



the
abduS salam
international centre for theoretical physics

40¹⁹⁶⁴
anniversary
2004

SMR 1585 - 2

WORKSHOP ON DESIGNING SUSTAINABLE ENERGY SYSTEMS
18 October - 5 November 2004

***REPRESENTATION OF DIFFERENT ENERGY TECHNOLOGIES
IN MESSAGE***

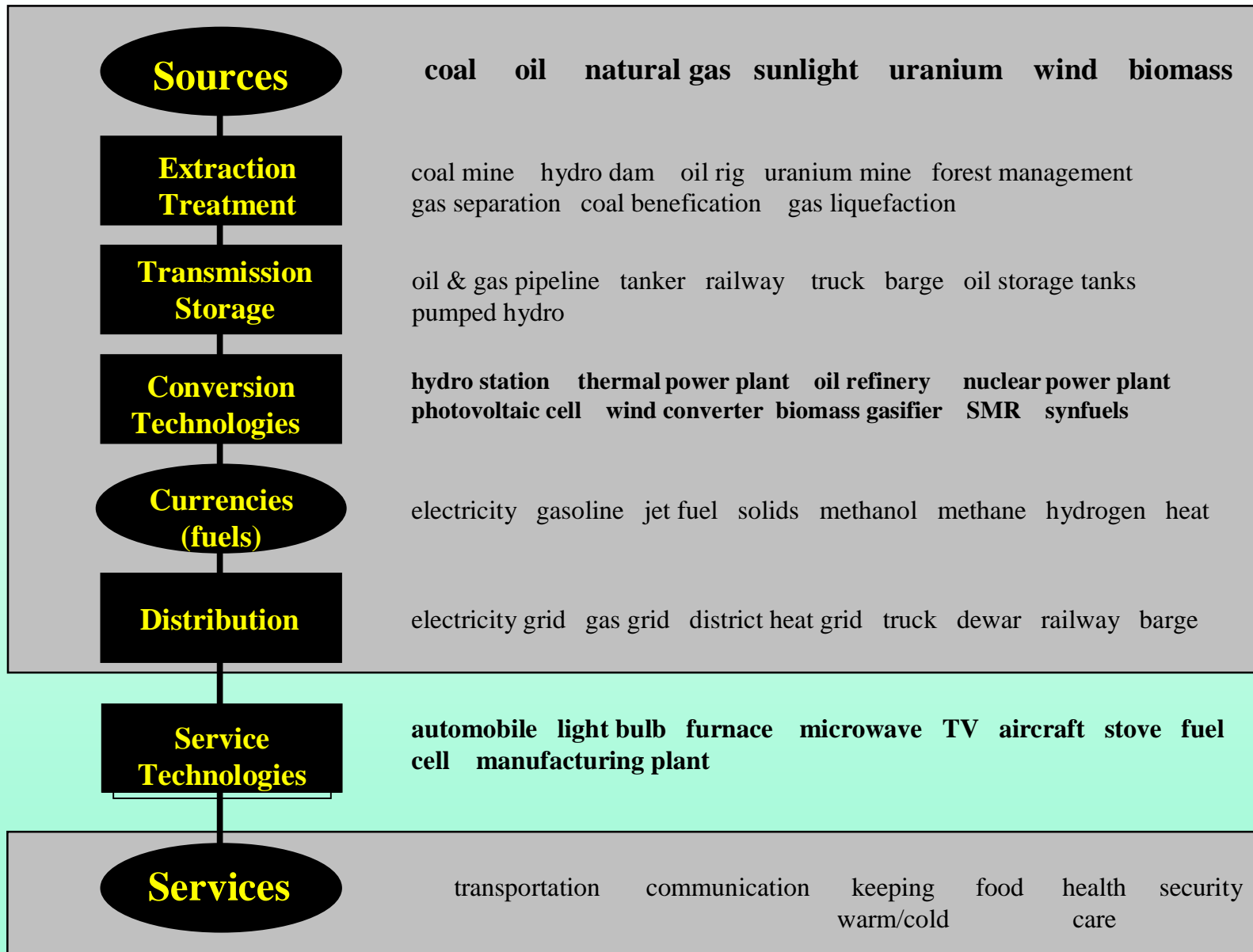
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These are preliminary lecture notes, intended only for distribution to participants.

**Representation of different
energy technologies
in MESSAGE**

A.Galinis

Research area

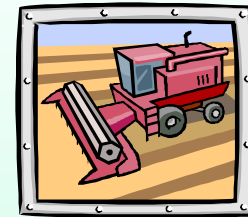
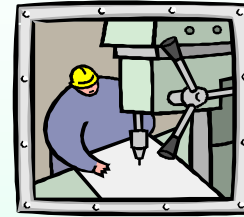


What Nature Provides

Energy Sector

What People Buy

Energy Technologies



Technologies in fuel supply sector

Fuel extraction (coal mines, oil-wells);

Fuel cleaning (coal washing);

Fuel enrichment (enrichment of nuclear fuel);

Fuel fabrication (nuclear fuel; peat briquettes);

**Fuel conversion (refineries, conversion of spent nuclear
fuel into nuclear fuel);**

Fuel transportation (by road, railway, ships, pipes);

Fuel distribution (by road, pipes);

Fuel import (oil terminals, coal terminals);

Fuel export (oil terminals, coal terminals);

Technologies in energy production sector

Power plants (oil, coal, nuclear, hydro)

Boiler-houses;

Refineries;

Electricity transmission and distribution networks;

Heat transmission and distribution networks;

Flue gas cleaning equipments;

End use technologies

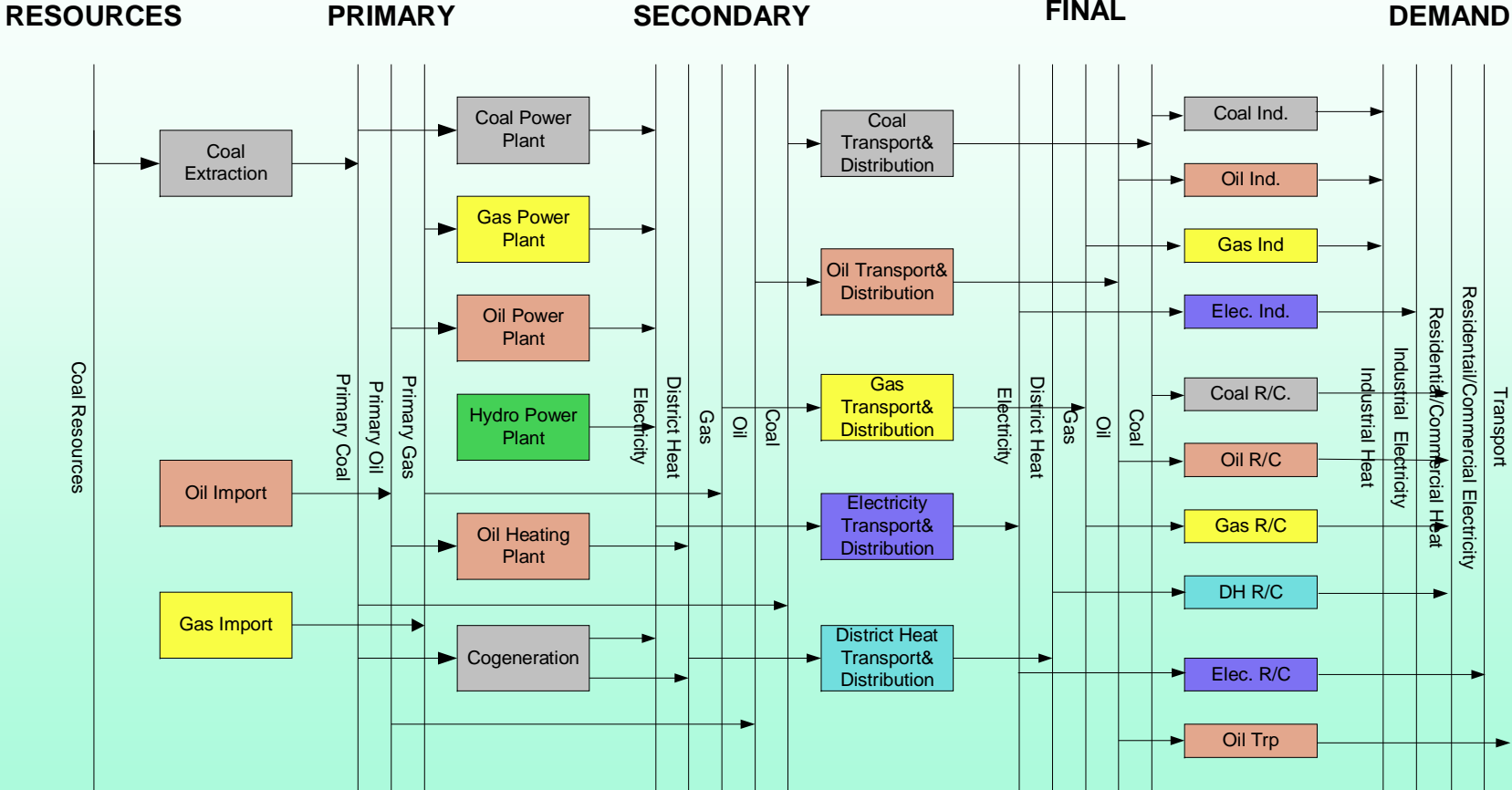
Technological lines of various industries;

Variuos houshalt devices;

Agricultural machines;

Transportation means;

Representation of technologies in energy flow network



Energy technologies in MESSAGE term (1)

Technologies having no input;

Technologies having single input and output;

Technologies having single input and multiple outputs

(with fixed or free energy shares);

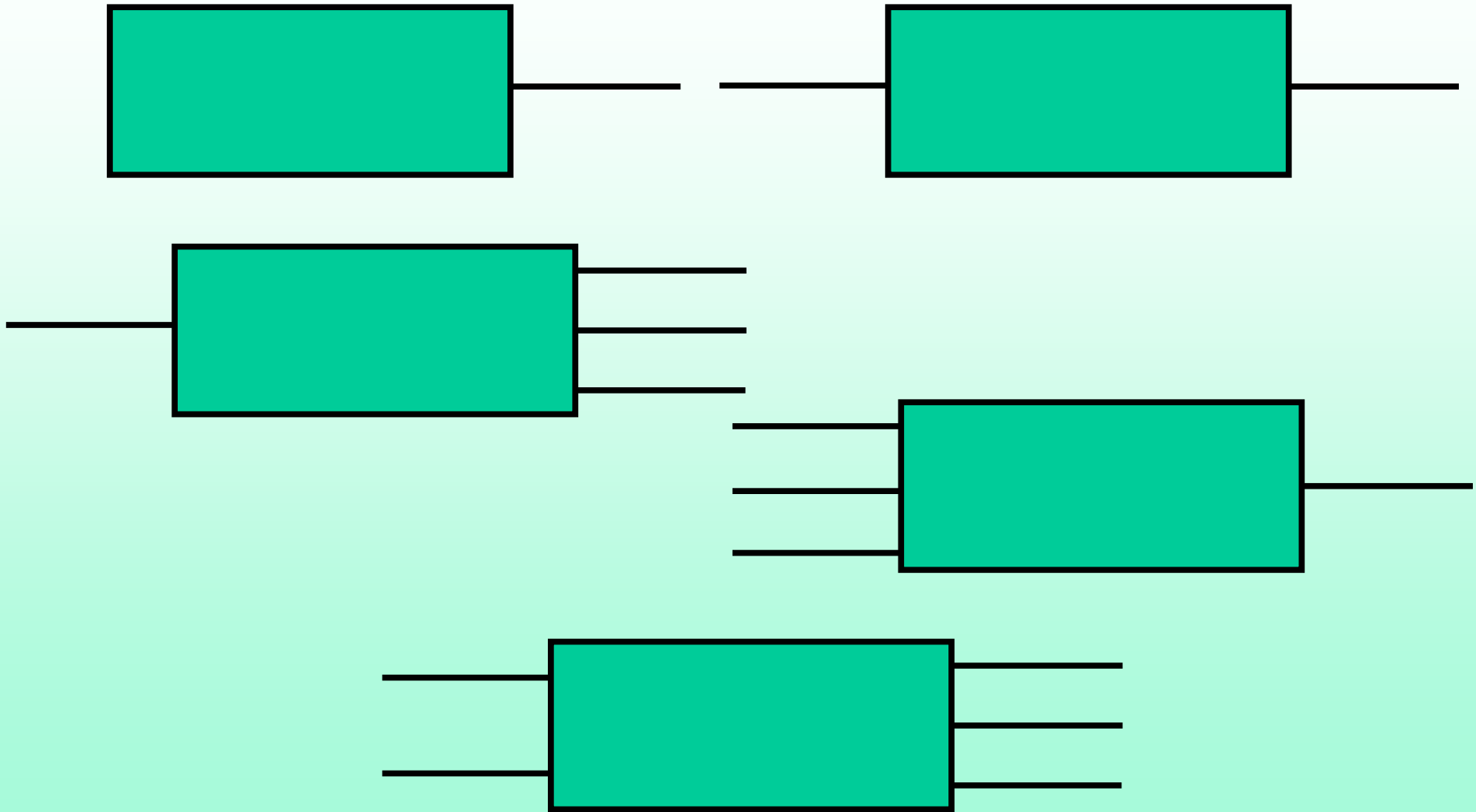
Technologies having multiple input and single outputs

(with fixed or free energy shares);

Technologies having multiple input and multiple outputs

(with fixed or free energy shares);

Energy technologies in MESSAGE term (2)



Peculiarities of technologies (1)



- **Seasonal variation**
 - **Water inflows**
 - **Mandatory releases**
 - **Storage capacity**
-
- **Probabilistic availability**
 - **Can be linked with storage or back-up systems**



Peculiarities of technologies (2)

- **Multiple inputs and outputs**
- **Fixed or flexible proportion of fuel inputs or energy outputs**
- **Seasonal limits on fuel use**
- **Efficiency may vary with fuel**
- **Emissions dependent on fuel use**
- **Environmental regulation**

Peculiarities of technologies (3)

- **Seasonal variation in capability**
 - **Limits on production or fuel input**
 - **Efficiency varying with time**
 - **Costs varying with time**
- Capacity constraints**
- **Market penetration**

Data entries for energy technologies in MESSAGE (1)

The image displays two overlapping windows from the MESSAGE software, both titled 'IAEA - MESSAGE V Latvia_bb adb'. The top window shows the 'Technologies' configuration screen for 'L_ex_R1chp_gen'. The bottom window shows the 'Capacity' configuration screen for the same technology.

Top Window: Technologies Configuration

- General:** input: all, output: all, relations: all, name (re): [empty]
- has inv:** all, yes, no
- operator:** and, or
- technologies:** L_ex_R1chp_gen
- Buttons:** Copy, Cut, Paste, Add from TDB, New, Del

Bottom Window: Capacity Configuration

- Activity:** Capacity
- Technology:** L_ex_R1chp_gen
- single entries:**
 - name: L_ex_R1chp_gen, id: a
 - capacity unit: MW
 - first year: [redacted], last year: [redacted]
 - initial state: on, off, f
- Table:**

	Unit	Switch	Time series	
plant factor	share	c	1	operation time s
minutil				
plant life	yr	c	51	unit size
inv cost	EUR'00/kW	c	0.001	constr. time
fixed costs	EUR'00/kW/yr	c	53.0	
hist. cap.	MW	hc	1955 83.5	
min. power				max. power
- multiple entries:** [empty]

Data entries for energy technologies in MESSAGE (2)

Activity **Capacity**

single entries

name id fixed yes no altern. op.

capacity unit

first year last year initial state on off free final state on off free

	Unit	Switch	Time series		Unit	Switch	Time series
plant factor	<input type="text"/>	<input type="text"/>	<input type="text"/>	operation time	<input type="text"/>	<input type="text"/>	<input type="text"/>
minutil	<input type="text"/>	<input type="text"/>	<input type="text"/>				
plant life	<input type="text"/>	<input type="text"/>	<input type="text"/>	unit size	<input type="text"/>	<input type="text"/>	<input type="text"/>
inv cost	<input type="text"/>	<input type="text"/>	<input type="text"/>	constr. time	<input type="text"/>	<input type="text"/>	<input type="text"/>
fixed costs	<input type="text"/>	<input type="text"/>	<input type="text"/>				
hist. cap.	<input type="text"/>	<input type="text"/>	<input type="text"/>				
min. power	<input type="text"/>	<input type="text"/>	<input type="text"/>	max. power	<input type="text"/>	<input type="text"/>	<input type="text"/>

multiple entries

bdc	bdi	clags	con1c	con2c	concc	conpc
consc	corin	corout	gbda	mpc		

Data entries for energy technologies in MESSAGE (3)

Activity Capacity

activities

Add Ins Del Rename Reseq

alt a

alt a

single entries

	Name	Unit	Value		
main input	<input type="text"/>	<input type="text"/>	<input type="text"/>	loadcurves for:	<input type="text"/> <input type="checkbox"/> abs/rel
main output	<input type="text"/>	<input type="text"/>	<input type="text"/>		
var costs	<input type="text"/>	<input type="text"/>	<input type="text"/>		
hist. act.	<input type="text"/>	<input type="text"/>	<input type="text"/>	pow. rel.	<input type="text"/> <input type="checkbox"/> additional options: <input type="text"/>

multiple entries

abda	alags	bda	con1a	con2a	conca	conpa
consa	inp	mpa	outp	softlims		