

## Introduction to the **Invert** Simulation Tool



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[www.Invert.at](http://www.Invert.at)

## ***Overview***

- ***Introduction***
  - System Requirements
  - Major Scenario Outputs
- **Rough Overview Computer-Tool**
- **Key Features of *Invert***

## ***Introduction***

The dynamic simulation tool **Invert** represents the main product of the project **Invert**

- ✓ A Database Management System for dynamic changes and pre-calculation of potentials, costs for RUE (demand-side activities), RES-E, RES-CHP, and Bio-Fuels for each selected region and defined technology, energy carrier.
- ✓ A dynamic bottom-up computer model integrating RUE (demand-side activities), RES-E, RES-CHP, and Bio-Fuels activities for the electricity, building and transport sector on a regional level.
- **Invert** allows comparative and quantitative sensitivity analyses of the interactions between RUE, RES-E, RES-CHP, and Bio-Fuels as well as GHG-reduction for each selected region.

## ***Introduction***

### **Major Scenario Outputs**

#### **General Outputs (for all sectors):**

- Public transfer costs for promoting RES & RUE technologies (Mio Euro/year)
- CO<sub>2</sub>-emissions (total and reductions due to promotion schemes) (kt/year))

#### **Heating and Cooling:**

- Energy demand reductions due to insulation and window replacement for various building types (GWh/year)
- Mix of energy carriers for heating, domestic hot water and cooling systems (numbers of systems (1); numbers of buildings (1); final energy demand (GWh/year);...)
- District heating related outputs

#### **Electricity:**

- Output from RES-E plants (GWh)
- Installed capacity of RES-E plants (MWel)

#### **Bio fuels:**

- Total production of various types of bio-fuels (l)

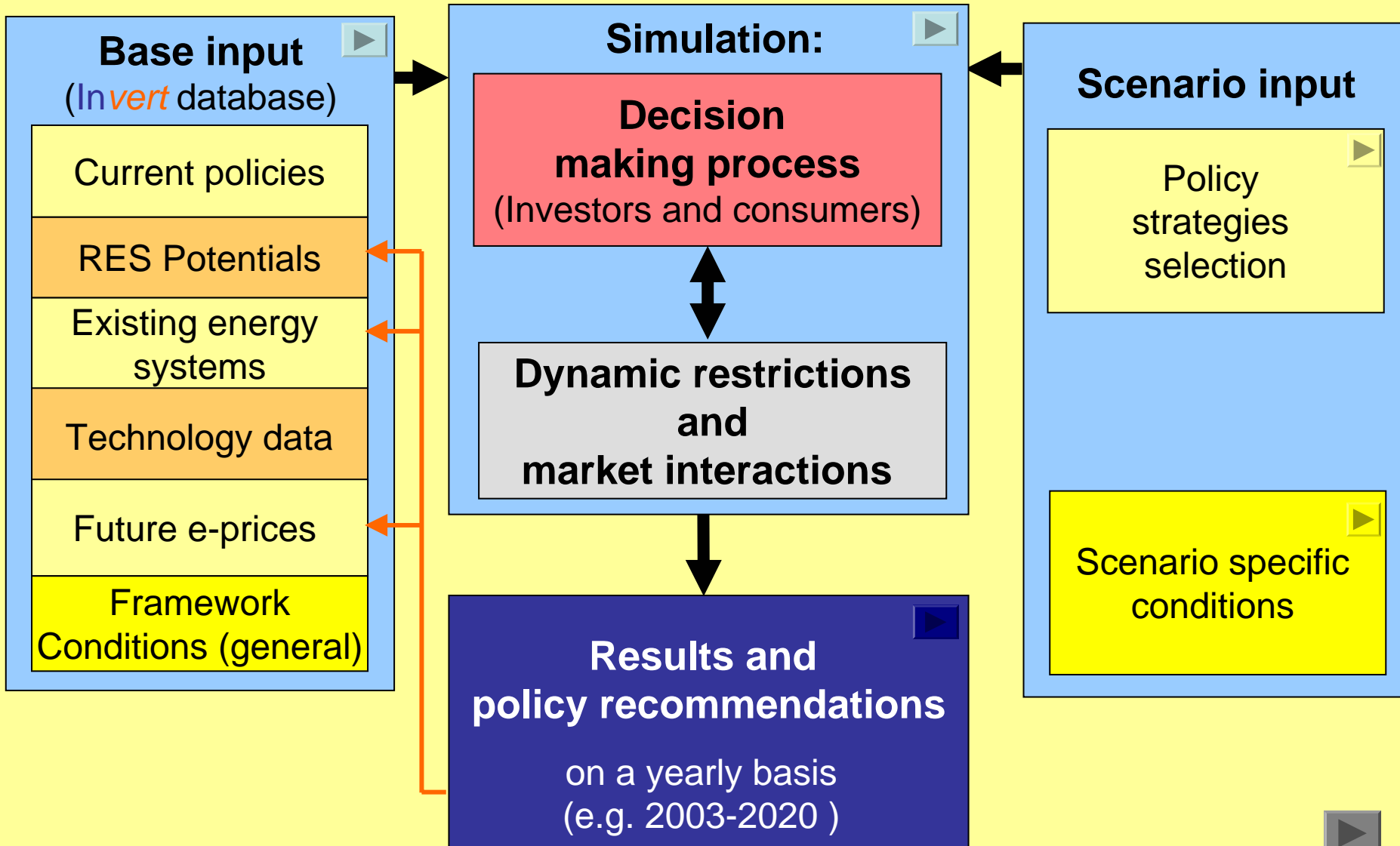
## ***Introduction***

### **System Requirements**

- **Intel Pentium IV or AMD Processor with 2500 MHz frequency or more, respectively Centrino Mobile Processor with 1700MHz frequency**
- **Minimum of 512Mb RAM**
- **Minimum Screen Resolution 1024\*768 (It is recommended to set the screen resolution to 1280\*1024)**
- **16Bit Colures**
- **Operating system: Win2000, WinXP**

**Please, keep this requirements otherwise the program might not work properly**

## Overview Computer-Tool



## Promotion Schemes

Sector	Sub-sector	CO <sub>2</sub> Tax	Investment Subsidy	Soft Loans	Feed in tariff
Building	Heating	✓	✓	✓	
	Domestic Hot Water (DHW)	✓	✓	✓	
	Air condition	✓	✓	✓	
	District Heating	✓	✓	✓	
Electricity	RES-E	✓	✓		✓
	RES-CHP	✓	✓		✓
Bio fuels	Bio fuel	✓			



## Promotion Schemes

Sector	Sub-sector	Tax incentive		Subsidy on fuel costs	Additional set aside premium
		Power	Energy		
Electricity	RES-E	√	√	√	
	RES-CHP	√	√	√	
Bio fuels	Bio fuel		√		√



# Scenario Specific Conditions

## General Simulation Parameters

**Simulation**
✕

**General Simulation Settings**

Demand-Side Simulation Settings

Reference Scenario

Sectors

- Building
- Heating and DHW
- Cooling
- Electricity
- RES-E
- RES-CHP
- Grid Connected Heat
- Transport

Simulation Years

Start year:

Select the end year:

Automatic Simulation

Autonomous simulation till

If you want perform a fully autonomous simulation check 'Autonomous simulation'. No interaction is possible in the autonomous mode till the 'autonomous simulation year' is reached.

Details Portfolio (Heating/DHW and Cooling)

Create comprehensive Portfolio for Heating and Cooling

Note: the creation of the detailed portfolio might take a while. If you want perform a fast simulation uncheck 'Create comprehensive Portfolio'. For a detailed report check 'Create Comprehensive Portfolio'.

Simulation

Payback Time

Use stakeholder payback time for the building sector

Soft barriers

Use soft barriers for the building sector

Formatting

Format simulation information (colors)

Cancel

Start Simulation

Step Backward

View Portfolio

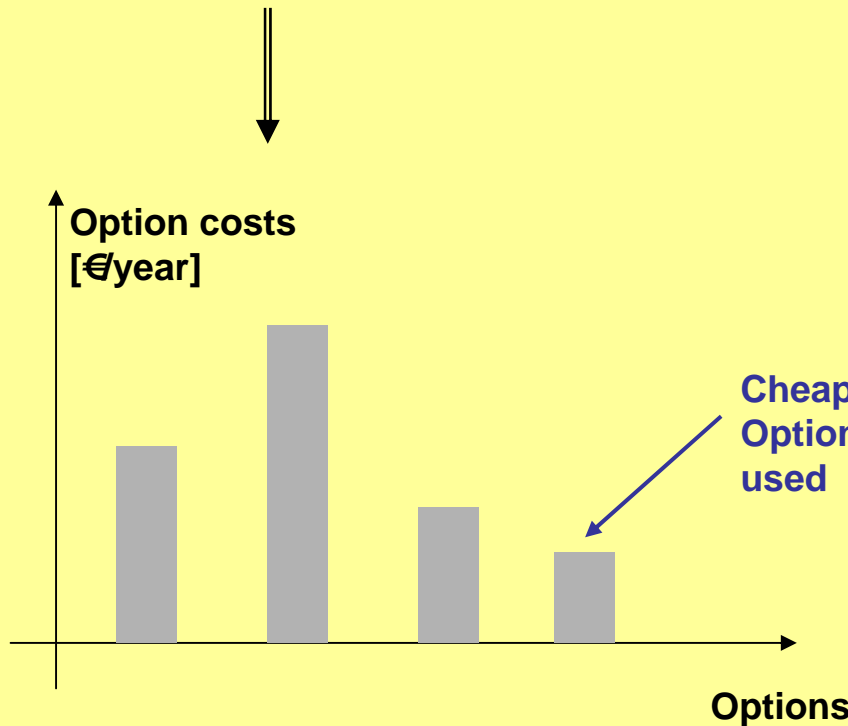
Change Parameters



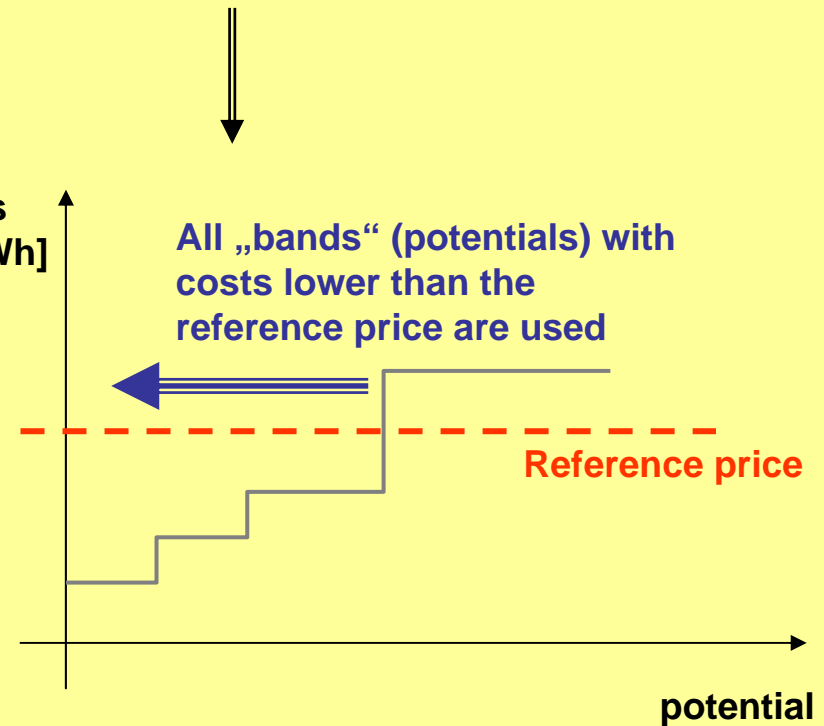
## Decision Making Process

Building (Heating, Cooling,  
Domestic Hot Water, Solar Thermal)

RES-E/RES-CHP and Bio-Fuel



Option approach  
based on the  
replacement rate



Cost curve approach



## **Survey of Key *Invert* Features**

- ✓ **Dynamic Bottom-Up modeling tool**
- ✓ **Reference Scenario Tool to evaluate different scenarios compared to a basic scenario (e.g. CO<sub>2</sub> Emissions)**
- ✓ **Database Management System to avoid predefined data sets ('Definition area and linked data sets')**
- ✓ **File Management System to work with database, simulation and portfolio (result) files**
- ✓ **Data Import Tool (automatic and semi automatic import functions)**
- ✓ **Copy Paste from Excel**
- ✓ **Copy Paste to Excel**



## **Survey of Key *Invert* Features**

- ✓ **Validation tool to check input data**
- ✓ **Direct data manipulation in *Invert* (Calculator functions: Multiplication, Division...)**
- ✓ **Interactive simulation modus vs. fully automatic simulation modus**
- ✓ **'Multiple Simulation Runs' to simulate up to 20 data files fully automatically**
- ✓ **Simulation Error Information System**
- ✓ **Graph Wizard (Diagram Wizard)**
- ✓ **Comprehensive help file with search function**
- ✓ **Live Update Tool**



## Contact Details

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### Modeling and software design

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### Project web-site:

[www.invert.at](http://www.invert.at)