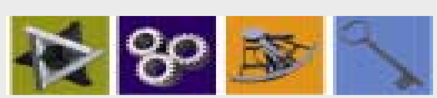
Tool for Environmental Analysis and Management (TEAM™) Demonstration

Annie Landfield
First Environment, Inc.
Seattle, WA September 22, 2003

FIRST ENVIRONMENT



ISO 14001 CERTIFIED

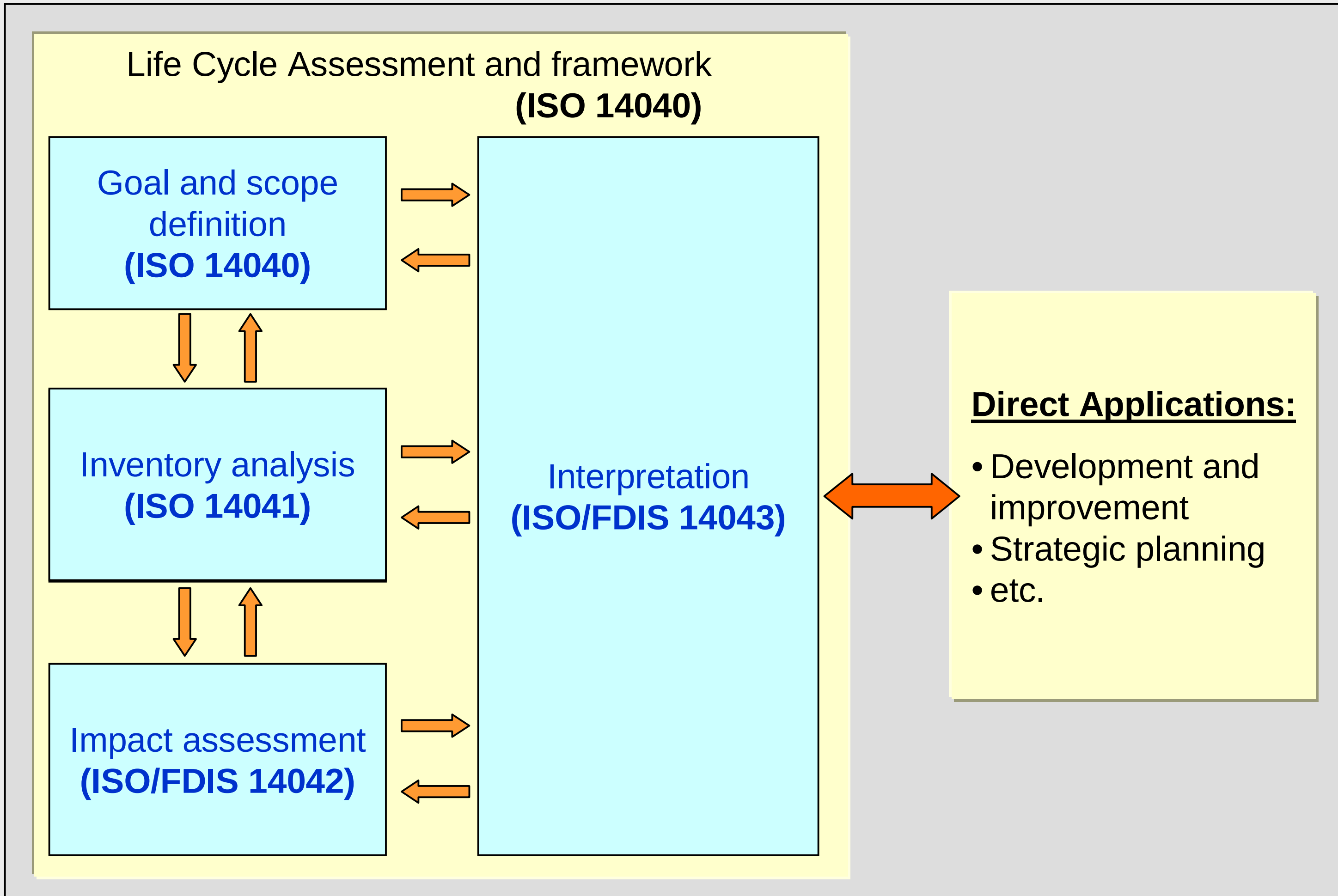
Agenda

1) Intro to LCA and TEAM (15 Minutes):
   - Objectives of the demonstration
   - Brief introduction of LCA (as necessary)
   - TEAM™ organization: Explorer and System Editor
   - TEAM™ components: flows, modules, and systems
2) Building a System in TEAM (15 Minutes):
   - Case study: LCA of a car
3) Results and Interpretation (15 Minutes)

Objectives of the Demonstration

- **To demonstrate how to perform LCIs, LCIAs, and Interpretation using an LCA software**
- **To make performing an LCA a reality (!), and to show how simple it can be when performed in an organized manner and software**
- **LCA disclaimer**
- **Please ask or jot down any questions**
  - **I will be around after this presentation and all week to answer any questions or discuss anything further**

Life Cycle Assessment According to ISO (14040-14043)



LCA - Basic Definitions

- **Life Cycle Assessment is the generic term used for process of evaluating the potential environmental impacts of a product throughout its life cycle. Four major steps:**
  - **Goal and Scope Definition**
  - **Life Cycle Inventory:** compilation of all the inputs and outputs directly coming from and returning to the earth over the life cycle of a product (elementary flows)
  - **Impact Assessment:** using the inventory results to assess the impact on ozone depletion, greenhouse effect, eutrophication, eco-toxicity, etc.
  - **Interpretation**

Goal and Scope of the Car LCA (1/2)

- **For the car case we will have already determined the reasons for carrying out the study and how the system will be modeled**

  1. <u>The reasons for carrying out the study</u>

  - Understand environmental impacts associated with the life of a current car

  - Use that baseline to see what kinds of improvements can be made along the supply chain (i.e., at production, end of life, etc.)

  - Create a comparison of the current car and a more innovative car

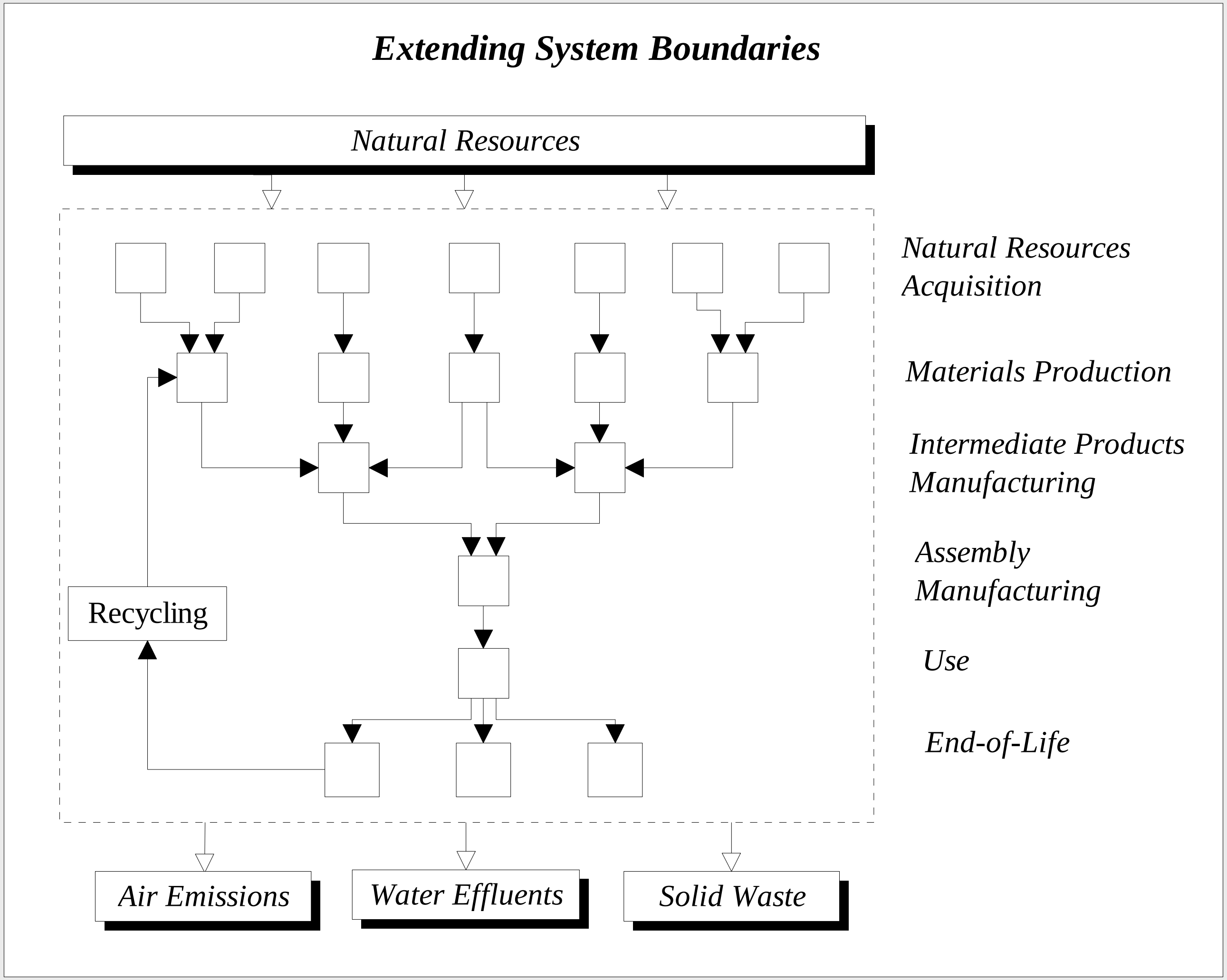
Goal and Scope of the Car LCA (2/2)

(con't)

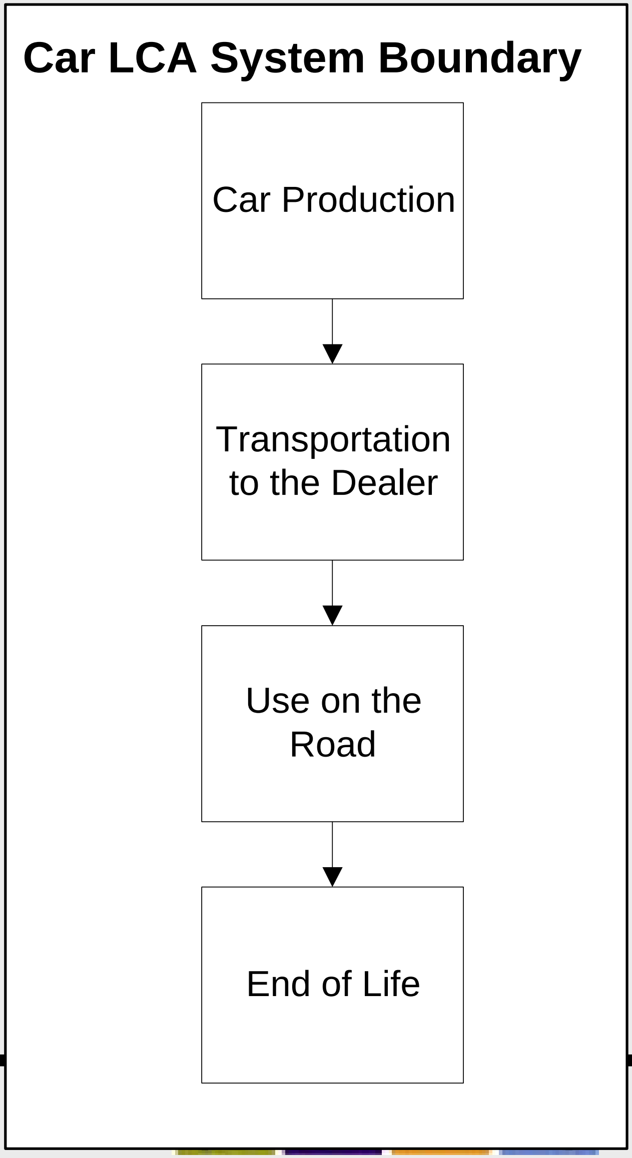
2. <u>The way the system will be modeled</u>

- The function of the study will be the use of a car, and the functional unit will be one car used over a 10 year lifetime
- Secondary (i.e., publicly-available) data will be used, and will be European data in the range of the 1990's through the present
- The system boundaries have been defined in the next slides

System Boundaries: Principle



System Boundaries: Car LCA

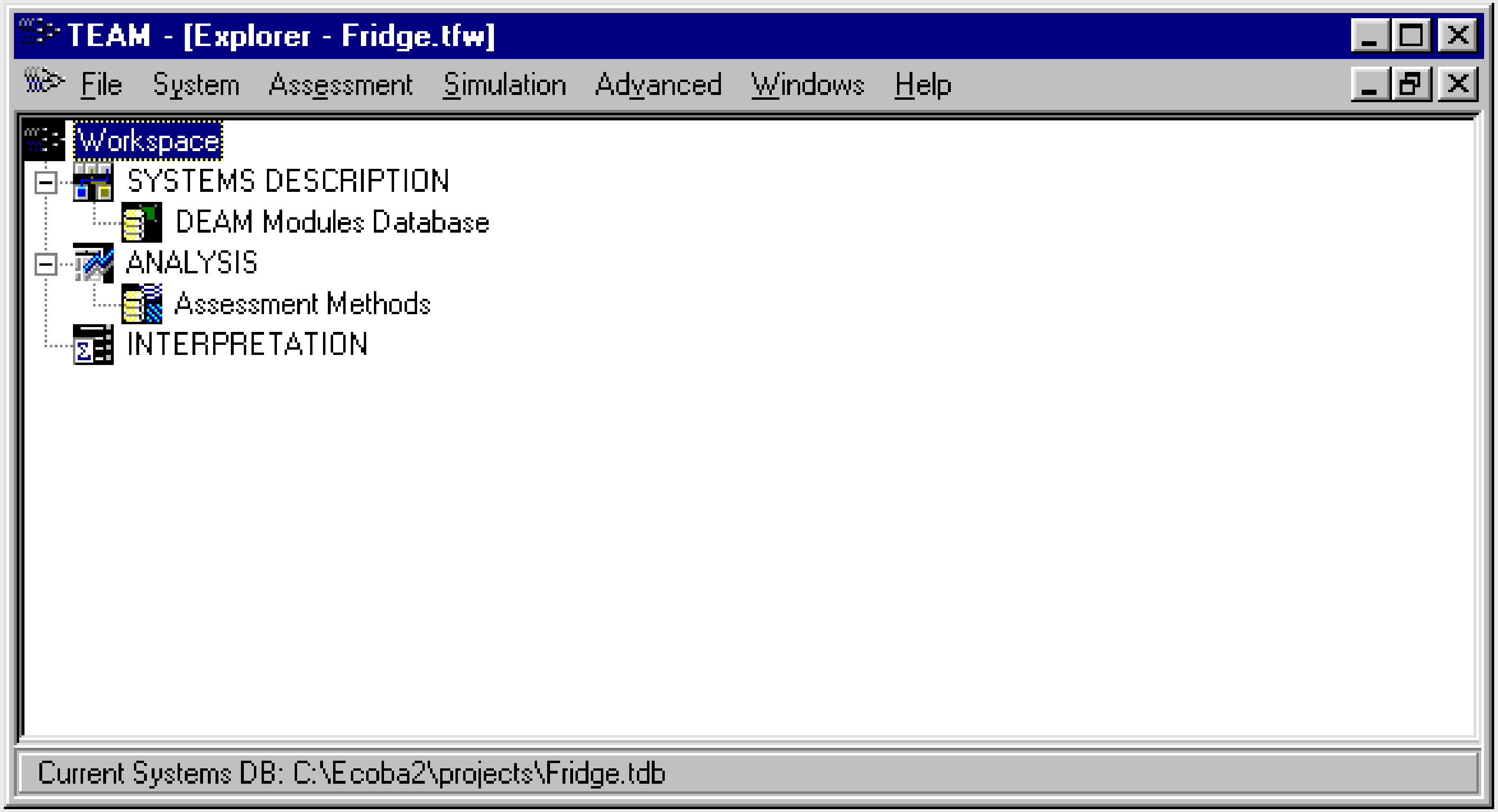


TEAM™ LCA Software

- TEAM™ organization: Explorer and System Editor
- TEAM™ components
  - Inputs & outputs: FLOWS
  - Data sets: MODULES
  - SYSTEMS
- Case study in TEAM™: LCA of a car
  - Building a system in TEAM™
  - Calculating an LCI in TEAM™
  - Editing and analyzing the LCI
  - Performing impact assessments with TEAM™
  - Performing scenario-based simulations with TEAM™

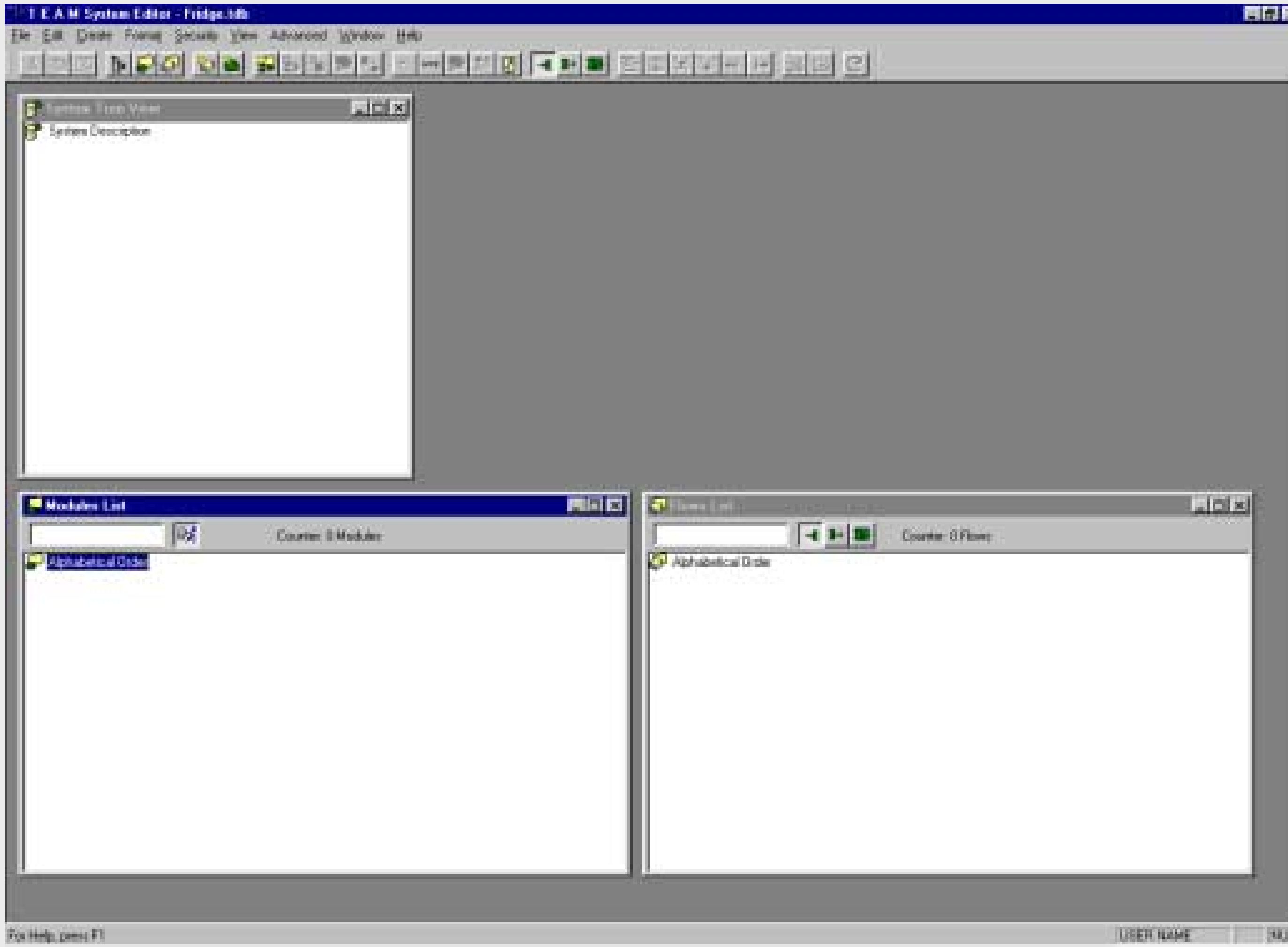
TEAM™ Explorer

- **Explorer is the Workspace in which LCI, LCIA, and other interpretation is performed**



TEAM™ System Editor

- The system editor is where the life cycle model is built

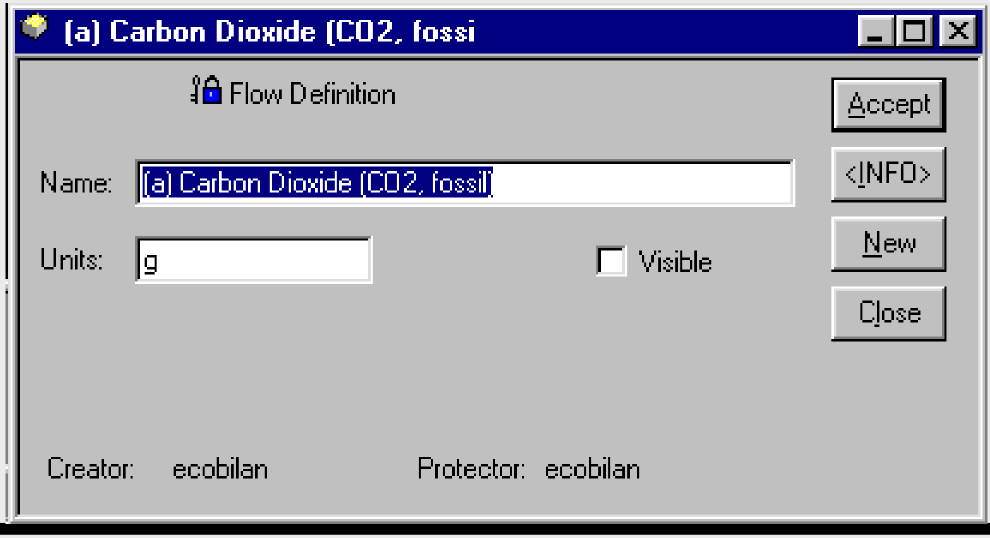


TEAM™ System Editor

- This window presents the elements contained in the database:
  - **Flows List** window, which groups all the flows used throughout the modules
  - a **Modules List** window, which groups all the data sheets sources used throughout the systems
  - a **System Tree View** window, which groups all the systems and sub-systems
  - a **System View** window, which shows a graphical display of the Systems

Flows

- **Flows represent the elements that are to be included in the inventory of a system, and make up the data sets (as inputs or outputs)**
- **Flow definition includes a name, a unit, information fields and some physical properties. This ensures that flow names are not repeated in different data sets**



Modules

- A Module usually describes:
  - a process, e.g. Ammonia Production
  - or a step, e.g. Road Transport
- A Module is made up of Flows (inputs and outputs)

DEAM^{TM} Database (1/3)

- **DEAM^{TM}, Database for Environmental Analysis and Management, is made up of hundreds of modules, and is available with the TEAM^{TM} software package**

Modules
211 Cardboard: Production
241 Ammonia: Production
241 Detergent: Production
241 High Density Polyethylene (HDPE): Production
241 Polyethylene (PE, All Grades): Production
241 Polypropylene (PP): Production
241 Polystyrene (PS, All Grades): Production
241 Polystyrene (PS, High Impact): Production
271 Steel: Production
274 Aluminium: Production
274 Copper: Production
401 Electricity (France, 1992): Production
401 Electricity (Germany, 1992): Production
401 Electricity (Japan, 1993): Production
401 Electricity (United Kingdom, 1992): Production
602 Road Transport 1 (Diesel Oil, I)
602 Road Transport 2 (Diesel Oil, I)
Physical Chemical Treatment (Grease)
Two Steps Treatment (Detergent)
Two Steps Treatment (Grease)
Cooled Water: Production
Electric and Cooling Circuit: Production
Insulation: Production
Metal Body: Degreasing
Metal Body: Production (Steel, Aluminium)
Plastic Body: Production (PP)
Refrigerator: Assembling
Refrigerator: End of Life
Refrigerator: Use

DEAM™ Database (2/3)

- **DEAM™ modules consist of:**
  1. **Bibliographic data (e.g. US EPA AP-42, APME)**
  2. **Real site data (e.g., from site questionnaires)**
  3. **Calculated data (generated from the results of site data, e.g. Electricity Production)**
- **DEAM™ provides modules containing production data for different electricity and energy sources (i.e., calculated for different countries and regions)**
  - **Energy is usually a big driver in LCA studies, so applying geographically relevant data sets is very useful**

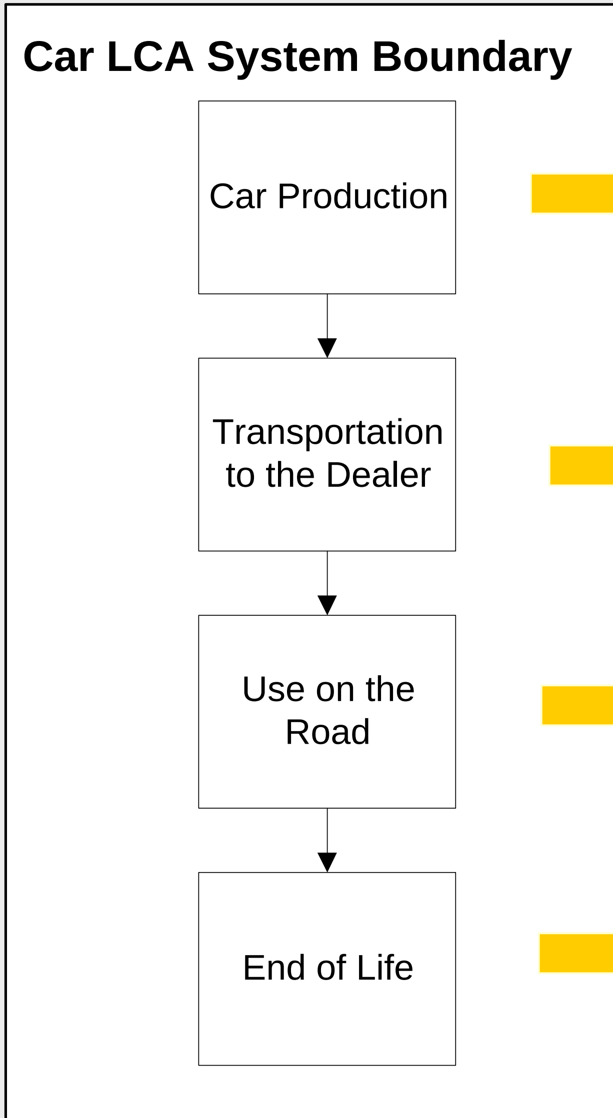
DEAM^{TM} Database (3/3)

- DEAM^{TM} modules are fully documented with information identifying:
  - A description of the process
  - The data quality and sources: temporal, geographical, and technological information
- Modules can be created by the user. This is one place where the user can fill out data quality fields
- A user can also import other data sets to make TEAM^{TM} modules
  - The new TEAM^{TM} version 4.0 allows an easy integration of Ecoinvent data (European data by ETH)

System

- A System is made up of modules connected together
- Systems are built in TEAM™ using the Russian puppet principle: systems are encapsulated within one another
- The benefit of this encapsulation:
  - The user can build highly complex models that are easy to follow and manage
  - The user can generate and analyze very simple or highly detailed results tables

Car LCA: System Boundaries, Main Data and Assumptions



Assumptions and Necessary Data:

- **200 kg PVC**
- **800 kg Steel**

- **1000 mi to dealer**
- **Transported in a 40-ton diesel truck**

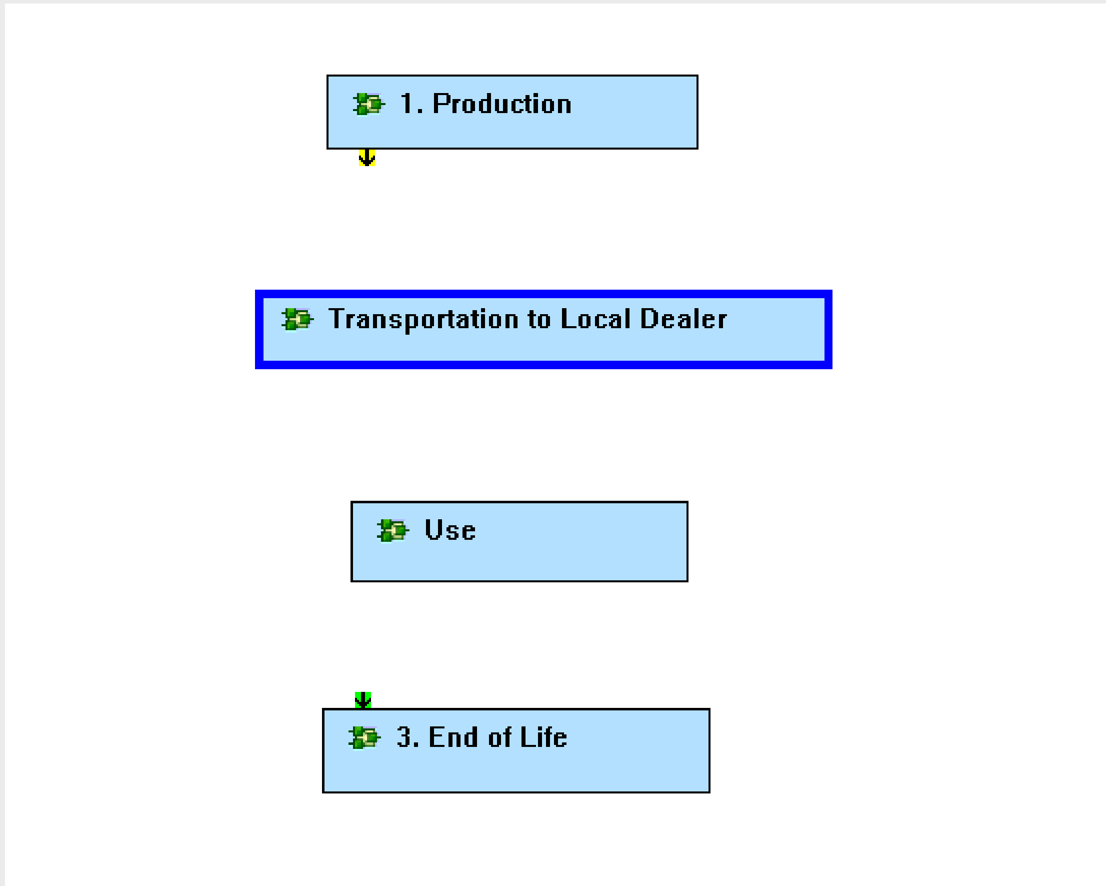
- **100,000 miles over its life (10 years)**
- **Unleaded fuel**

- **10% of the plastic is recycled**
- **60% of the steel is recycled**
- **Benefits of recycling are included in system**

Building the Car LCA System

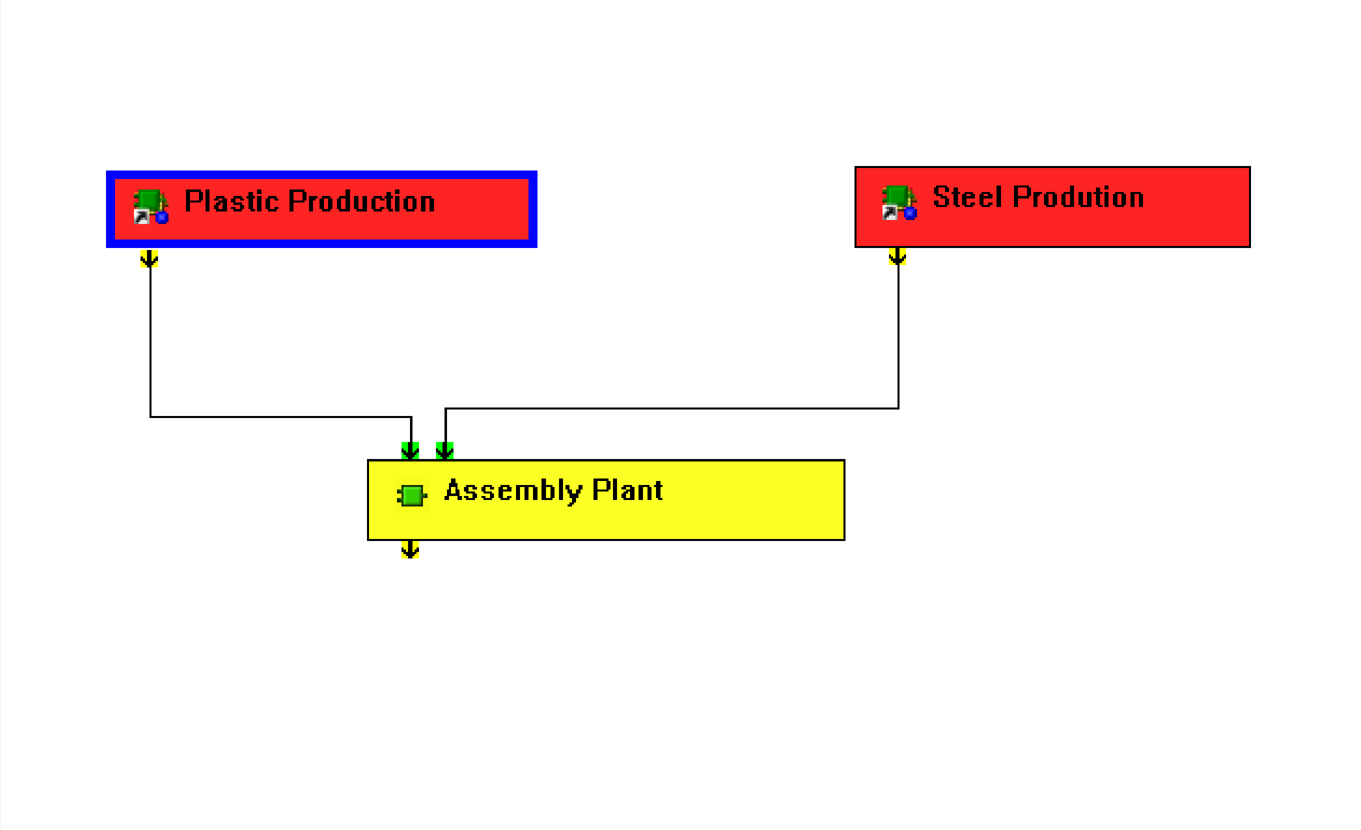
- First, draw the main systems in the car life cycle
- Next, model each system knowing the data and assumptions
- See next slides

Drawing the Main Systems in the Life Cycle



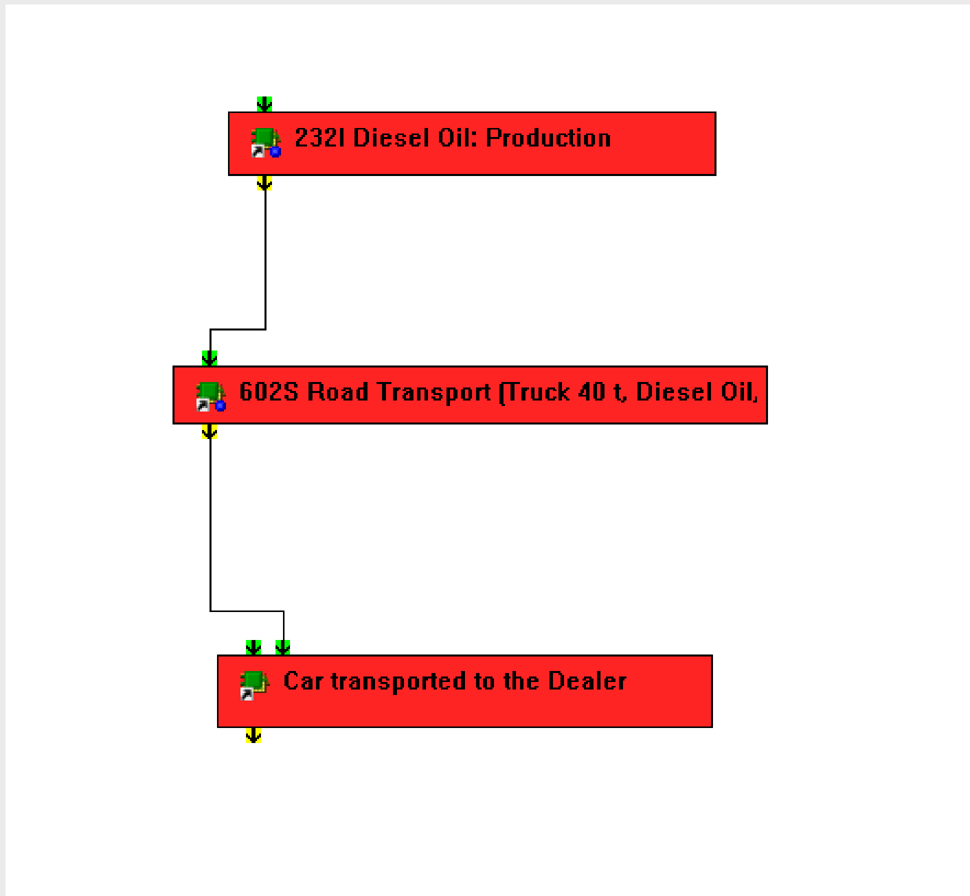
Car Production System

- Only materials are modeled for this case study



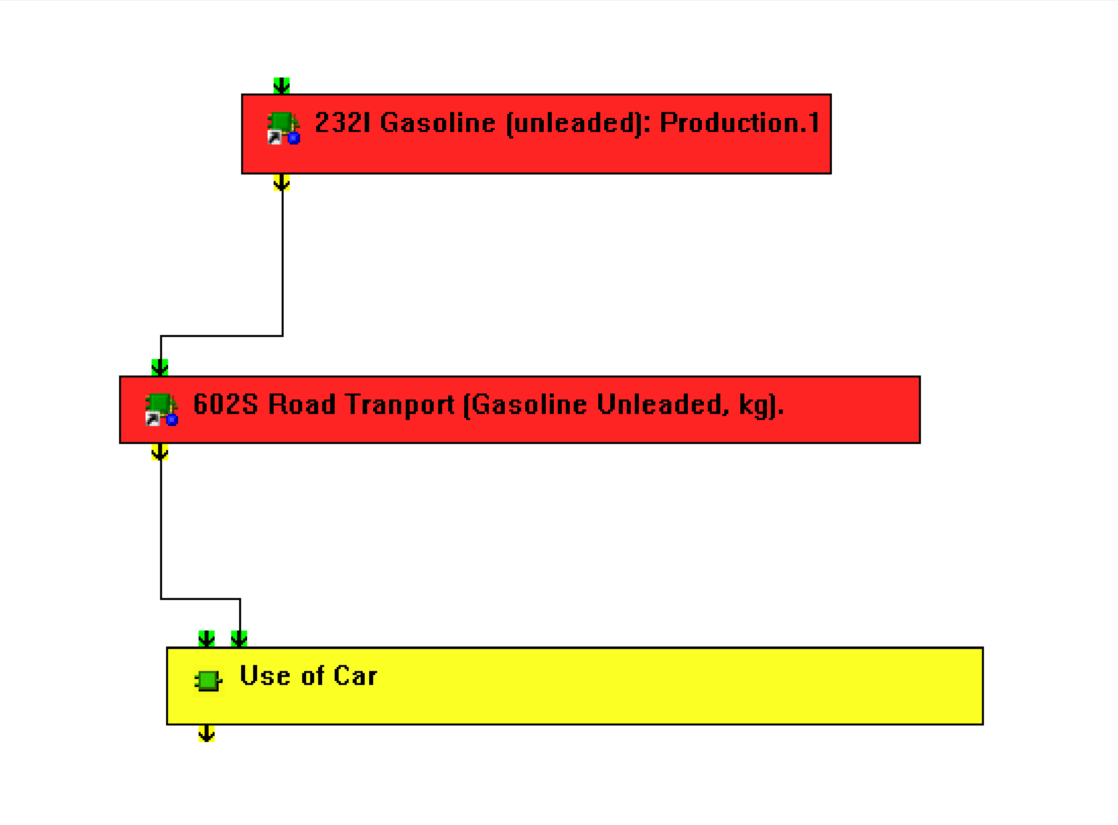
Car Transportation System

- **Transportation to local dealer: 1000 miles traveled**



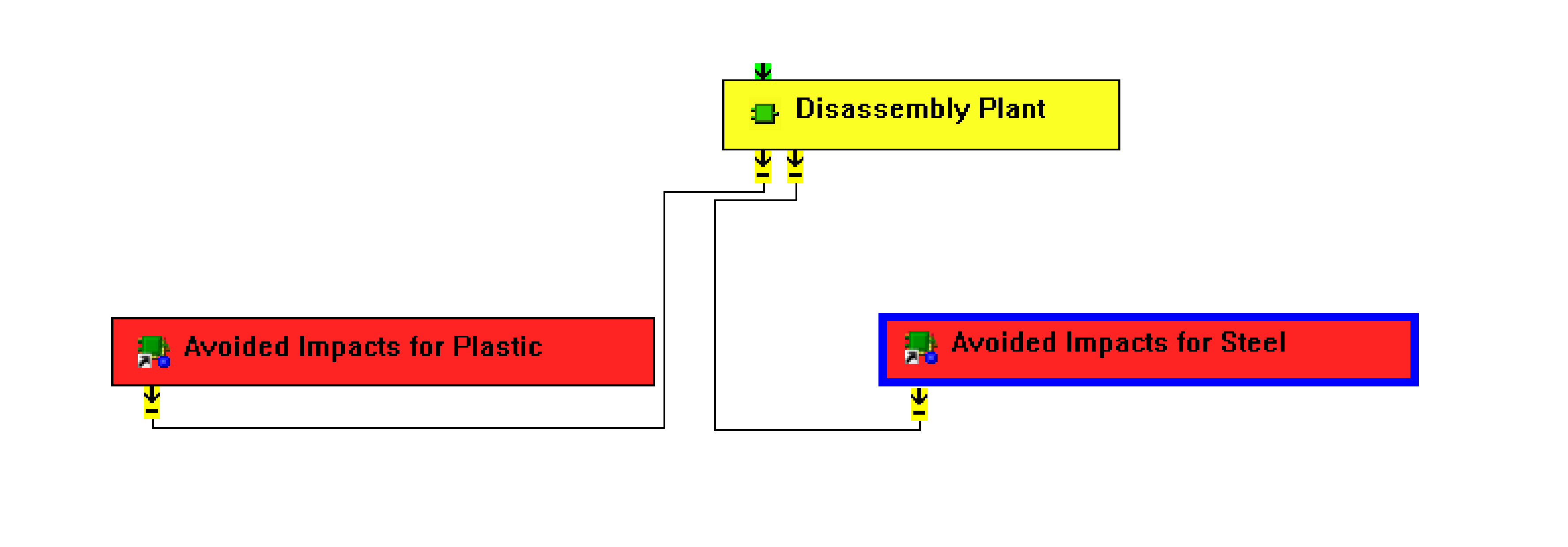
Car Use Phase

- Assume 100,000 miles, using unleaded fuel, over the life of the car: 10 years



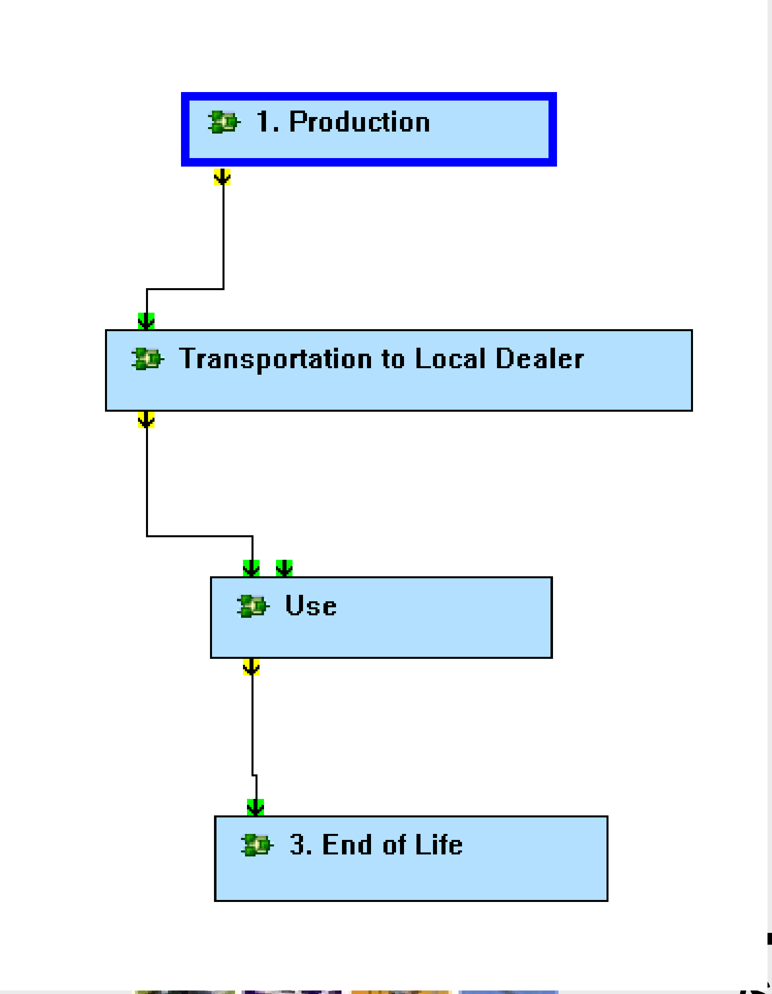
Car End-of-Life Phase

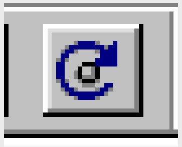
- Assume 60% of steel is recycled and 10% of plastic is recycled. No other EOL scenario is modeled for this case.



Creating the Inventory and Generating Results (1/2)

- **Link modules together, run results, and create inventory**





Creating the Inventory and Generating Results (2/2)

- **To be shown during the live demonstration**

Life Cycle Interpretation (ISO 14043)

- “The objectives of life cycle interpretation are to analyze results, reach conclusions, explain limitations and provide recommendations based on the findings of the preceding phases of the LCA or LCI and to report the results of the life cycle interpretation in a transparent manner” according to ISO 14043
  - Identification phase
    - “Structure the results of LCI and LCIA in order to determine the significant issues”
  - Evaluation phase
    - “The objectives of the evaluation element are to establish and enhance the confidence in and the reliability of the results of the study, including the significant issues identified in identification phase”

Interpreting Results of the Car LCA

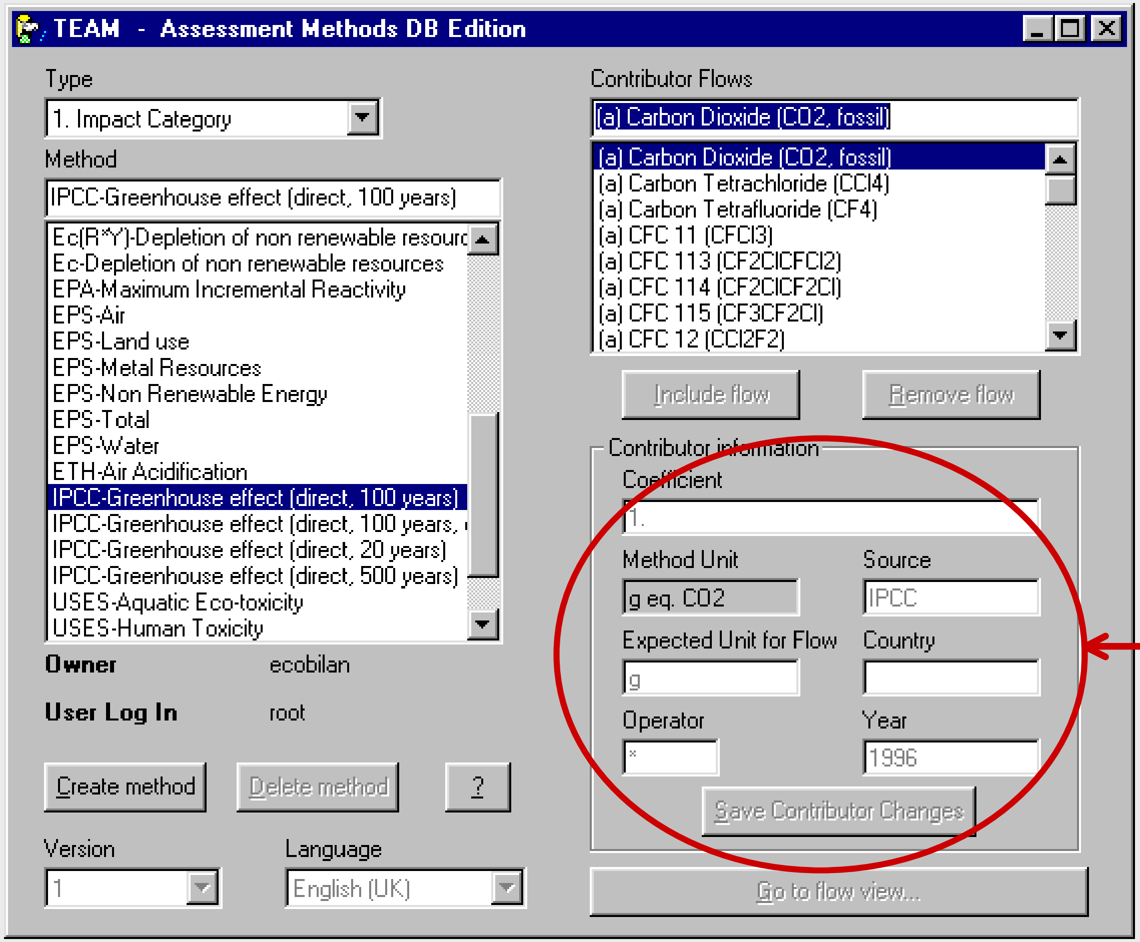
- **Contribution analysis**
- **Impact Assessments**
- **Sensitivity analysis:** transportation to use phase (to the dealer)
- **Scenario analysis:** numerous scenarios, dependent on time
- **Life Cycle Comparison:** current car vs. hybrid car

Impact Assessments in TEAM™

- **New TEAM™ 4.0 contains new impact assessment and weighting methods from a variety of sources, providing several assessment methods each for:**
  - Resource depletion
  - Greenhouse effect (direct and indirect)
  - Ozone layer depletion
  - Air acidification
  - Nutrification/eutrophication
  - Photochemical oxidant formation
  - Human, terrestrial, and aquatic toxicity
  - Air odor
  - Land damage

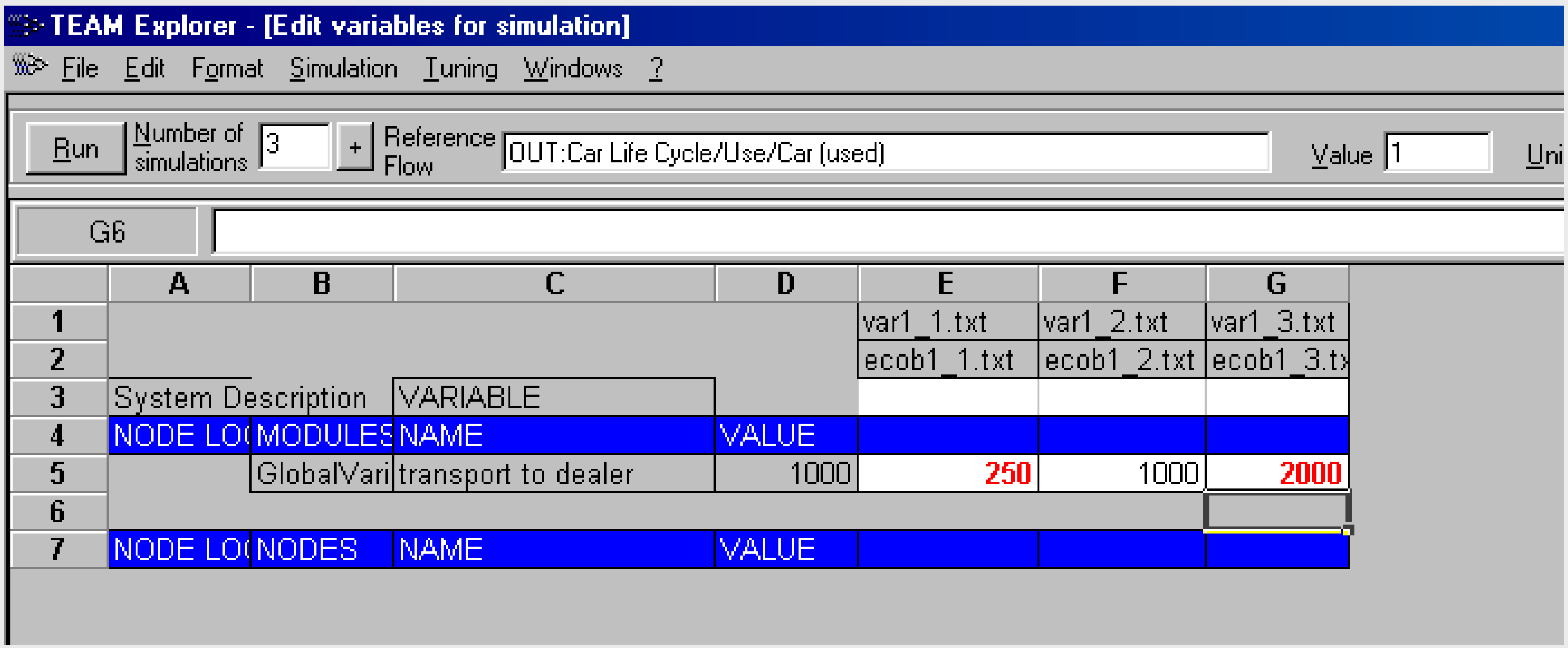
Assessment Database

- Flows are displayed with the coefficient, operator used to calculate the impact, and the unit used for the impact

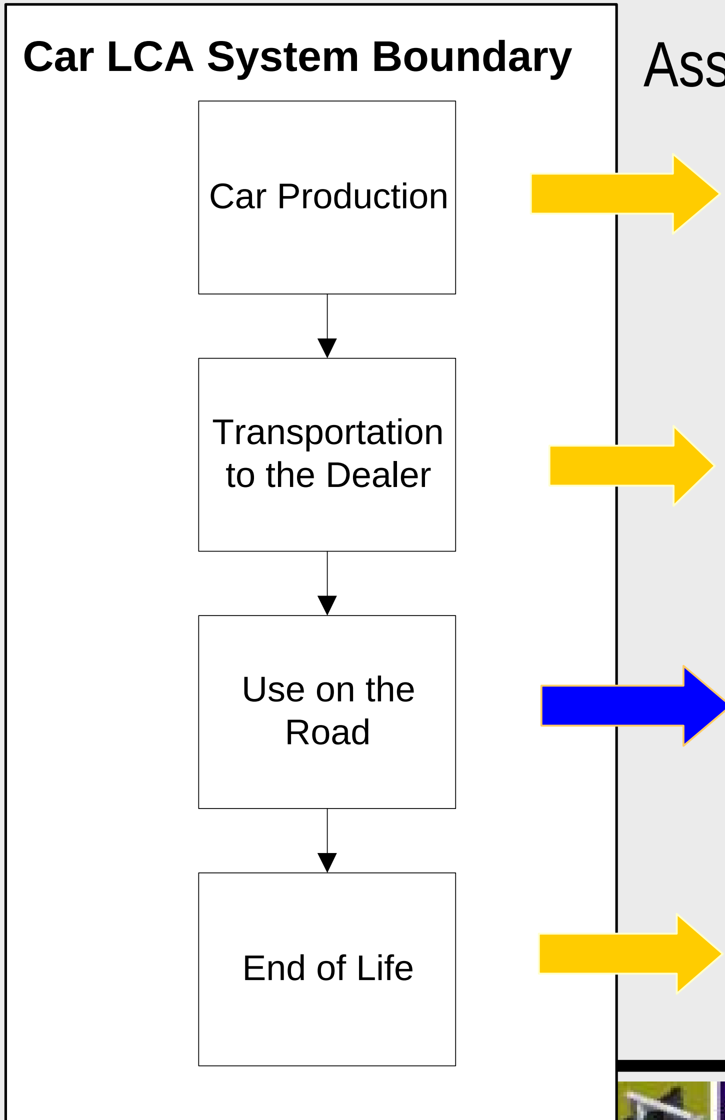


Performing Sensitivity or Scenario Analyses

- **Example: Transportation**
- **The user runs the model simultaneously for several distances**



Comparison LCA: System Boundaries, Main Data and Assumptions for a Hybrid



Assumptions and Necessary Data:

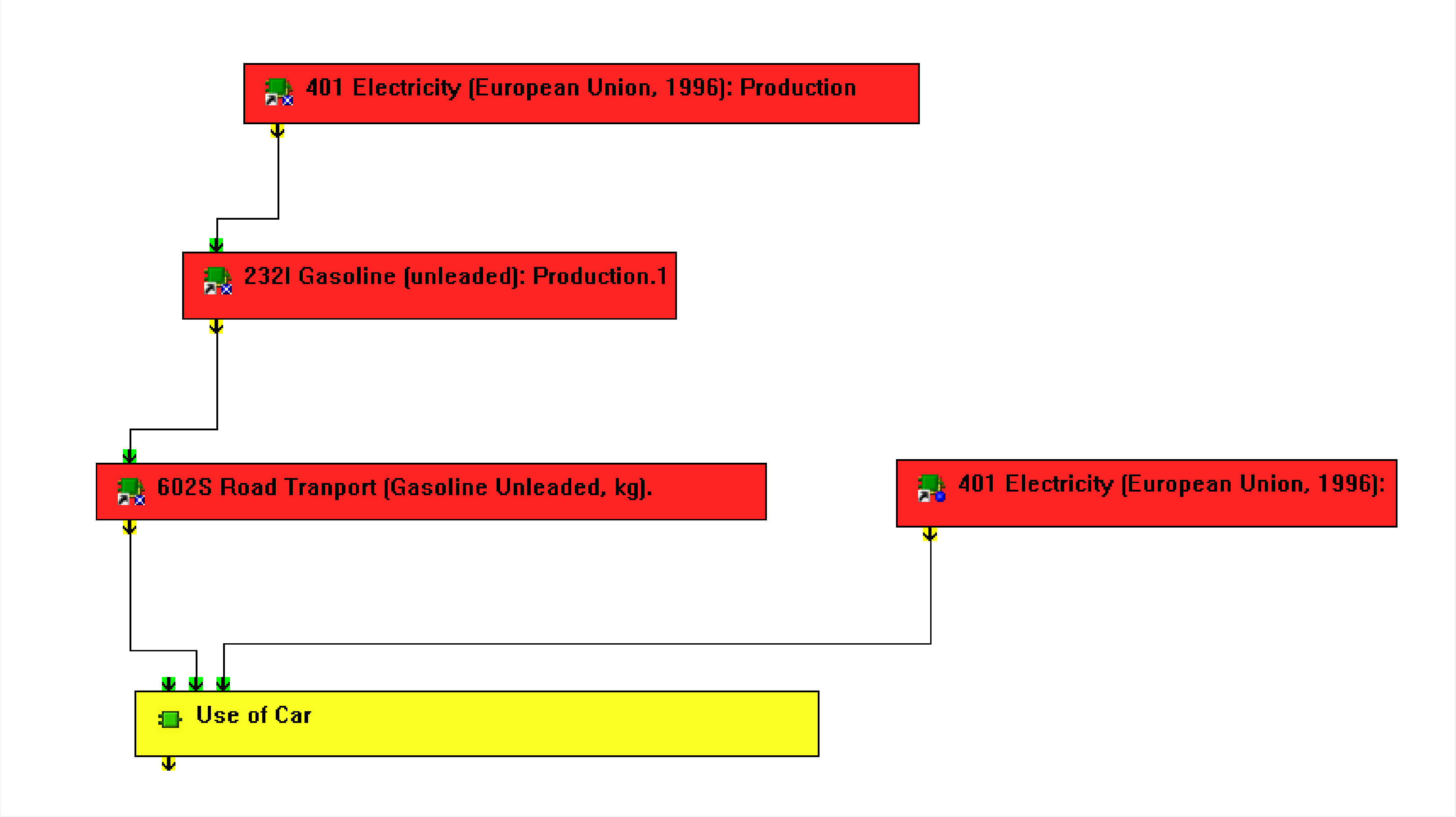
- **200 kg PVC**
- **800 kg Steel**

- **1000 mi to dealer**
- **Transported in a 40-ton diesel truck**

- **100,000 miles over its life (10 years)**
- **50,000 mi: Unleaded fuel**
- **50,000 mi: electricity (lead-acid batteries)**

- **10% of the plastic is recycled**
- **60% of the steel is recycled**
- **Benefits of recycling are included in system**

Life Cycle Comparison: Hybrid Car Use



Other TEAM™ Features; Changes from v. 3.0

- **Ability to perform varying methods of coproduct allocation and recycling; has other advanced LCA modeling features**
- **New, improved data management system**
- **Updated impact assessment methods, including IPPC, CML 2000, and ECO99 indicators**
- **New colors in TEAM, distinguishing between the various components in the model**
- **Web access for data updates**

Contact Information

Annie Landfield

First Environment, Washington, DC
(W) 202-962-8684, (M) 240-426-1098
alh@firstenvironment.com

First Environment Corporate Headquarters

Boonton, NJ
1-800-486-5869
www.firstenvironment.com