whatIf?

whatIf? Technologies

Designing the Future

Models and Measurement

Presentation by Robert Hoffman

Mind, Thinking & Creativity
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Stafford Beer

Now there is a proven cybernetic theorem which says that the regulation that the regulator can achieve is only as good as the model of the reality that it contains. . .It comes down to this: we cannot regulate our interaction with any aspect of reality that our model of reality does not include - whether as to its theoretical range or as to its observational facilities and resolution - because we cannot by definition be conscious of it.

Stephen J Gould

New facts, collected in old ways under the guidance of old theories, rarely lead to any substantial revision of thought. Facts do not “speak for themselves”; they are read in the light of theory. Creative thought, in science as much as in the arts, is the motor of changing opinion.

John von Neumann

The sciences do not try to explain, they hardly even try to interpret, they mainly make models. By a model is meant a mathematical construct which, with the addition of certain verbal interpretations, describes observed phenomena. The justification of such a mathematical construct is solely and precisely that it is expected to work.

Donnella Meadows

Computer models do not make the job of decision making any easier.

They make it harder.

They enforce rigourous thinking and expose fallacies in mental models we have always been proud of.

We think it is worth it.

We think it pushes our mental models to be a bit closer to reflecting the world as it is.

Alan Kay

The heart of computing is building a dynamic model of an idea through simulation. Computers can go beyond static representations that can at best argue; they can deliver sprightly simulations that portray and test conflicting theories. The ability to “see” with these stronger representations of the world will be as important an advance as was the transition to language, mathematics and science from images and common sense.

Kenneth Boulding

It is much more accurate to identify the factors of production as know-how (that is genetic information structure), energy, and materials, for, as we have seen, all processes of production involve the direction of energy by some know-how structure toward the selection, transportation, and transformation of materials into the product.

Kenneth Boulding

Our own society cannot be understood by equilibrium concepts alone. The universe is a disequilibrium system and has been from the very beginning. Equilibrium, therefore, is a figment of the human imagination. It is a product of our limited perception.

Oscar Wilde

The systems that fail are those that rely on the permanency of human nature, and not on its growth and development.

Erwin Laszlo

The evolutionary paradigm challenges concepts of equilibrium and determinacy in scientific theories; and it modifies the classical deterministic conception of scientific laws. The laws conceptualized in the evolutionary context are not deterministic and prescriptive: they do not uniquely determine the course of evolution. Rather, they state ensembles of possibilities within which evolutionary processes can unfold.

Woody Allen

More than any other time in history, mankind faces a crossroads. One path leads to despair and utter hopelessness. The other, to total extinction. Let us pray we have the wisdom to choose correctly.

Newtonian

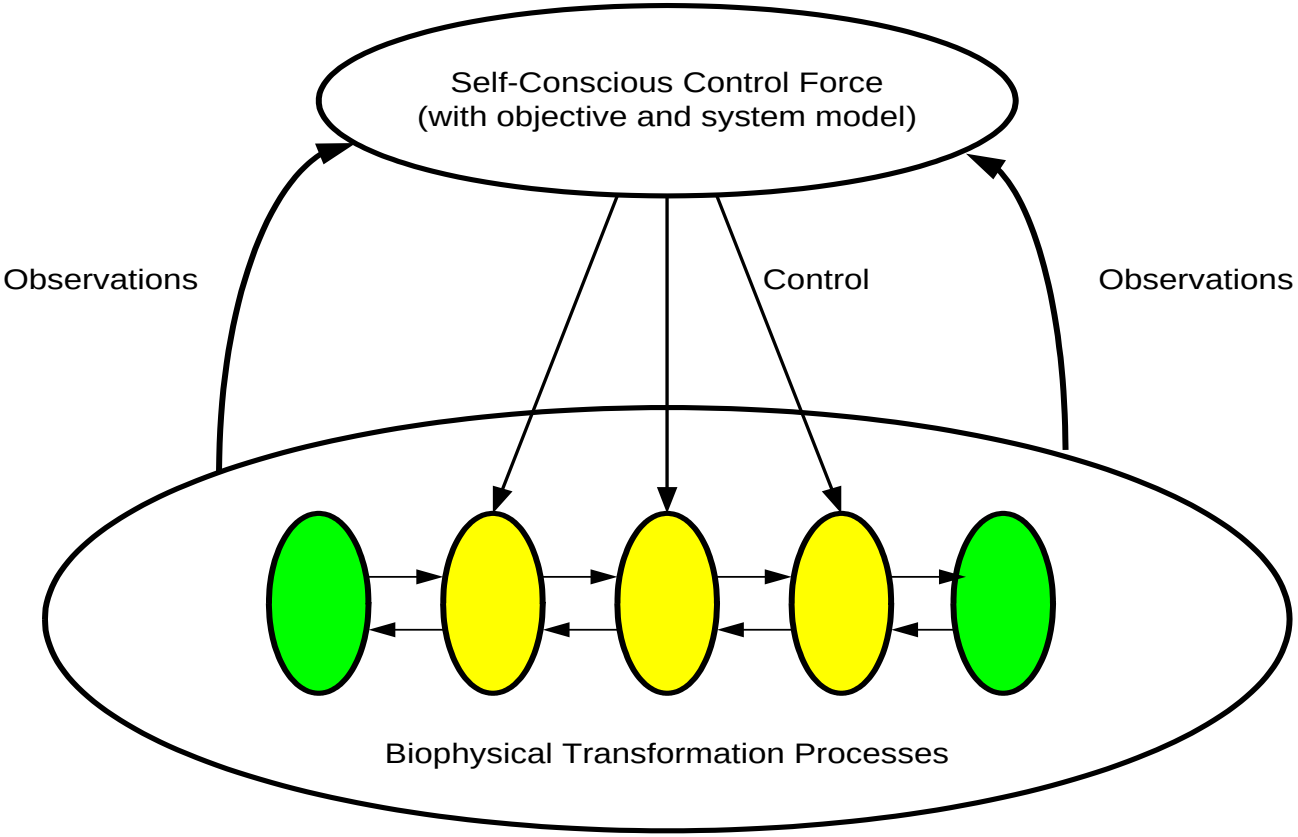
- Observers of a closed system
- Future is determined by universal and timeless laws
- Structure is given by starting condition
- Choice is an illusion

Evolutionary

- Integral part of a system
- Open to low entropy energy
- Earth system processes are far from thermodynamic equilibrium
- Future is in part determined by choice
- Structure is emergent and unpredictable

whatIf? Design Approach Modelling

World View



Design Approach Concepts

- Whole system
  - A set of processes connected together to form a whole
  - Properties of the whole emerge from the interactions among the processes
- Two system components
  - Biophysical substrate
  - Mind space – self-conscious control force
- Process as fundamental concept
  - Transformation of input flows to output flows
  - Time structure
- Physical substrate
  - Consists of material/energy transformation processes
  - Naturally occurring and purposeful processes
  - Subject to physical laws
- Mind space
  - Consists of information transformation processes
  - Controls purposeful processes
  - Effective control requires an objective and understanding of the system
- Tension
  - System to be controlled is over determined in terms of control variables
  - Incoherence among control variable settings results in tension
  - Tension is used to guide navigation

Origins - Theory

- Activity Analysis – Koopmans, Leontief, Georgescu-Roegan
- System Dynamics - Forrester
- Control Theory – Mesarovic, Findeisen
- General System Theory – Ashby, Bertalanffy, Beer
- Cognitive Theory – Bateson, Maturana and Varella
- Evolutionary Theory –Jantsch, Laszlo, Boulding, Smolin
- Theory of Dissipative Structures - Prigogine

Origins - Practice

- Input - Output Modeling – 1970s
- Energy Analysis – 1970s and 1980s
- Socio-Economic Resource Framework – 1980s
- Global Systems Simulator – 1990s
- Australian Stocks and Flows Framework - Ongoing
- Canadian Energy Systems Simulator - Ongoing

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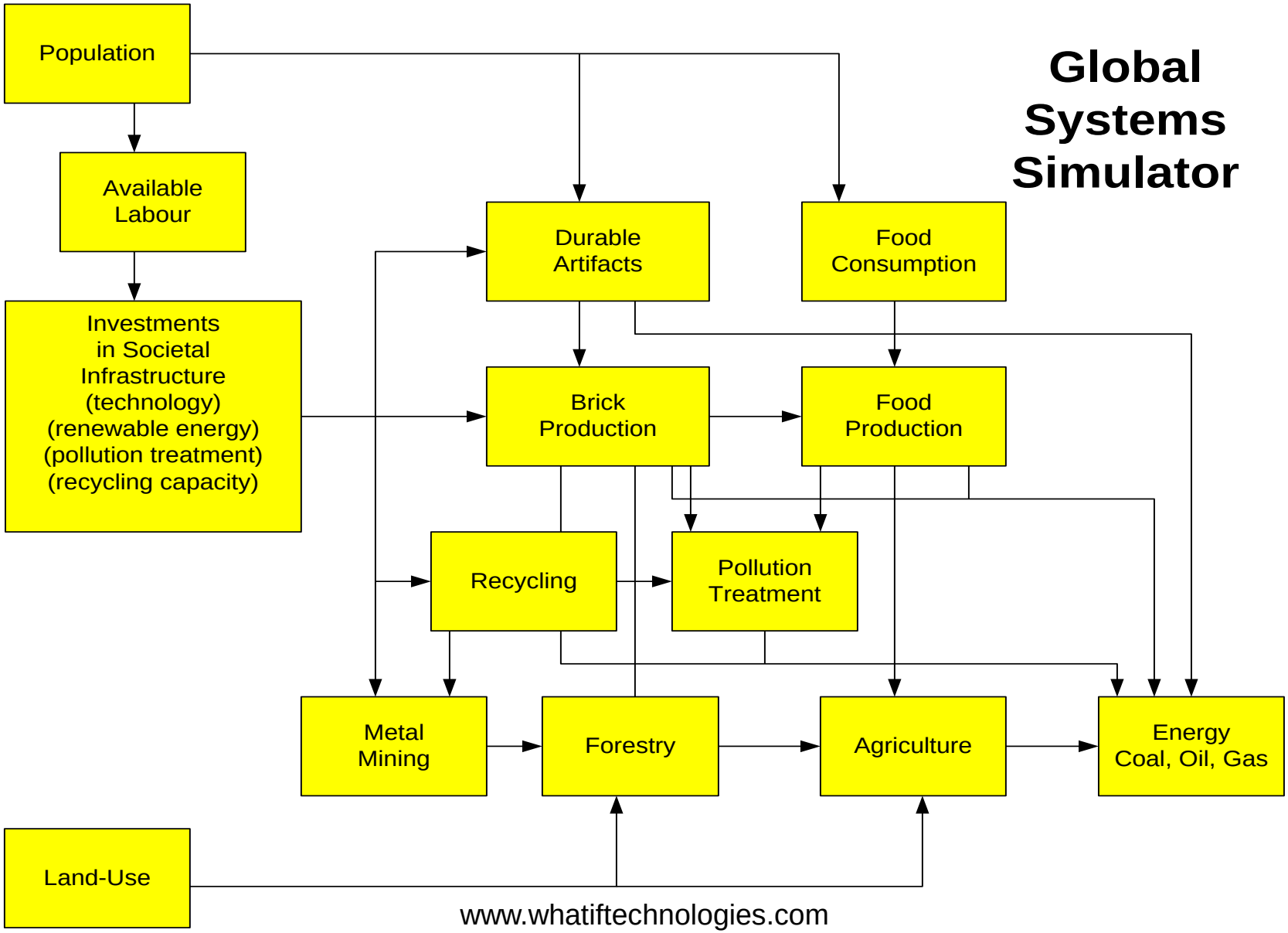

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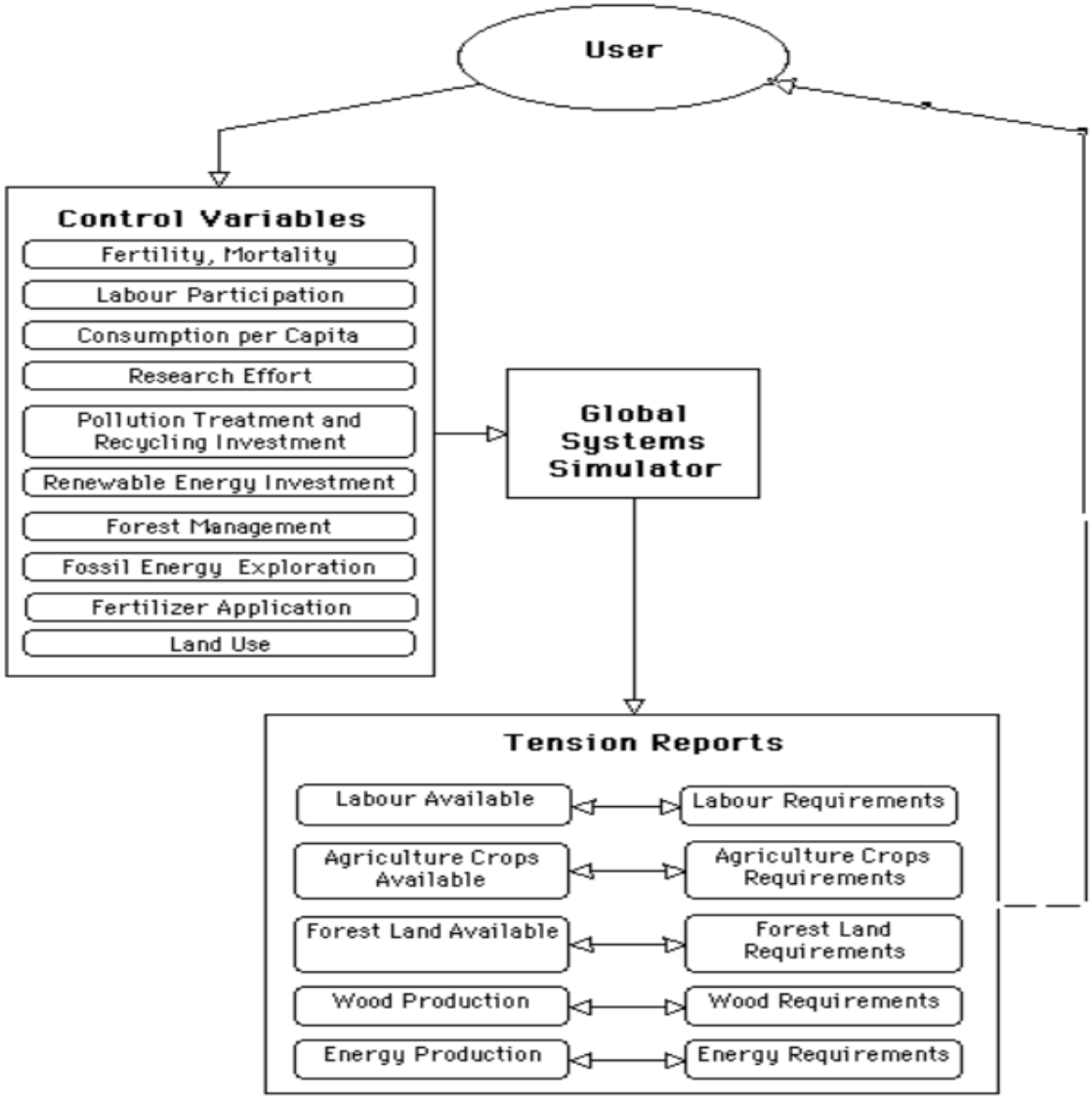

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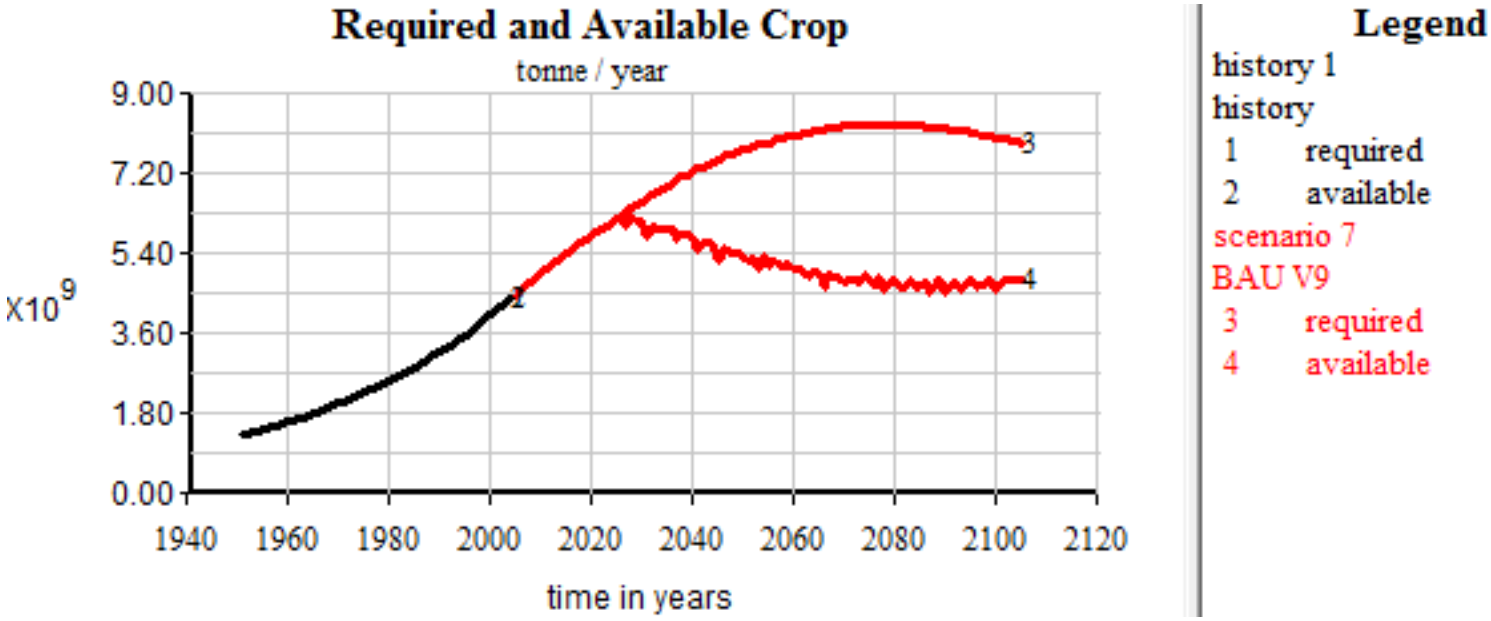

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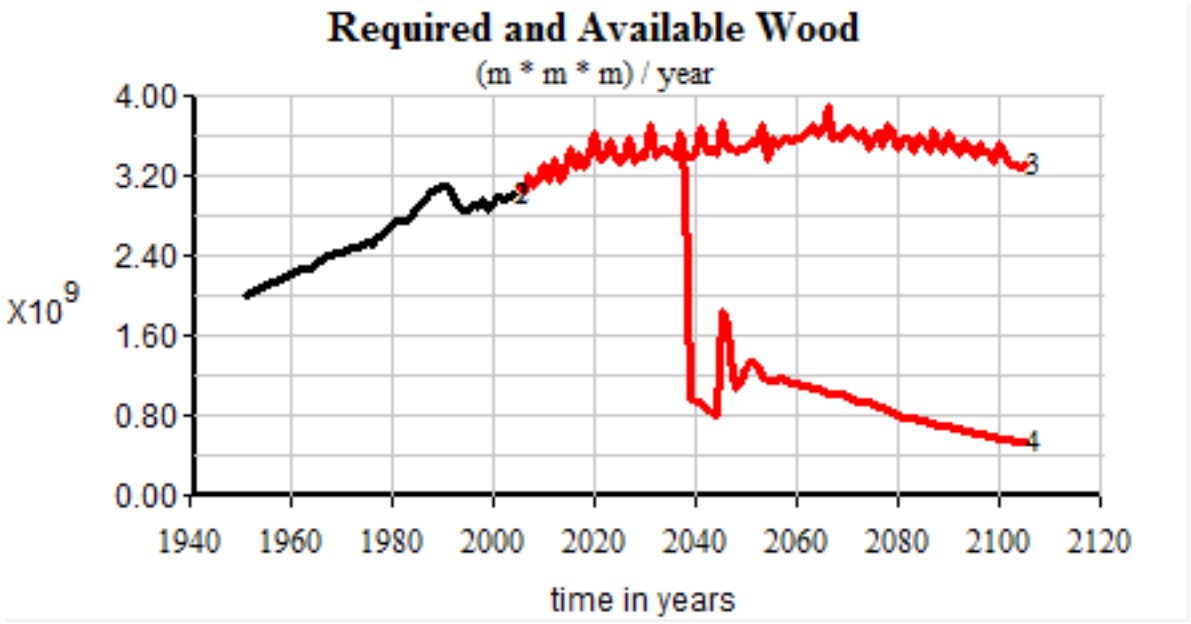

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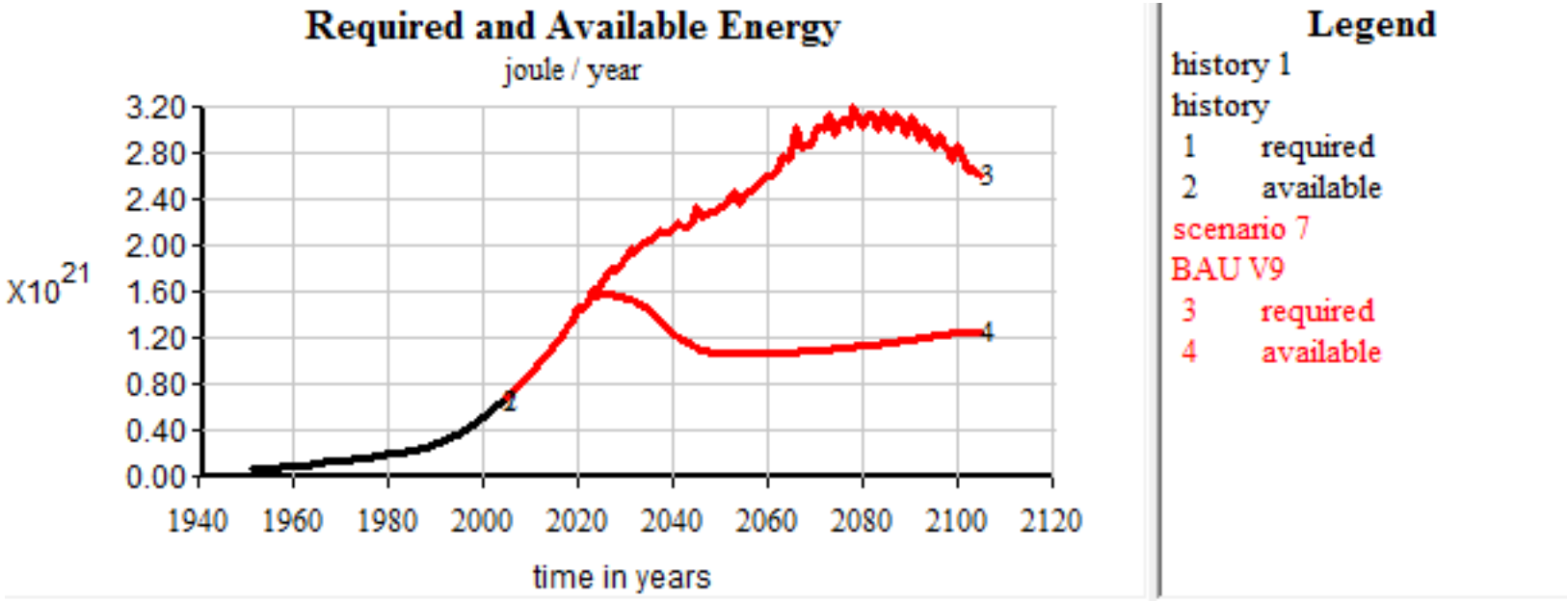

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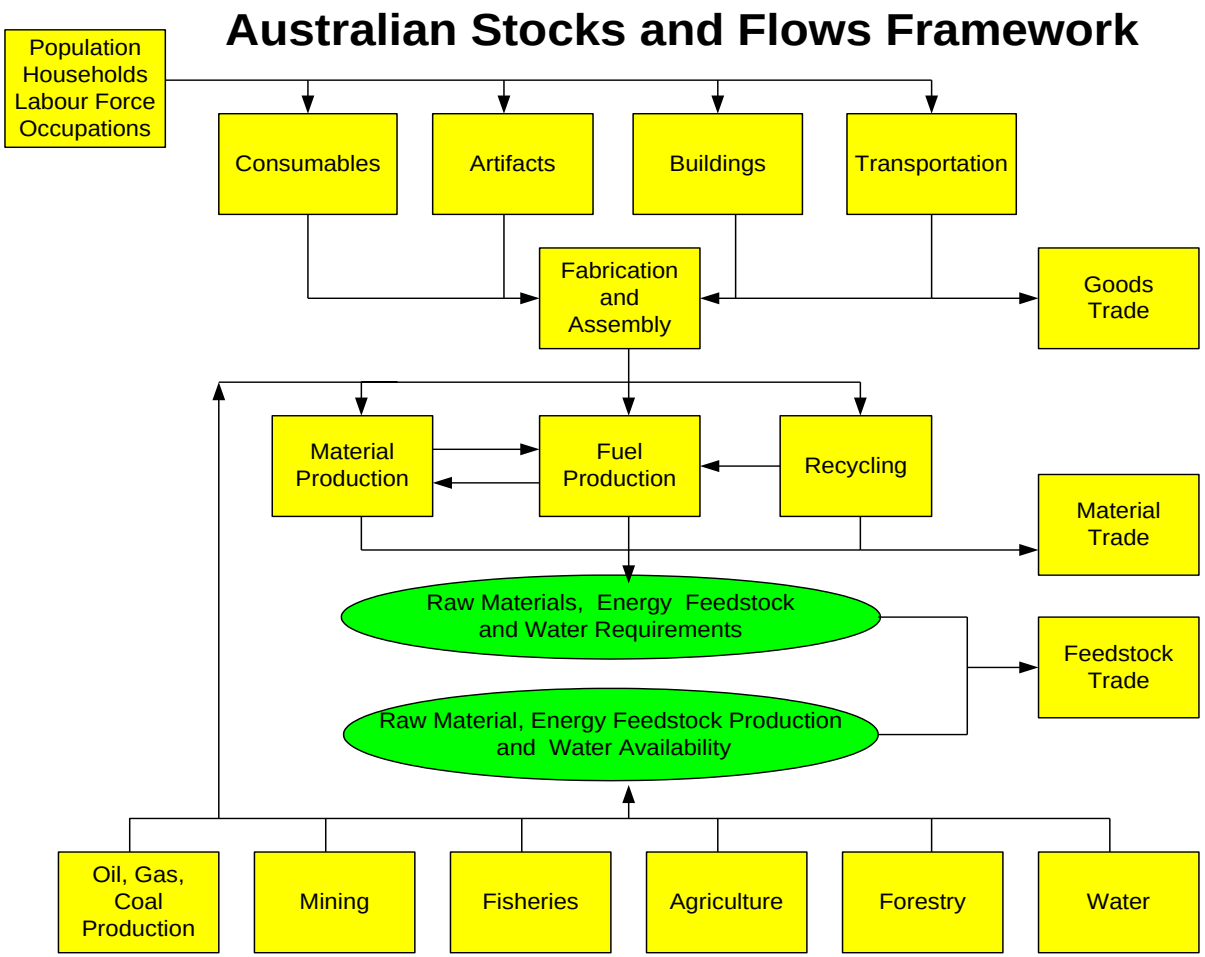

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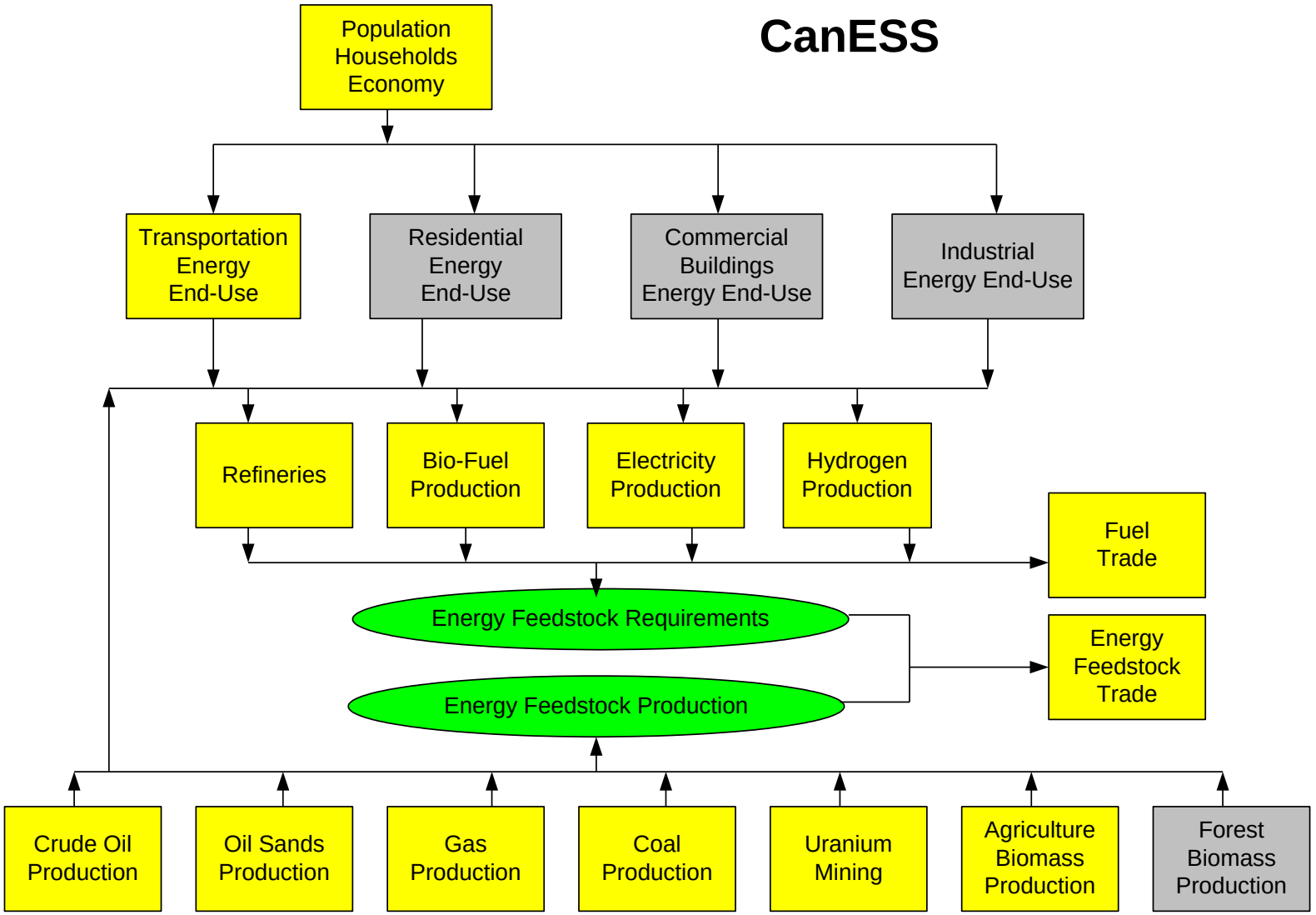

Model Development Process