Moving towards a Bio-Economy – Summary of a European Discourse

Do not follow mistakes already made!

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What you can expect

The summary of a European discourse within eseia about rational use of bio-resources:

- Indicating traps we have to avoid
- Trying to get a better understanding for bio-resources
- Outlining how bio-resources should be used in the framework of sustainability

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No doubt: The economy of the 21st century must re-orient itself

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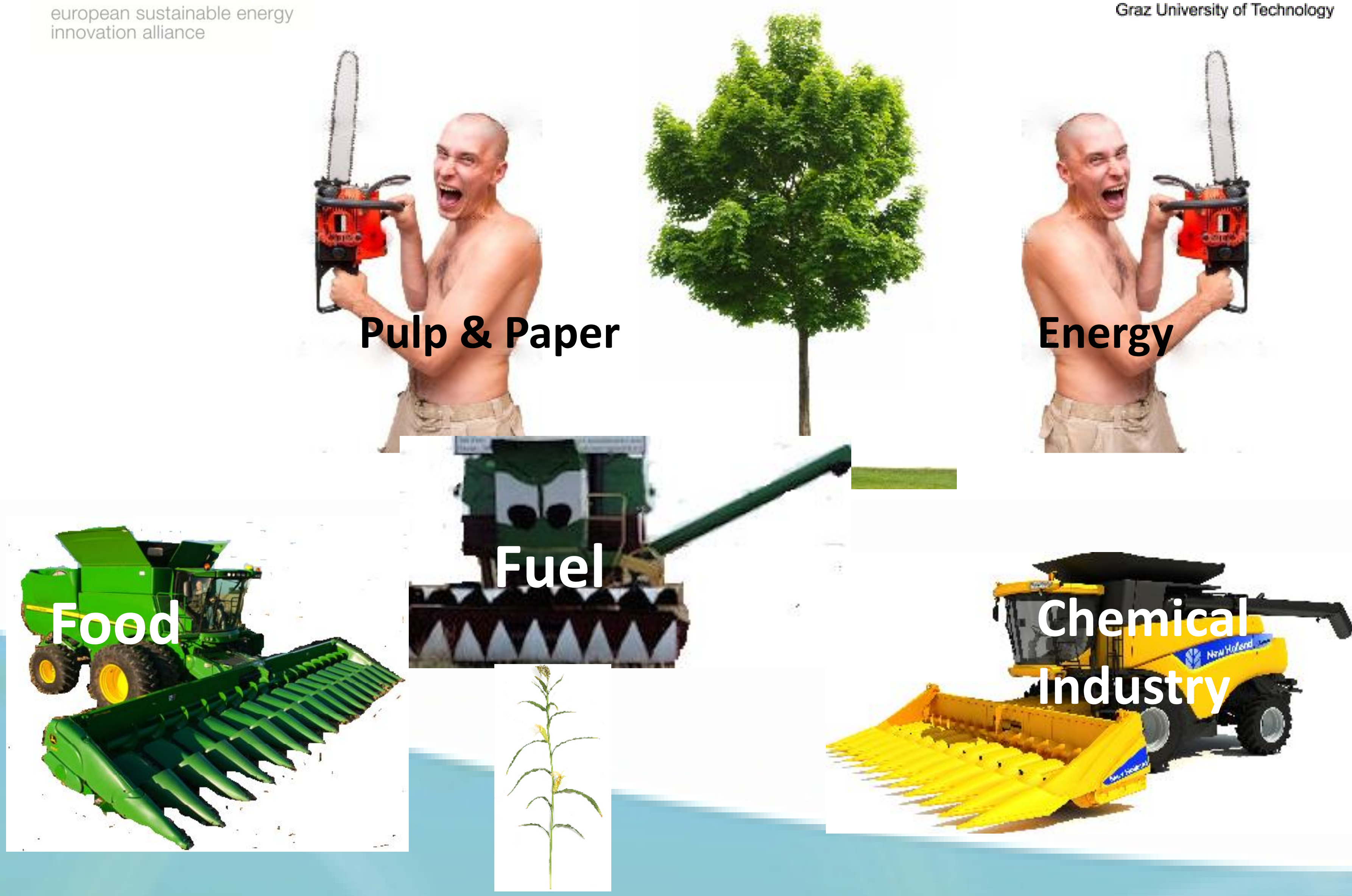
from **to**

Raw materials →



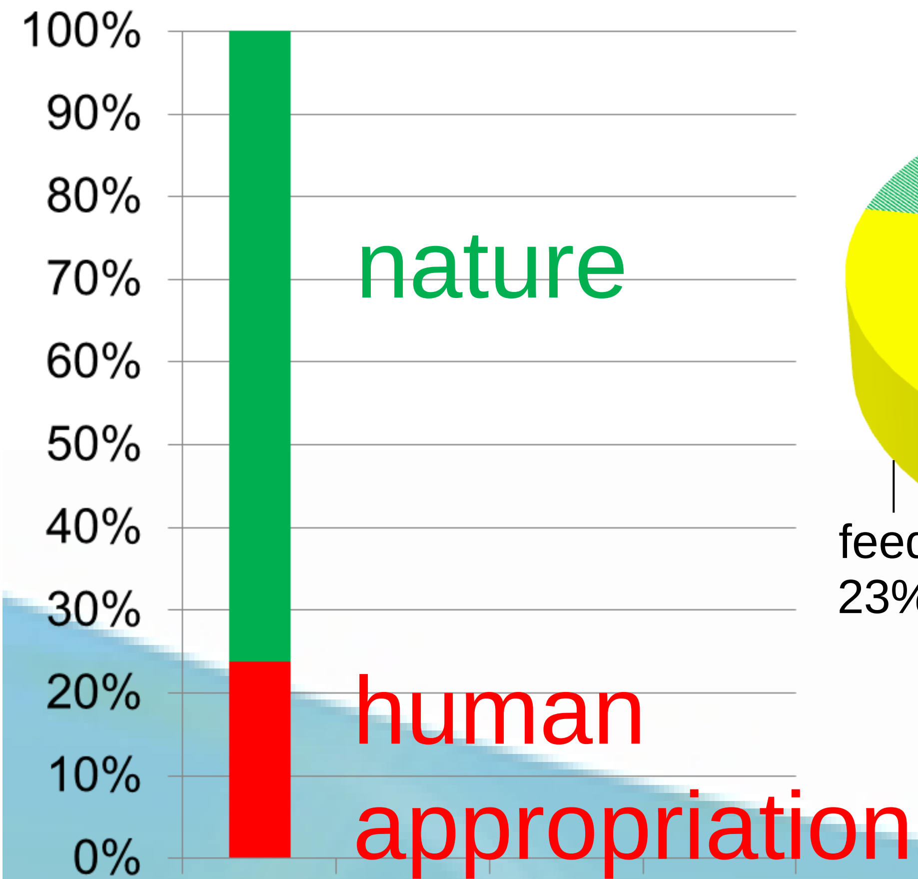

sources →

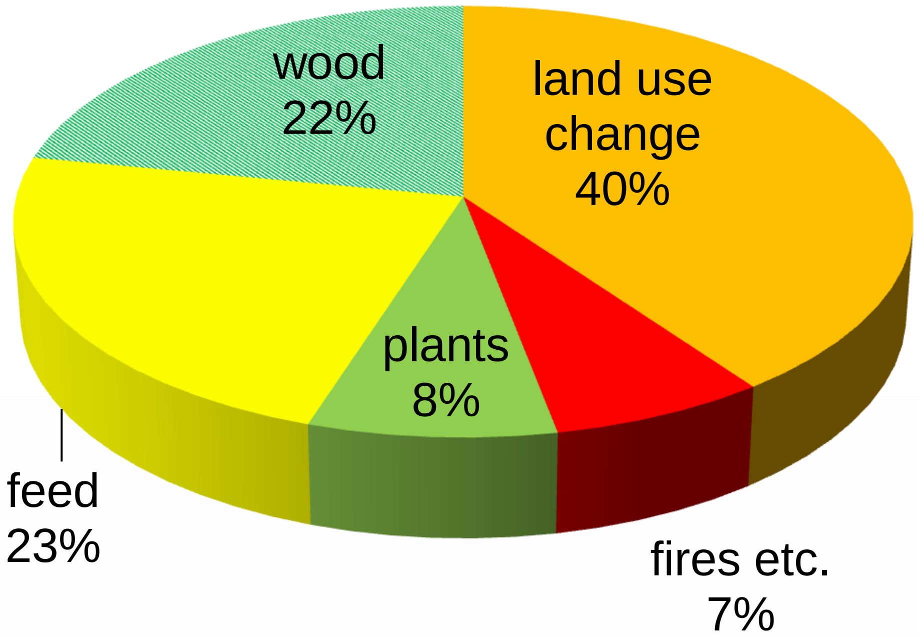

But: THAT must not happen!



Human net appropriation

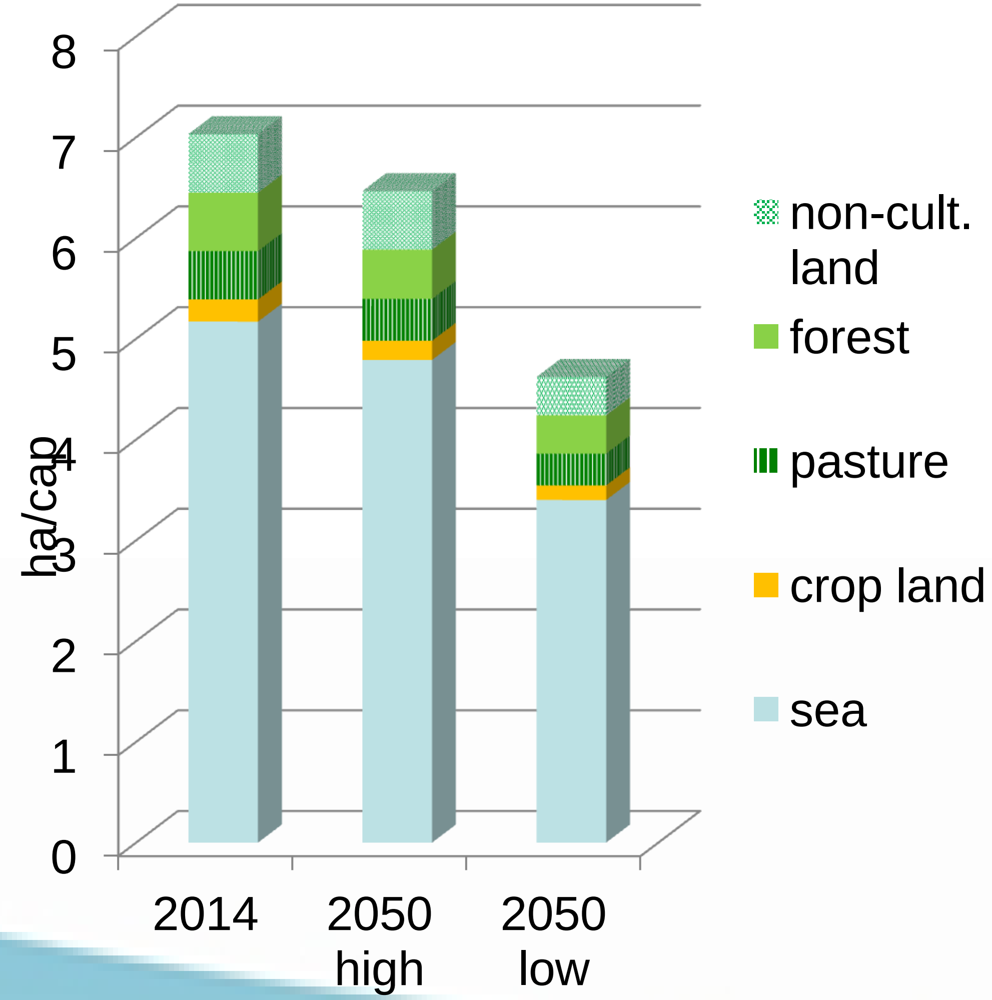
105-150 Gt Carbon/y





- 10 % net productivity by human impact!

Basic resources

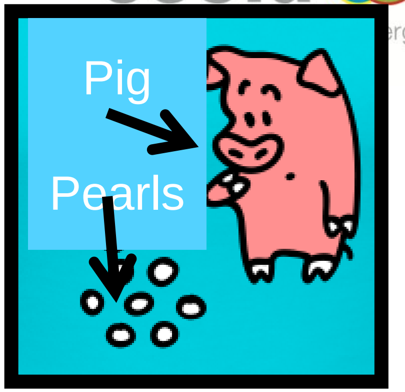


The „competition trap“: everone wants them!

Bio-resource	Origin	Yield
		
		[tFM/(ha.y)]*
			Main content	Yield for main comp.
				[t /(ha.y)]
					Current competition:
					f= food; b =bio-fuel;
					c= chemicals;
					e= energy;
					p= pulp&paper

corn	fields	10-15	starch	6-9.5	f/b /c
wheat	fields	8	starch	4.5	f/b /c
potatoes	fields	30-50	starch	5-8.5	f/b /c
rape	fields	2-4	oil/protein	0.9-1.8/0.5-1	f/b /c
sun flower	fields	2.6-3.6	oil/protein	1.3-1.8/0.5-0.7	f/b /c
jatropha**	fields	4	oil	1.2	b/c
palm fruits**	plantation	15-22	oil	4-6	f/b /c
sugar beet	fields	70-95	sugar	10-16	f/b /c
sugar cane**	plantation	40-100	sugar/cell.	6-15/6-15	f/b /c
grass	grass land	6-12	cellulose	2.5-5	f/e
miscanthus	fields	12-28	cellulose	5-13	e/(c/p)
wood	forest	3.5-6	cellulose	1.3-2	c/e/p
short rotation wood	fields/grass land	10-18	cellulose	3-6	e/(c/p)

We need a rational use of key resources



Do not throw „Pearls to Pigs“

Energy and plastic bags can be made from different sources:

Trying to avoid the„competition trap“:

Raw material category	Origin	Material (examples)
Secondary	Agricultural wastes	Manure
	Residues from industries	Slaughterhouse residues
		Tallow
		Oil seed cake
		Glycerol from bio-diesel prod.
		Dried distillers grain
		Black liquor from pulping
		Sugar beet chips
		Pomace
		Tanning residues
	Residues from energy provision	CO_2
		Ashes
	Harvest residues from agriculture/forestry	Low quality forest residues
		Straw from corn, cereals, oil seeds, …
		Leafs from beets, potatoes, …
		Cuttings from wine yards, orchards, …
Tertiary	Residues from society	Waste paper
		Waste plastic
		Organic municipal waste
		Garden cuttings
		Used vegetable oil
		Waste water
Additional	Underutilised bio-resources	Grass
	currently uncultivated land	Micro algae

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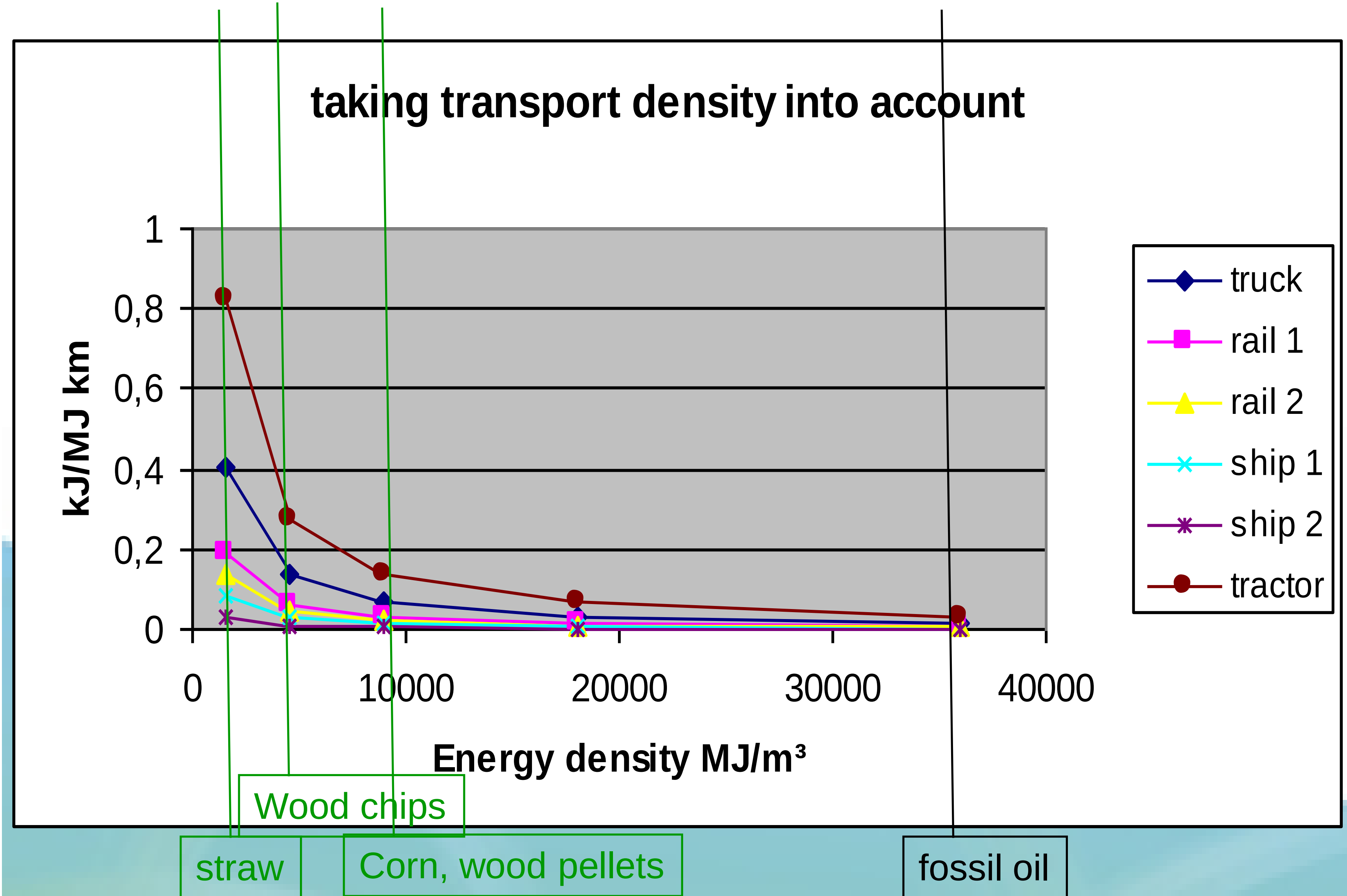
The “Logistical Trap”

Conversion	Material	Humidity [%w/w]	Energy content [MJ/kg]	Density [kg/m³]	Energy density [MJ/m³]
Incineration	Straw (grey)	15	15	100-135	1.500-2.025
	Wheat	15	15	670-750	10.050-11.250
	Rape seed	9	24.6	700	17.220
	Wood chips	40	10.4	235	2.440
	Wood pellets	6	14.4	660	9.500
Biogas production	Grass silage	60-70	3.7	600-700	2.220-2.590
	Manure	95	0.7	1000	700
	Light fuel oil	**0**	**42.7**	**840**	**36.000**

The “Logistical Trap”

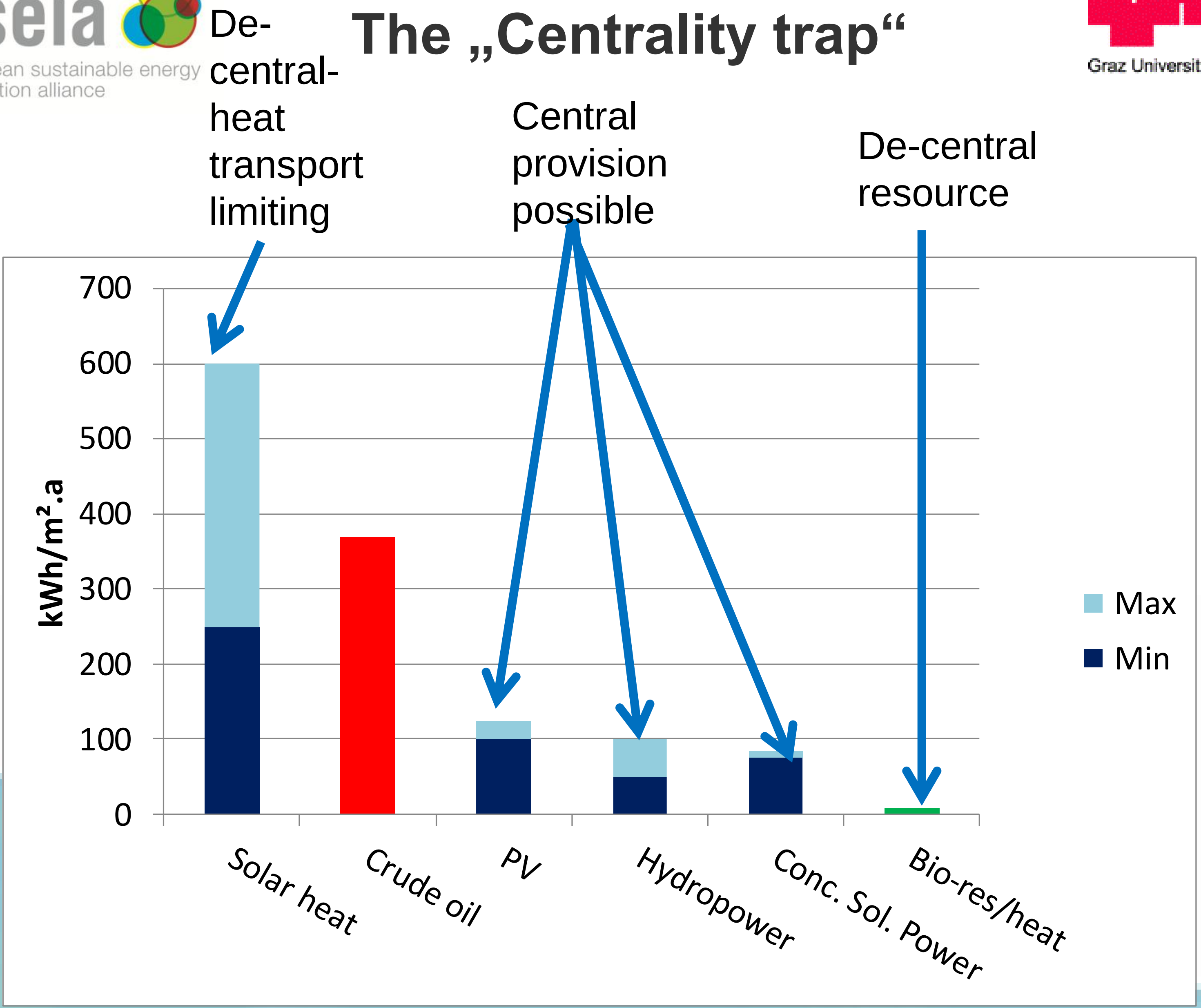


Taking transport density into account…

- …5,7 km transport of manure and
- …12 km transport of straw with tractor…
- …or 40 km transport of wood chips with lorry…
- …or 475 km transport of pellets with train
- …or 7.800 km transport of crude oil with ship or pipeline consume **1 %** of the transported energy

Raw material provision must become closer!

The „Centrality trap“



The „Centrality trap“

Plant size	Upper and lower land requirement in km²	Transport distance in km with land use	
		30 %	10 %
Very small 50 t/a	0.125	0.4	0.6
	.03	0.2	0.3
Small 5.000 t/a	12.5	3.6	6.3
	3.3	1.9	3.2
Medium 50.000 t/a	125	11.5	20
	33	5.9	10.2
Industrial 500.000 t/a	1,250	36	63
	333	18.8	32.6

Upper land requirement calculated with 4 t/ha.a (e.g. wood chips), lower limit with 15 t/ha.a (e.g. corn or miscanthus)

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The „Intermittency trap“

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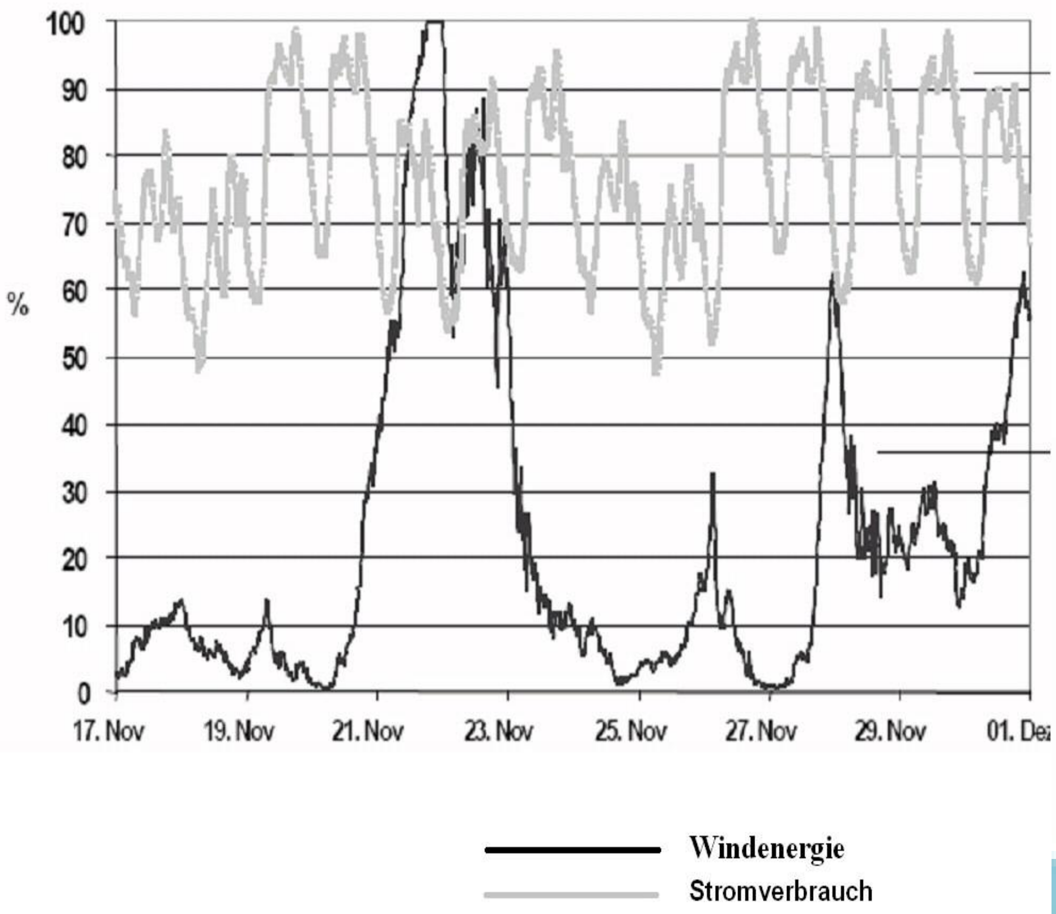
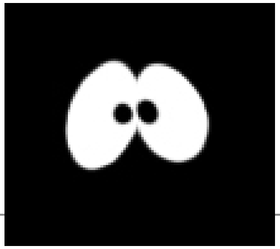
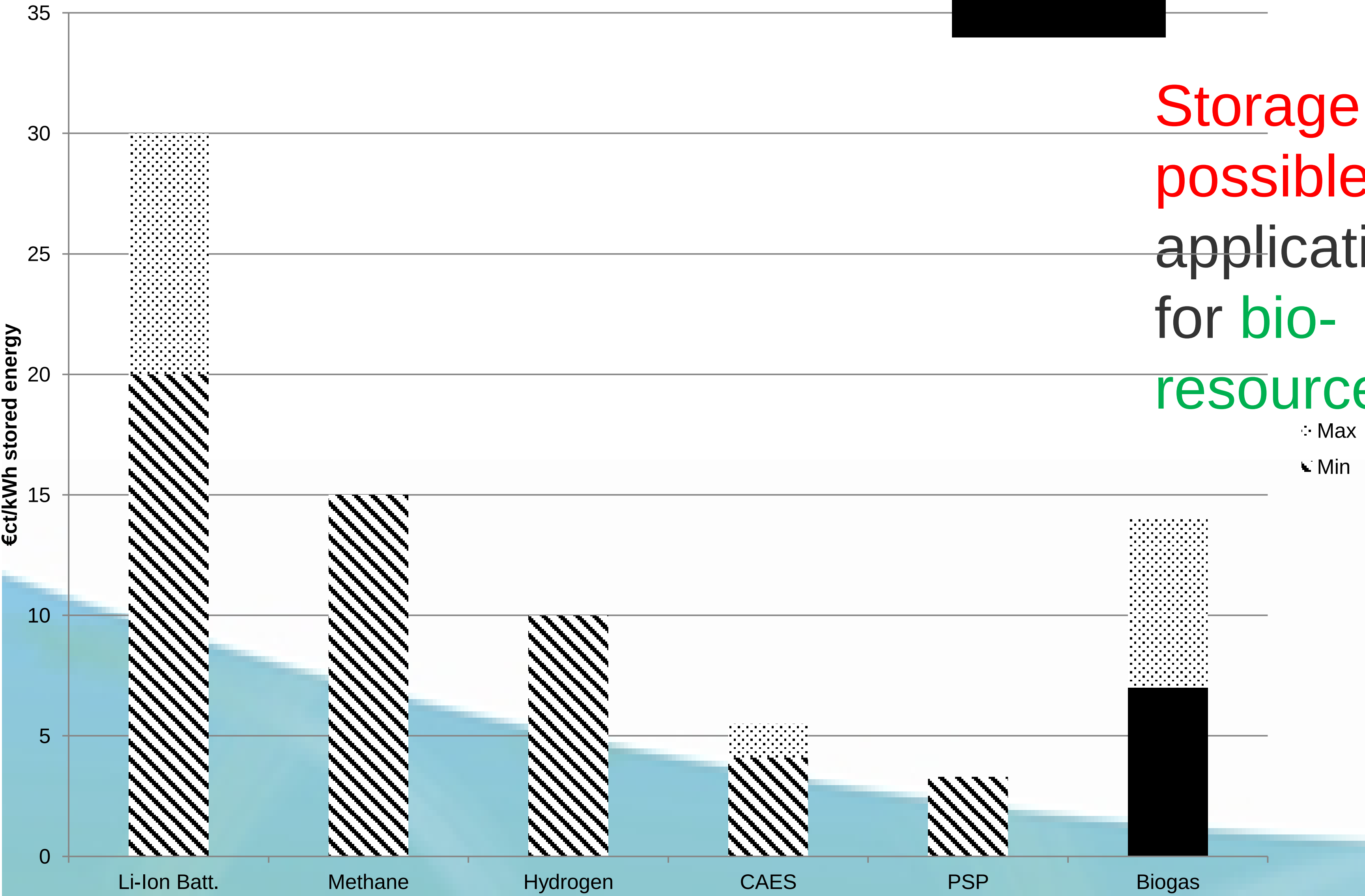


- Many renewable (energy-) sources are intermittent
- How to aligne provision with demand?

The „Intermittency trap“



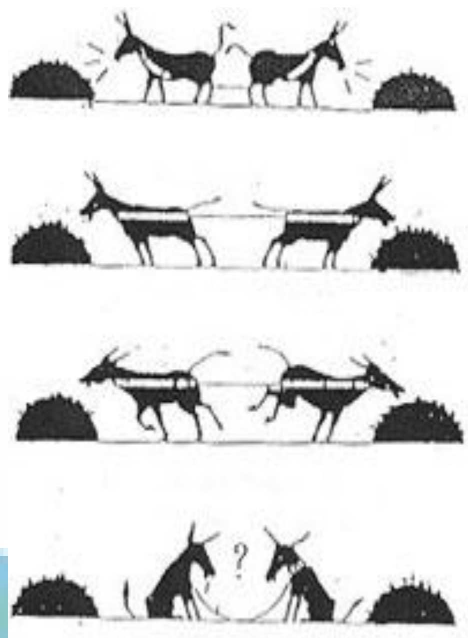


Storage is a possible application for bio-resources

The bio-resource service challenge

Type of service	Service	Possible other resources
Social	**Nutrition**	None
	Jobs and development for rural regions	None
	Social stability for rural regions	None
Economic	**Stability for energy distribution grids**	Smart grids, hydro power, pumped hydro power, hydrogen, compressed air energy storage, (fossil resources)
	Transport fuel	Electricity (using battery storage), hydrogen, synthetic fuels, (fossil resources)
	High temperature industrial heat	(fossil fuels), H_2 from excess electricity
	Feedstock for synthetic materials and plastics	(fossil resources), sequestered CO_2 plus H_2 from excess electricity
	Feedstock for conventional bio-based products	None
Environmental	**Reduction of greenhouse gas emissions**	Wind and hydro power, solar thermal systems, photovoltaic, oceanic power, geothermal energy
	Preserving soil fertility	None
	Preserving water and nutrient cycles	None
	Preserving bio-diversity	None

In times of change we see…



- Strategic confusion
- Science and technology preferences
- “Pseudo-activity”
- Decision avoidance

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The complex bio-resource value chain…

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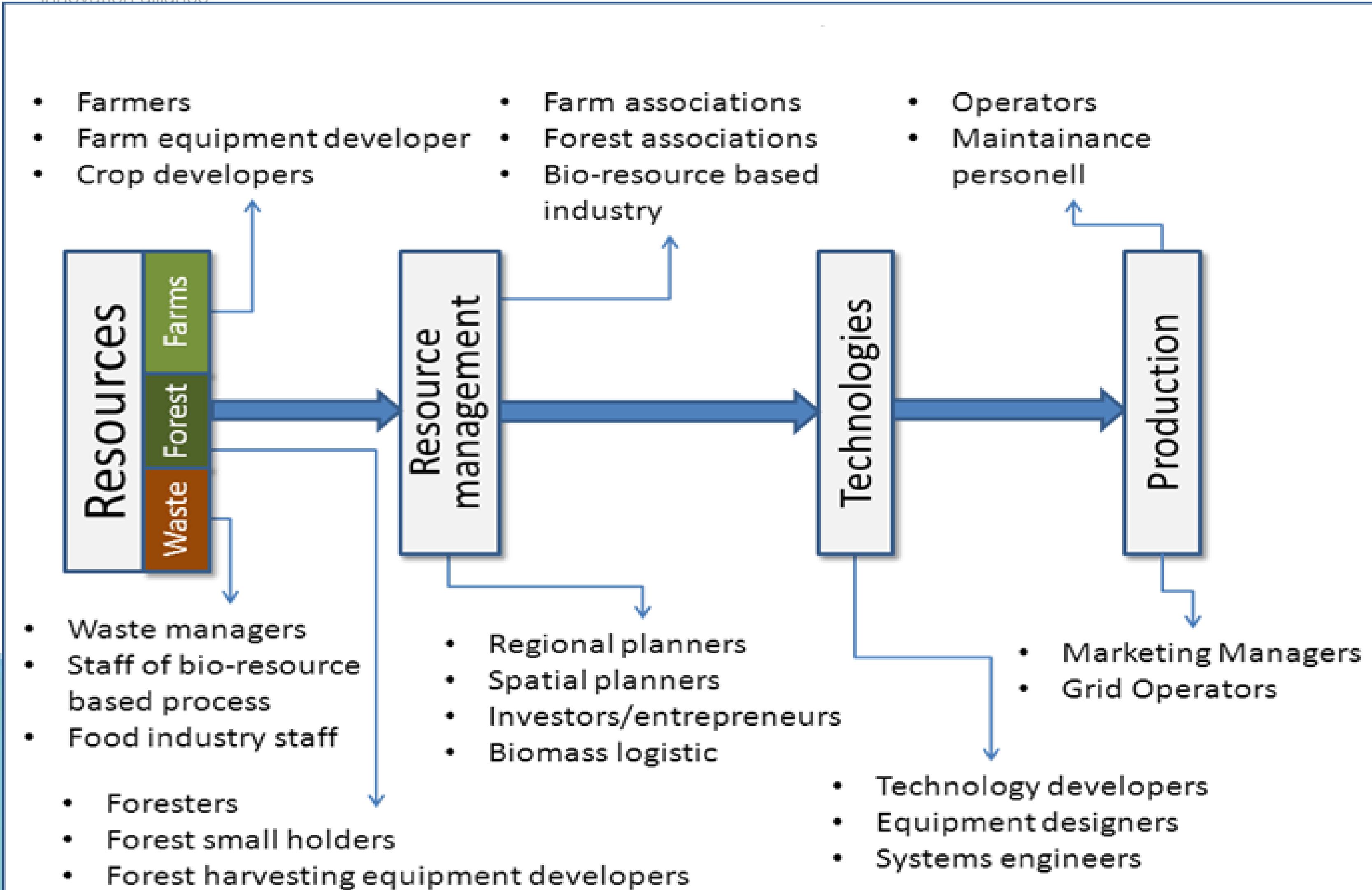

…requires non-technical innovation

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The Problem

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We have many actors

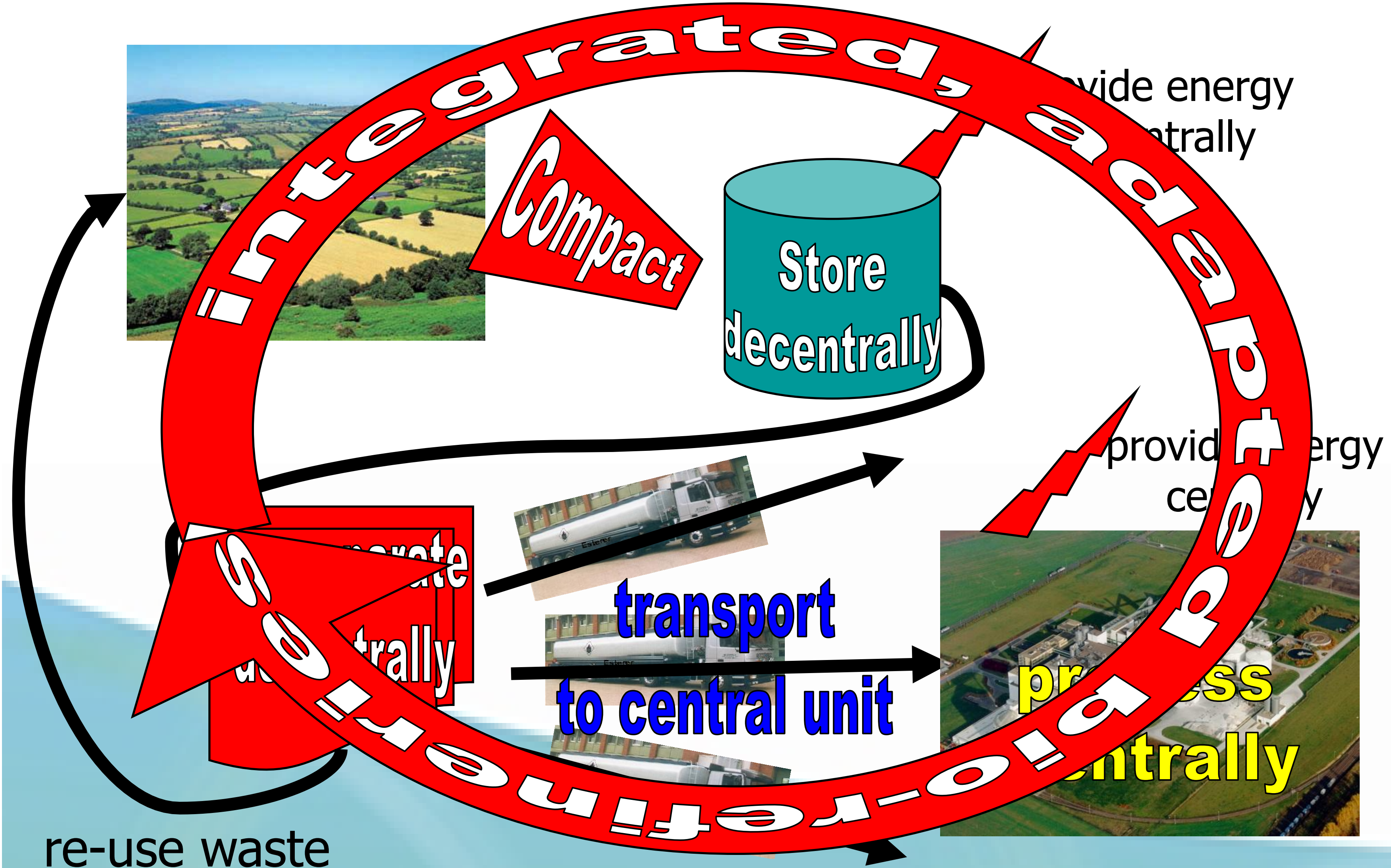
How to make them see
a bright common future?

Technical challenges

Learn your „old dogs“ new tricks!

- Increase raw material flexibility of existing technologies
- Increase tolerance for lower grade resources
- Increase range of useful products from current technologies

Technical challenges



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Pilot plant parks…

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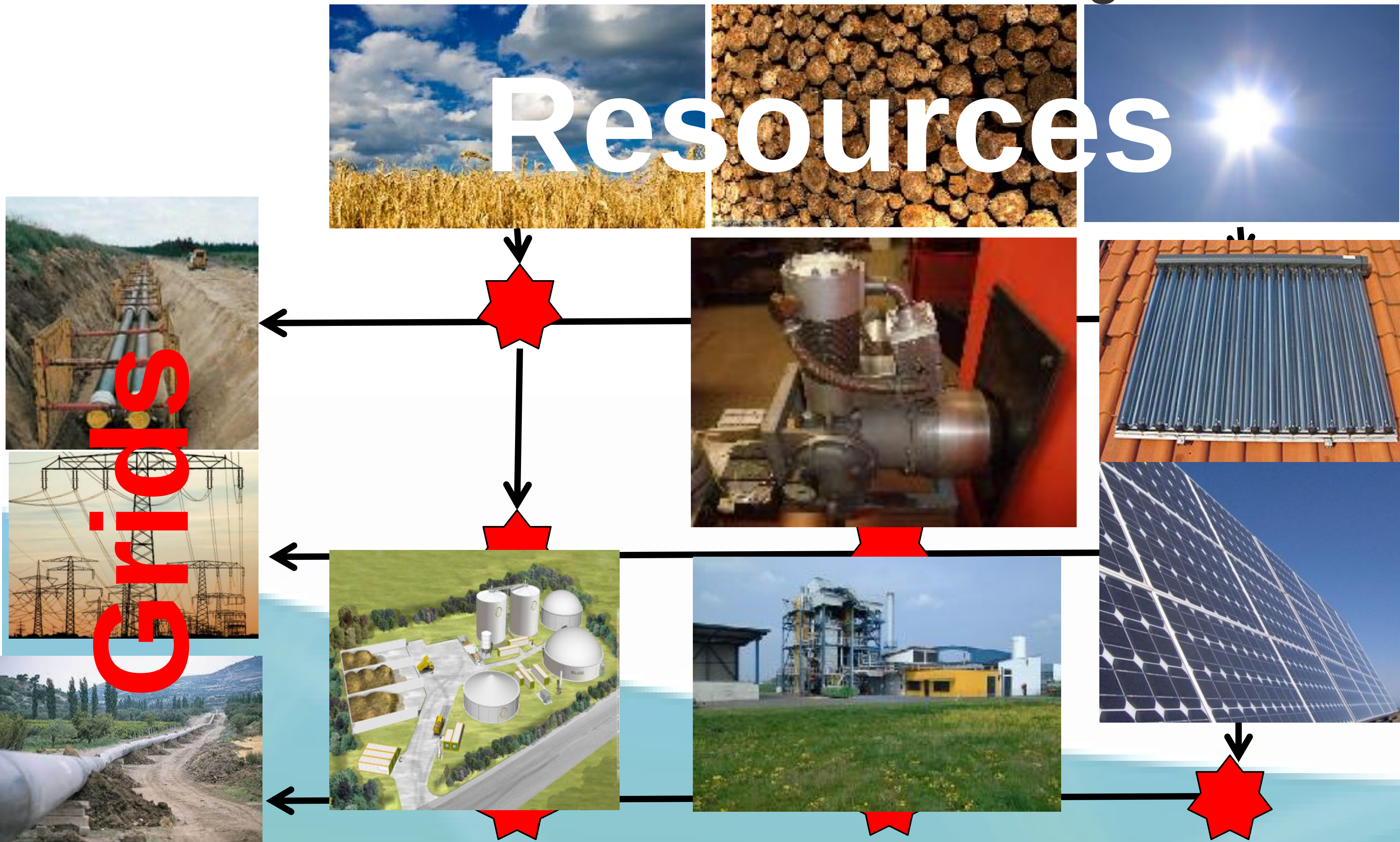
- …to shorten idea2market time
- …to optimise complex technologies
- …to increase confidence in technologies
- …to improve praxis-relevant education

Answering systemic challenges: The end of autarky: regions as active links between resources and grids



Frame regional resource plans

- Modernise existing bio-resource utilisation sectors (e.g. food industry, pulp & paper industry, timber industry) to become versatile bio-refineries
- Favour pathways leading to material products, establishing longer value chains and generating more social benefit from bio-resources.
- Keep as much material close to the place where bio-resources are grown thus closing material cycles with least transport effort and retaining valuable nutrients for preserving eco-system functions.
- Use intersections of energy distribution grids for bio-refineries based on secondary bio-resources (residues from agriculture) and tertiary bio-resources (wastes from industry and society) in order to contribute to stabilising grids

General rules

Use bio-resources fully

- high efficiency
- complex technology systems (e.g. biorefineries)
- cascading utilisation of bio-resources,
- utilising every by-product and organic waste along the life cycle

Life cycle wide responsibility

- whole pathway of bio-resources through society must be managed…
- …in a way that preserves ecosystem functions
- …from cultivating plants to the safe return of residues to nature…
- …while providing optimal societal benefit

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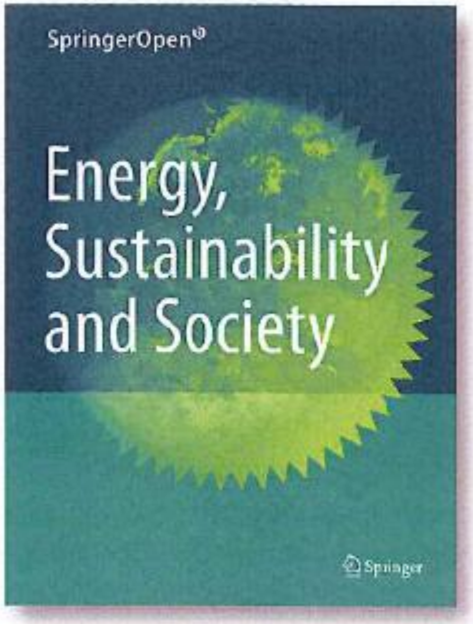

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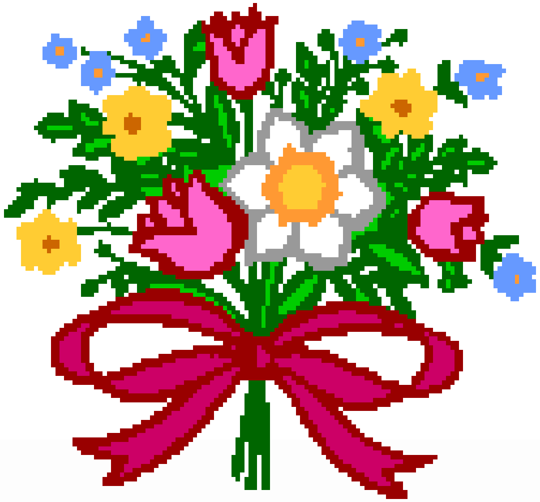

Thank you for your attention!

And if you want to evaluate yourself or your process ecologically or optimise your regional energy system, visit www.fussabdrucksrechner.at