultural Energy Hierarchy

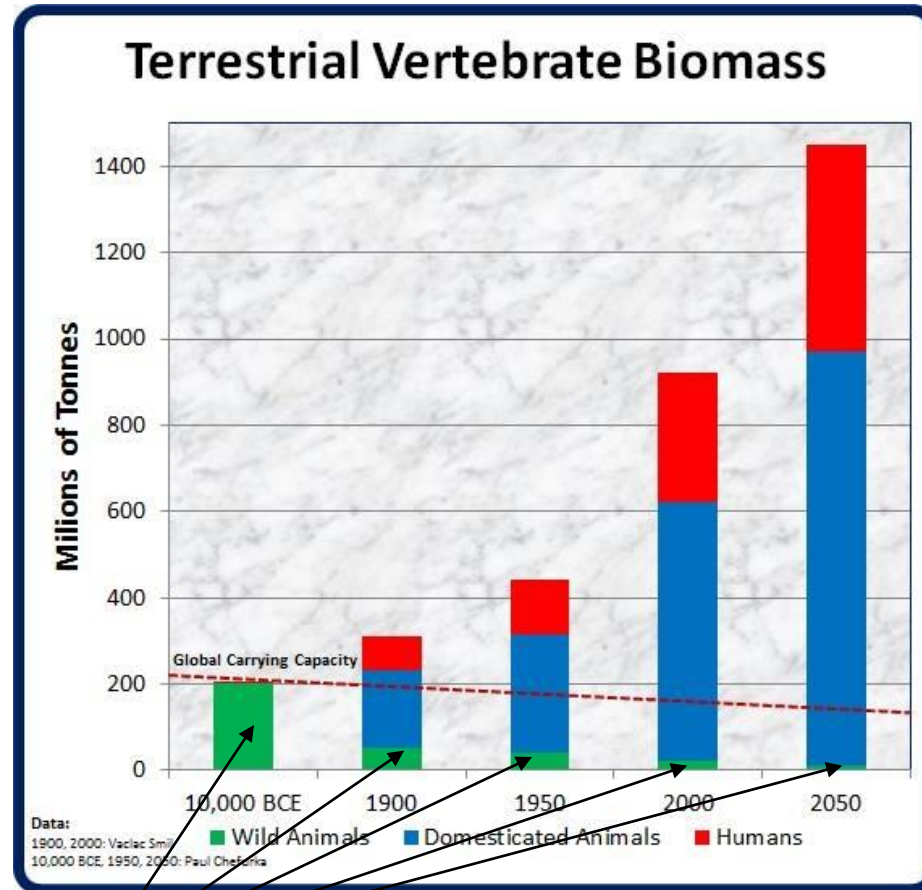
- The diagrams below are ‘energy’
- They have a couple numbers, but they are really just graphic story-telling
- I.e., as you move right in ‘scales’, energy is lost with each transformation
- The objects are stretched ‘process’ boxes of extreme aggregation (all plants, all small animals, etc)
- My hierarchy of ‘cultural information’ is tacked on at the end (though missing some of my usual scales)
- The first diagram is one I made a few years ago
- Following that you will see why I changed it
- I was stunned when I saw those charts, and wanted to add it to my diagram, further down



# Then I saw this...

Total vertebrate biomass has grown?

I assumed it just shifted to domestic and human

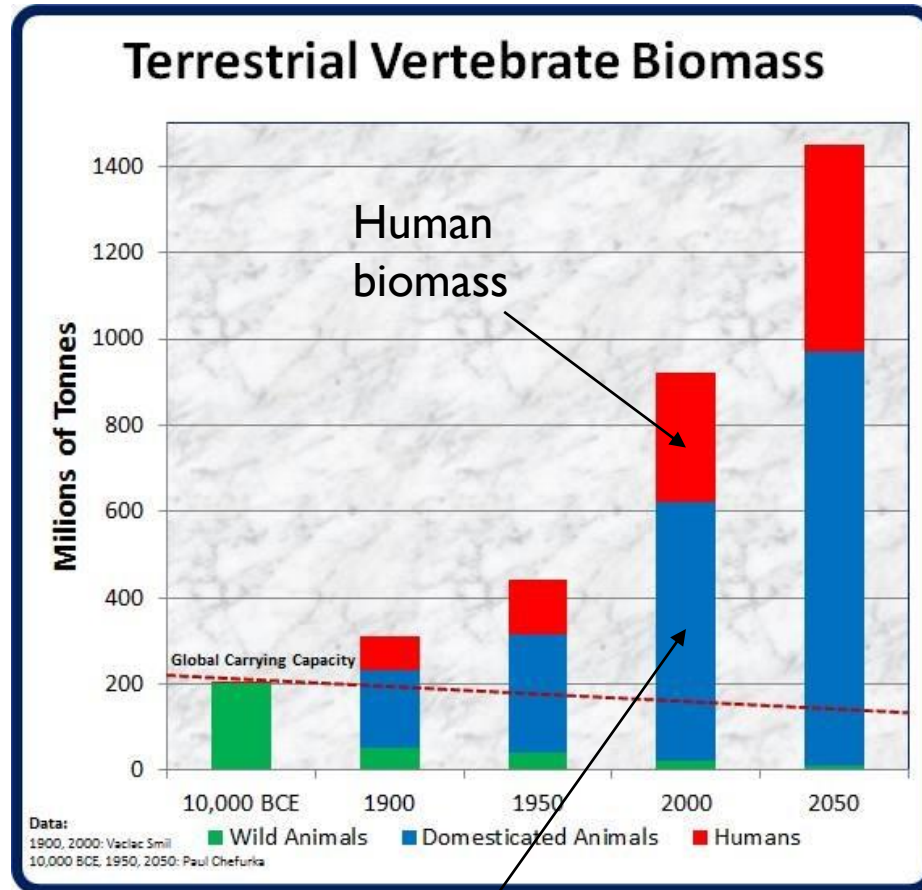


Wild vertebrate animals

# Then I saw this...

But isn't it limited by sunlight and space?

I guess not if you can clear forests for grassland, and if you can add fossil fuel fertilizer to increase crop production, then you can feed more domestic animals and more (domestic) humans



Domestic animals

This view is even more dramatic



Tide

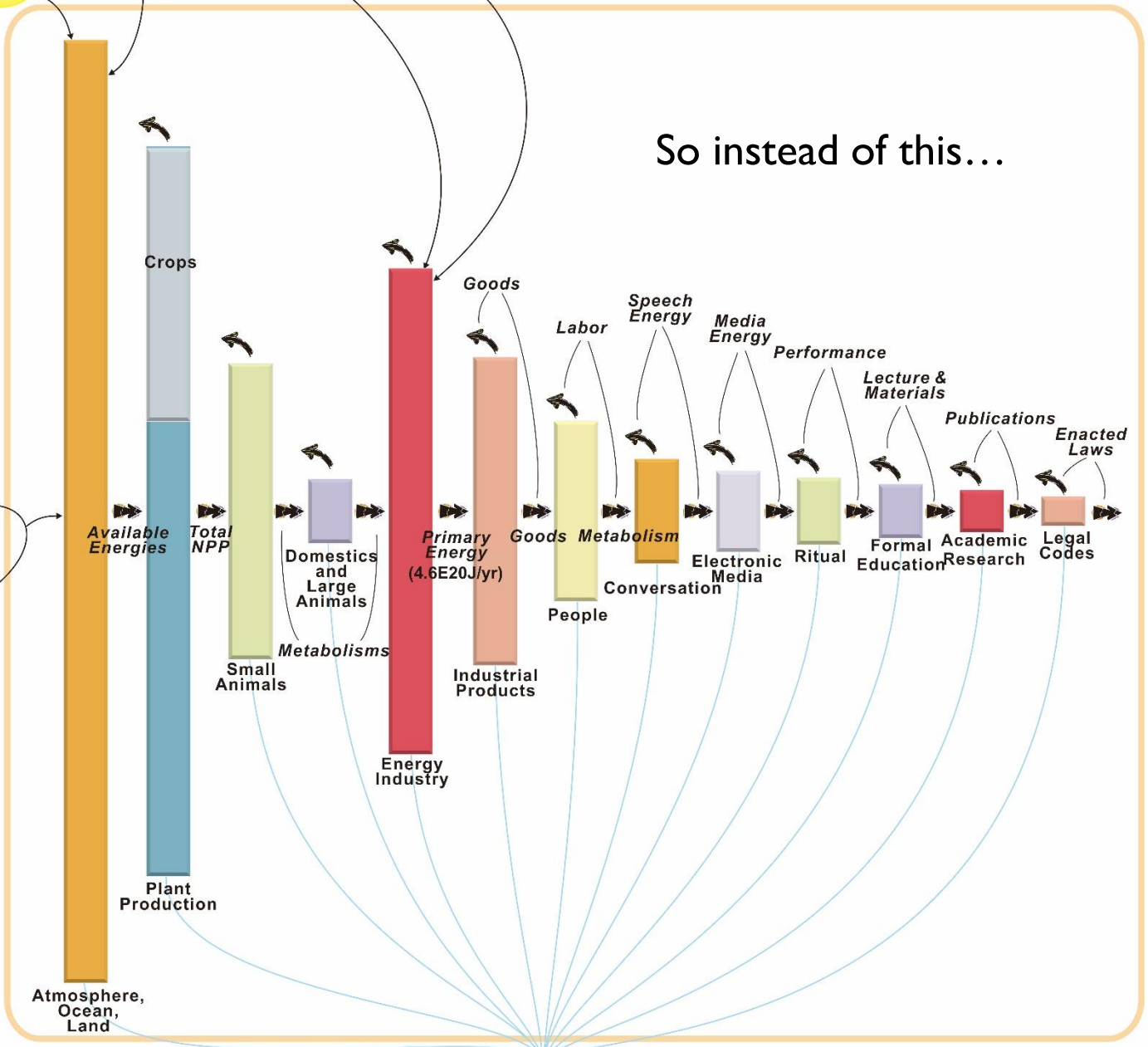
Uplift

Hydrocarbons

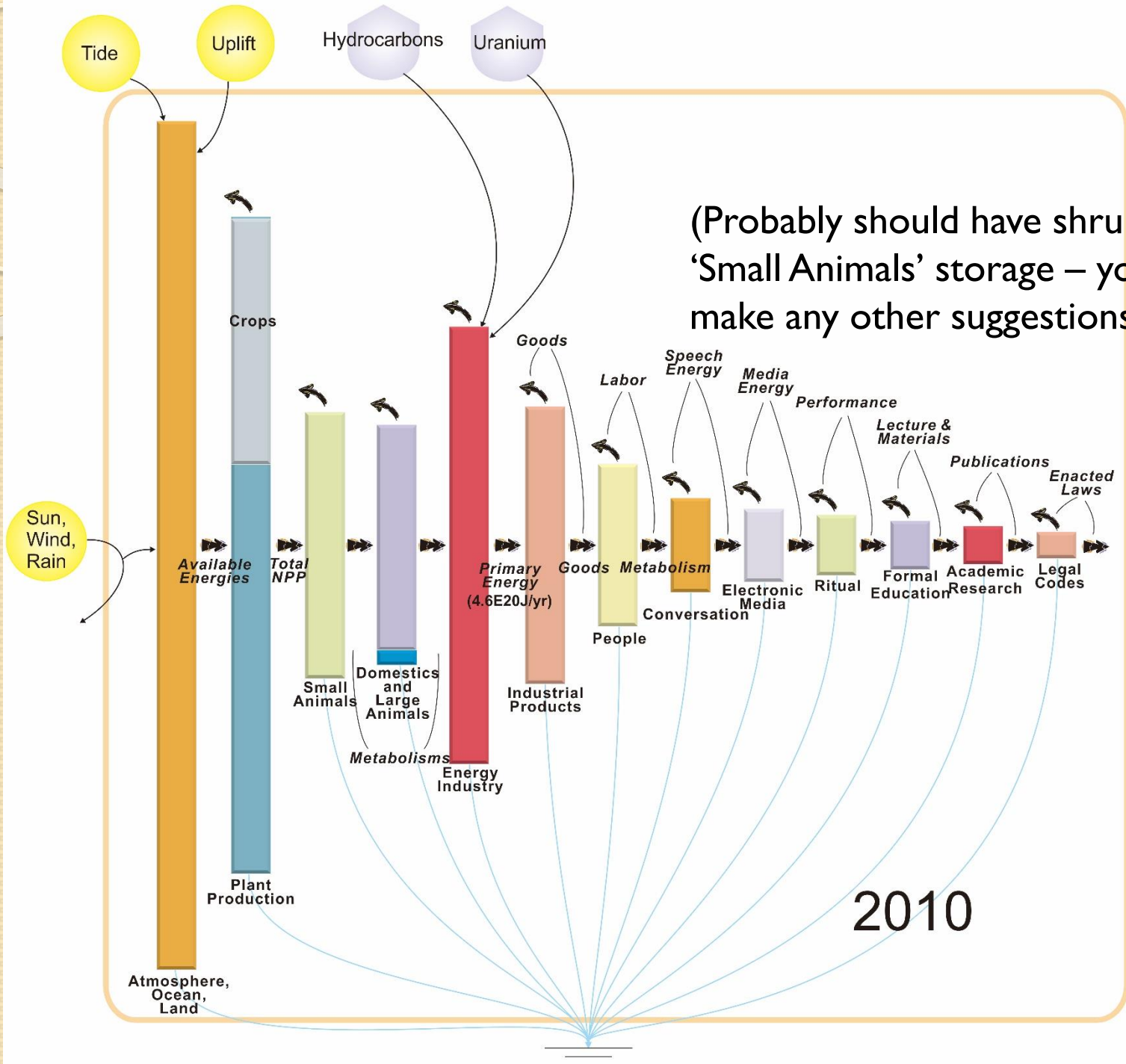
Uranium

Sun, Wind, Rain

So instead of this...







(Probably should have shrunk the 'Small Animals' storage – you can make any other suggestions)

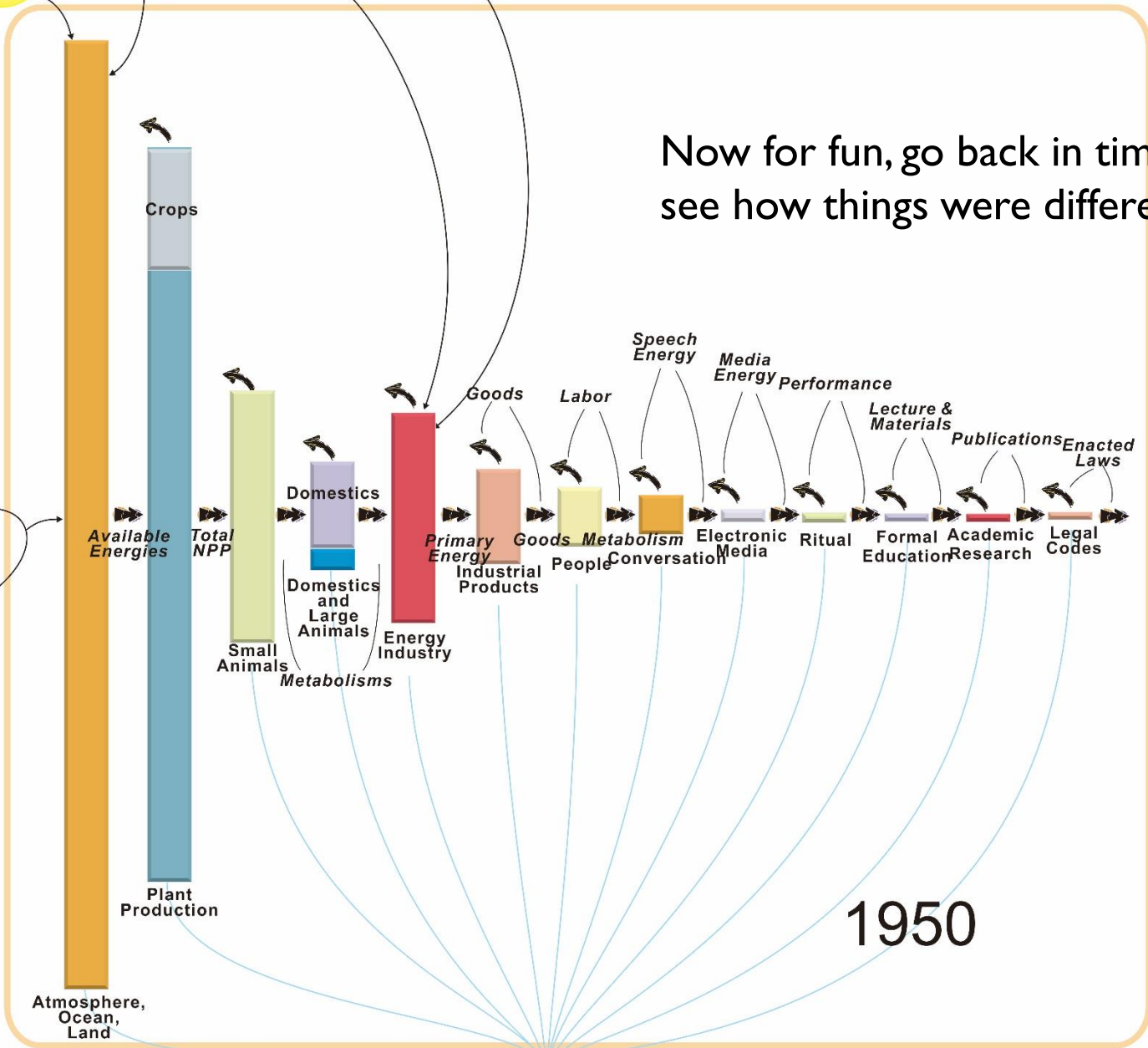
2010



Tide Uplift Hydrocarbons Uranium

Now for fun, go back in time and see how things were different

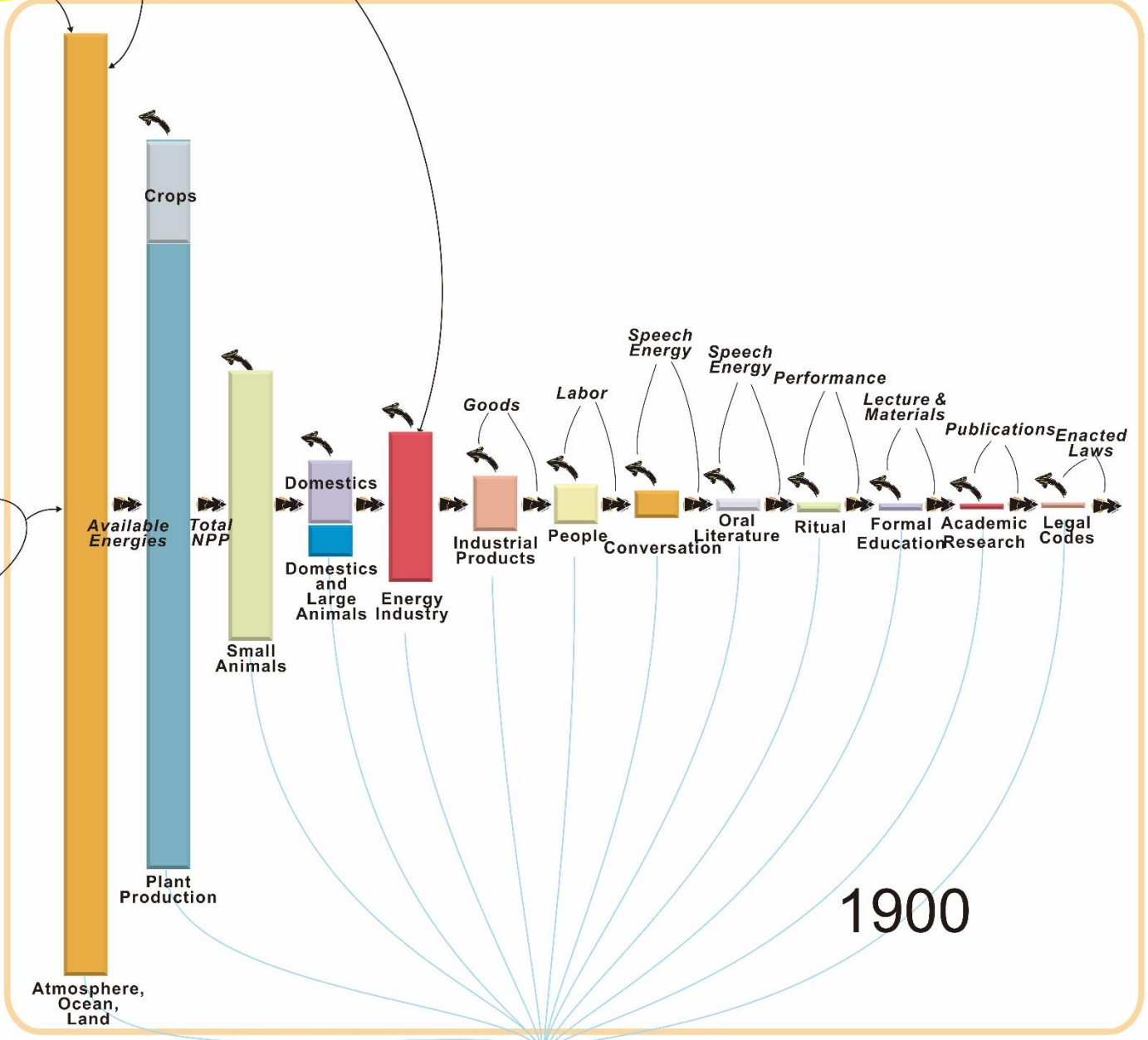
Sun, Wind, Rain



1950

Tide Uplift Hydrocarbons

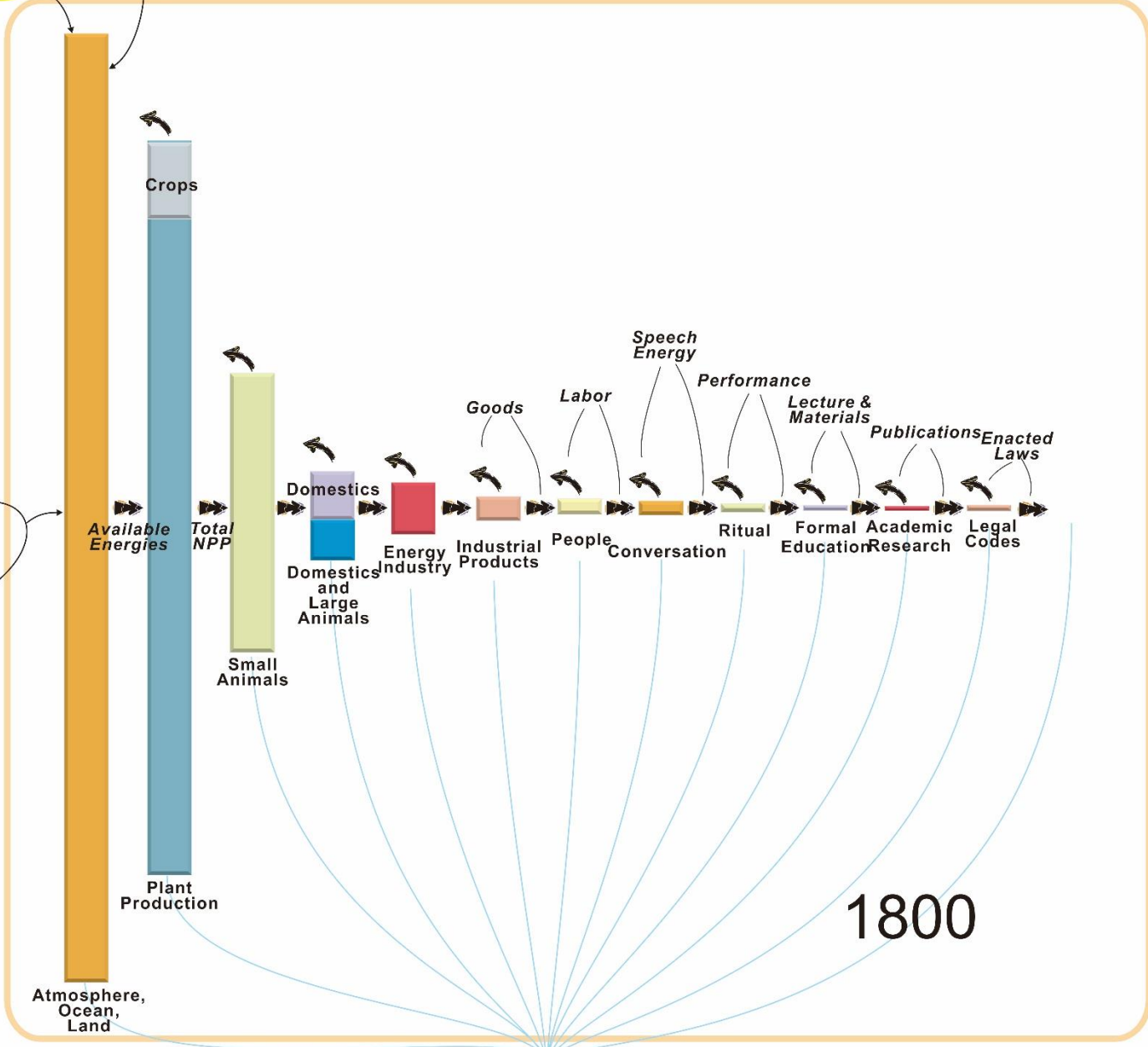
Sun, Wind, Rain



1900

Tide Uplift

Sun, Wind, Rain

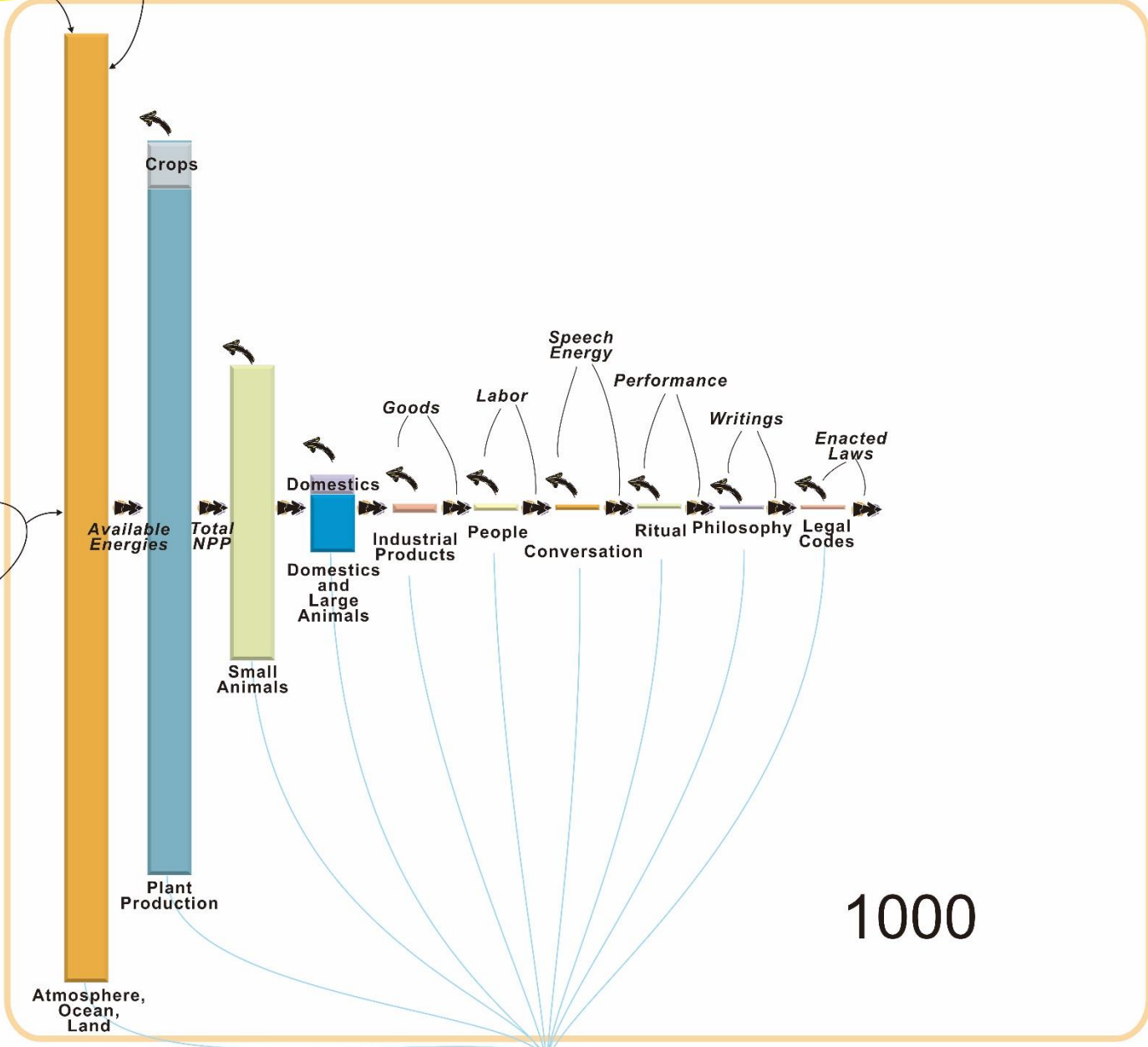


1800

Atmosphere, Ocean, Land

Tide Uplift

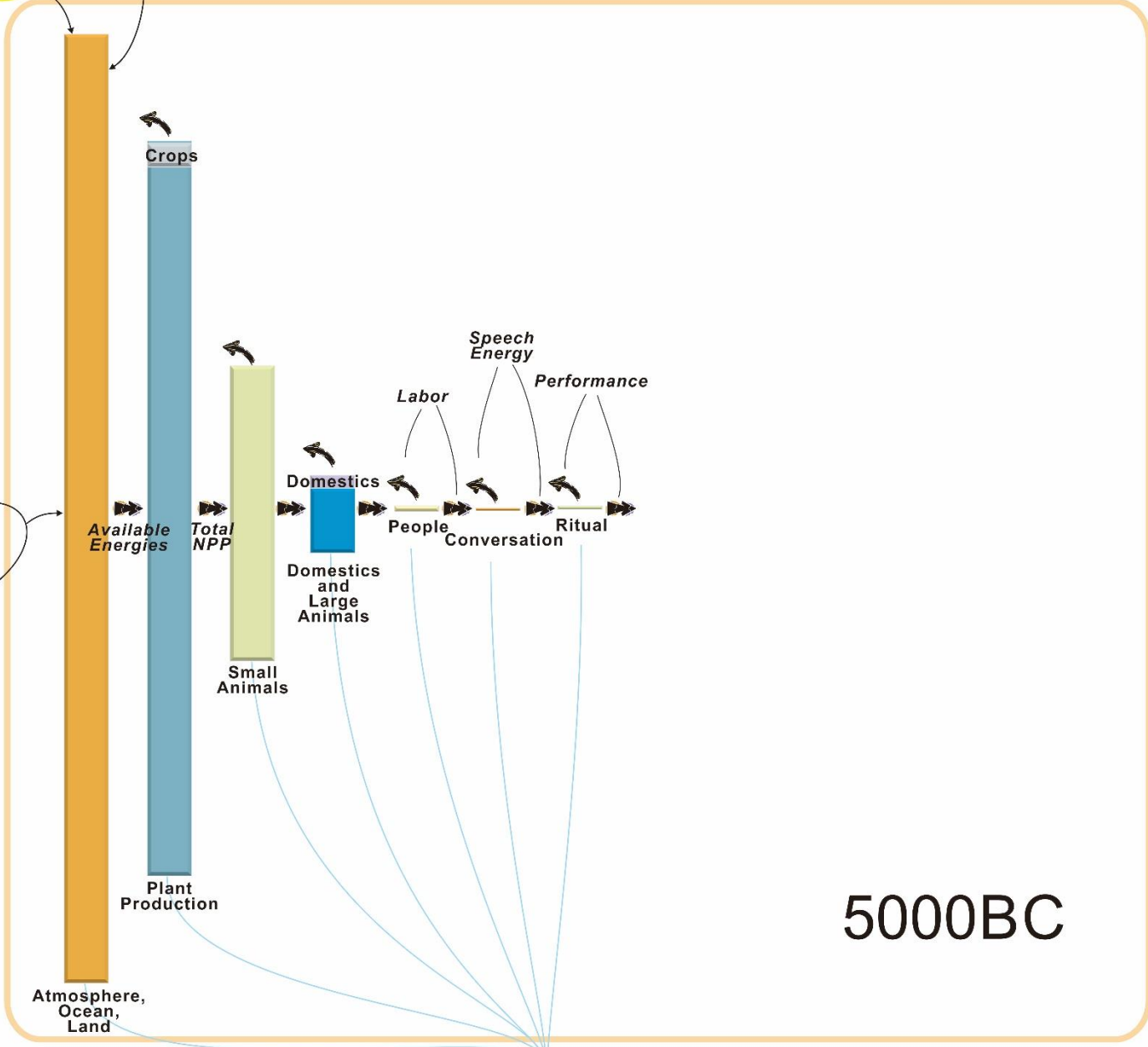
Sun, Wind, Rain



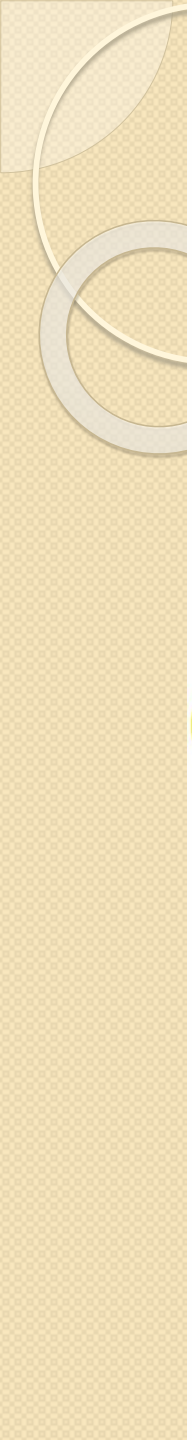
1000

Tide Uplift

Sun, Wind, Rain

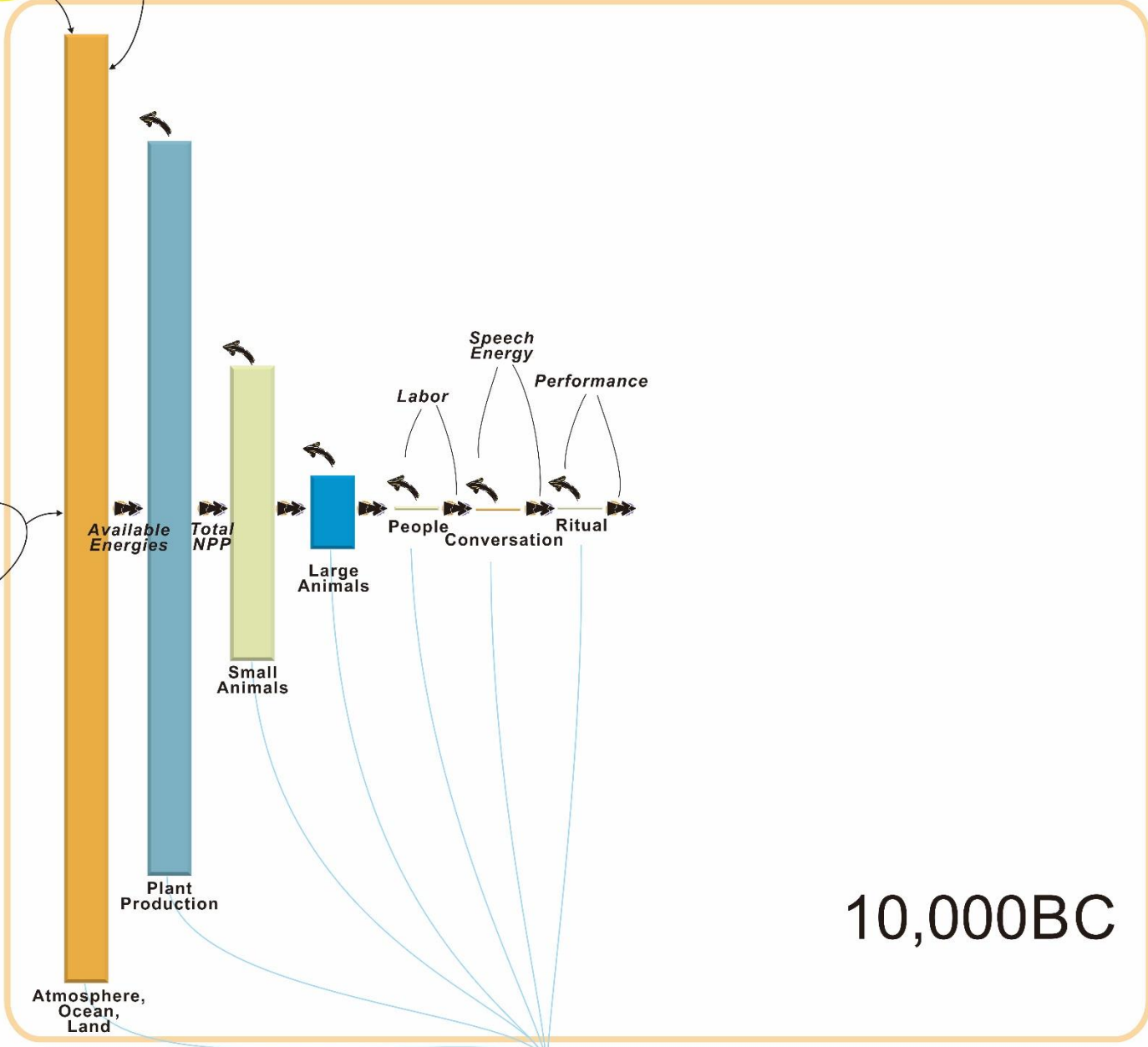


5000BC



Tide Uplift

Sun, Wind, Rain



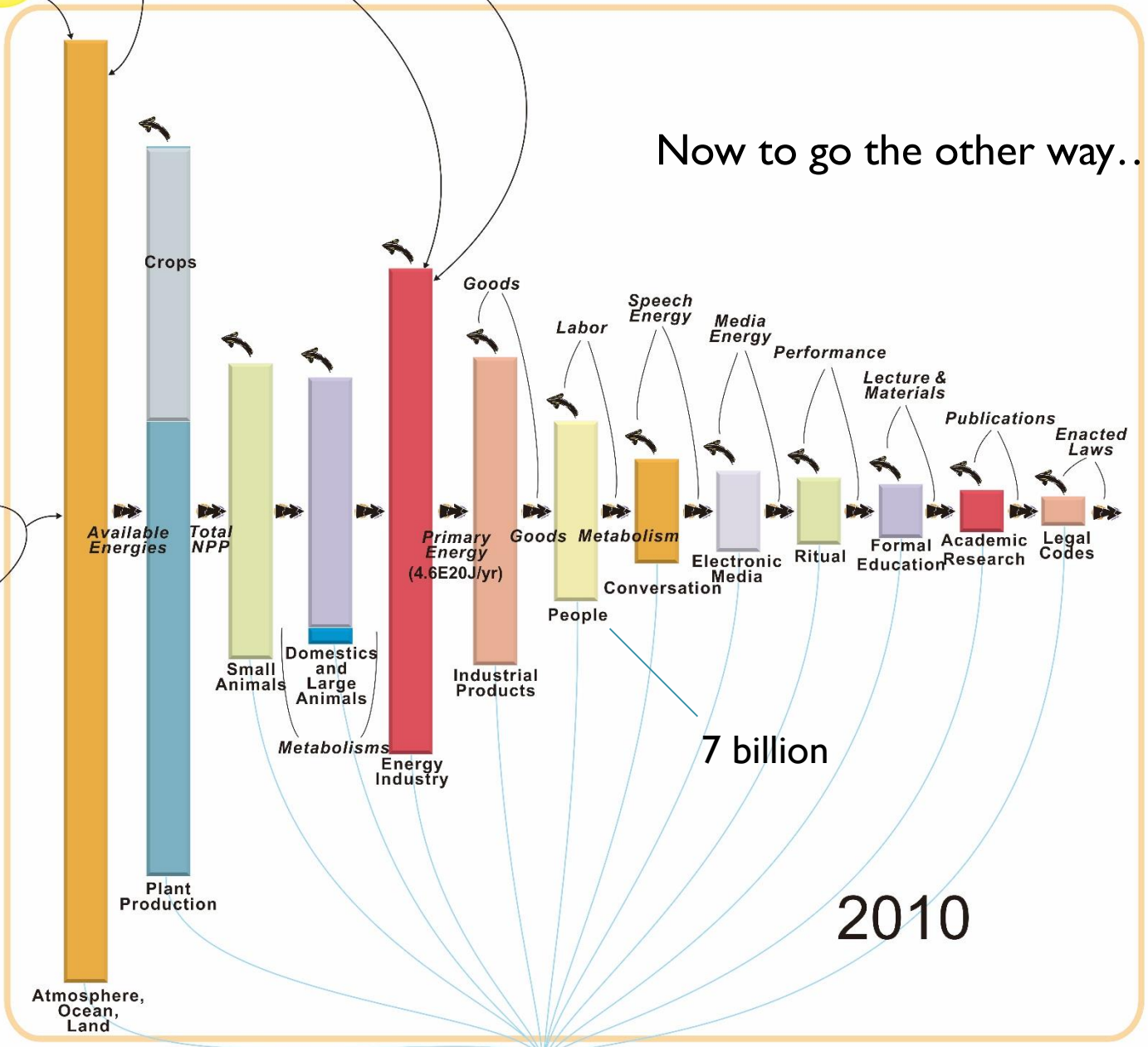
10,000BC



Tide Uplift Hydrocarbons Uranium

Now to go the other way...

Sun, Wind, Rain

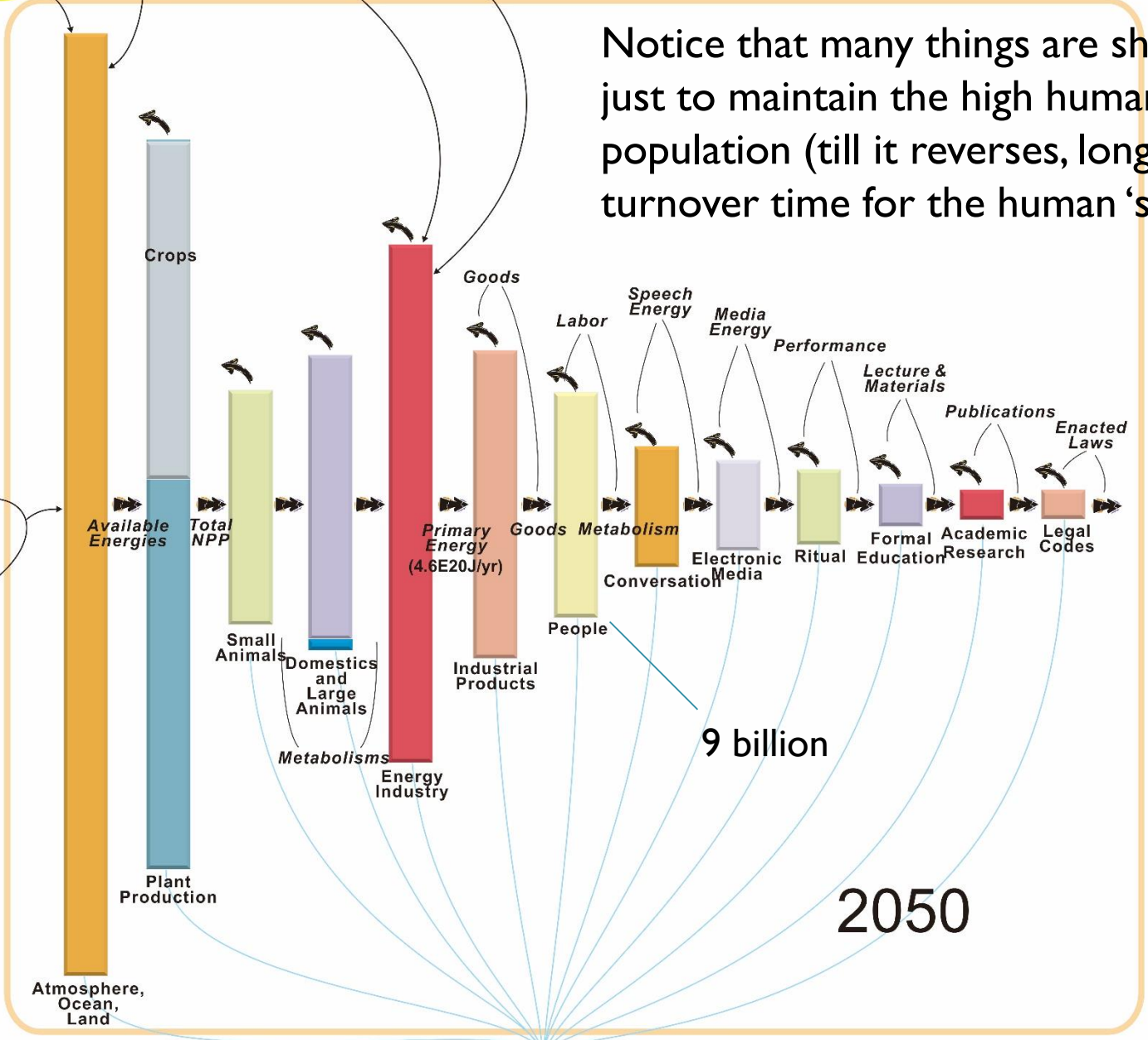


2010

Tide Uplift Hydrocarbons Uranium

Notice that many things are shrinking, just to maintain the high human population (till it reverses, long turnover time for the human 'storage'!)

Sun, Wind, Rain



9 billion

2050

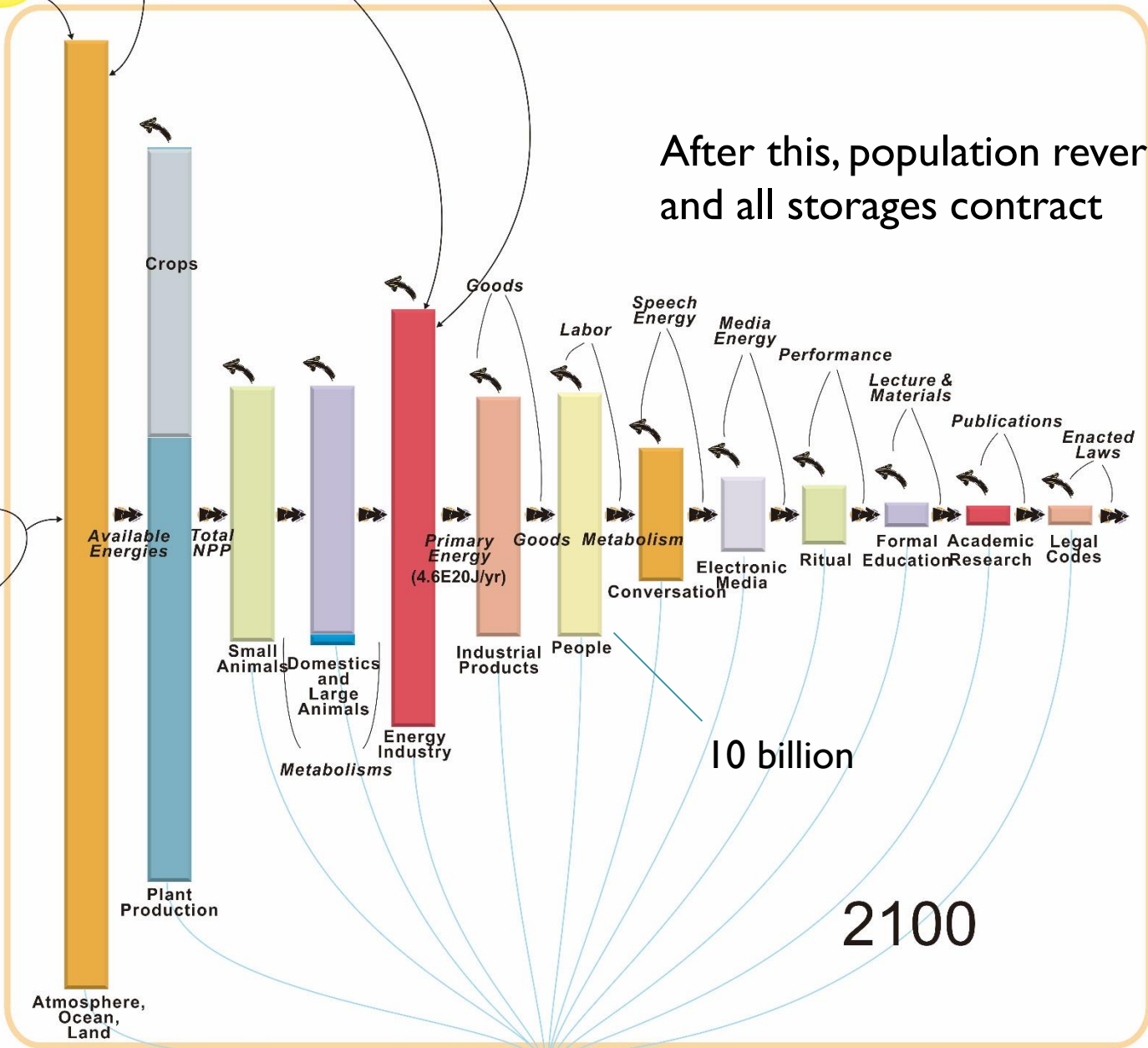
Tide

Uplift

Hydrocarbons

Uranium

Sun, Wind, Rain



After this, population reverses and all storages contract

10 billion

2100



**THE END**