Twinningový Projekt

FINANCNÍ NÁSTROJE

pro implementaci *acquis* v oblasti životního prostredí

Regional Seminar Waste

Jihlava

4th October 2004

Praha

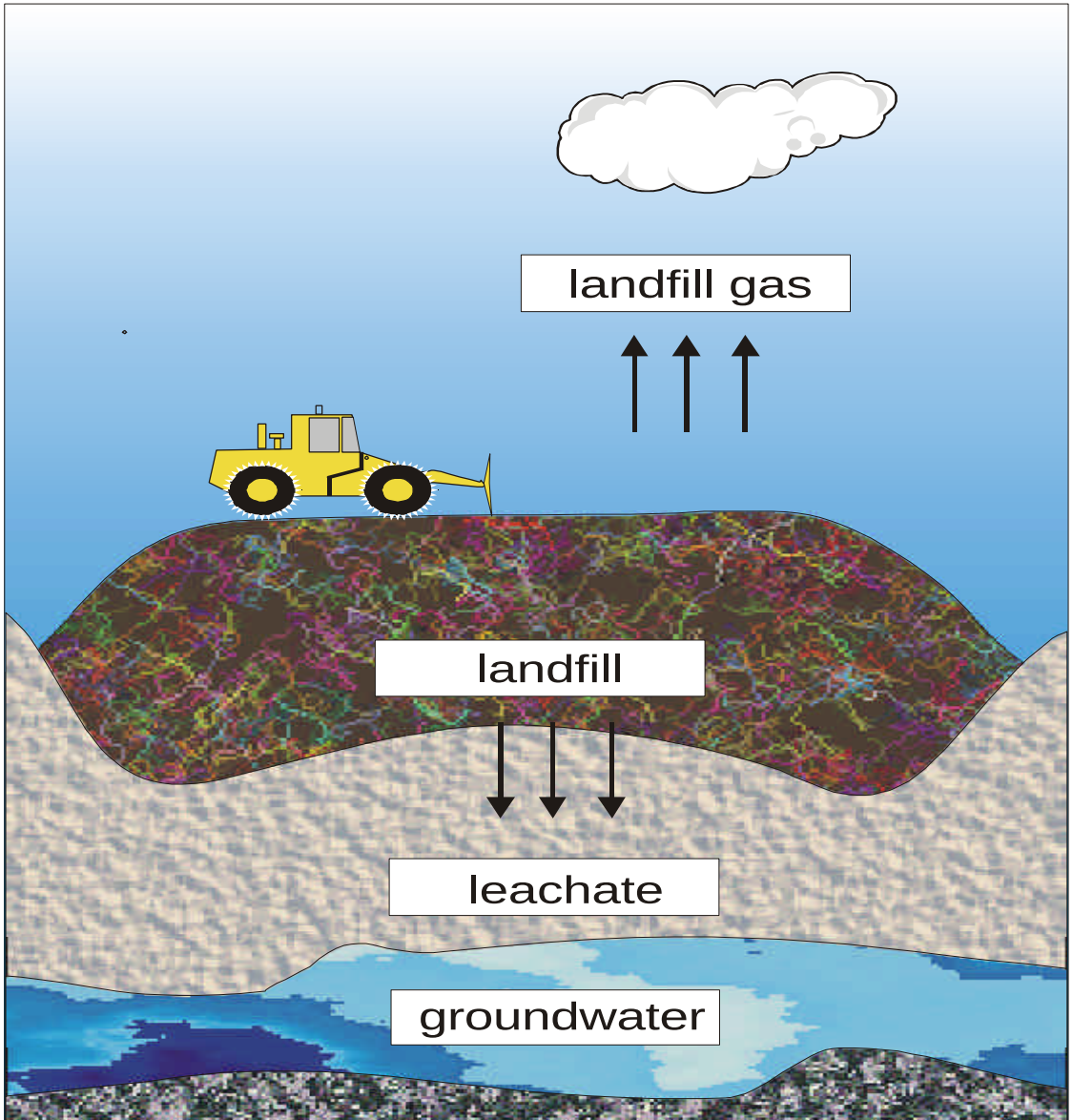
5th October 2004

Walter HAUER
Tim YOUNG

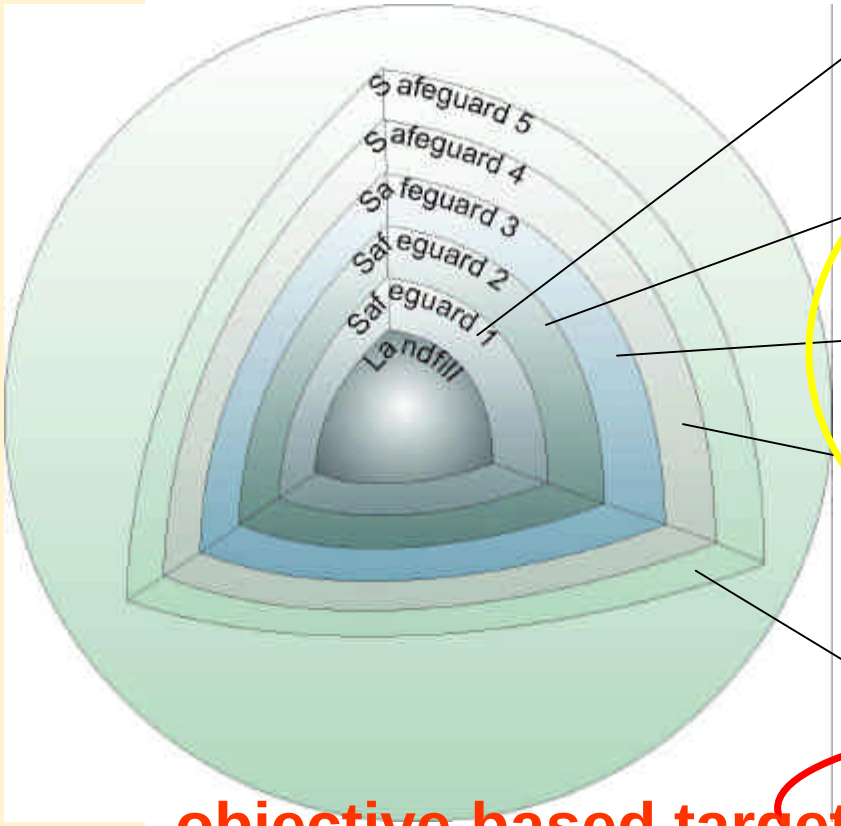
Content

- EC Landfilling Directive
- Waste quantities, currently and prognosis, examples, contribution of separate collection
- Capacities needed for stabilisation of residual MSW and investments needed in the CR
- Basic Technologies for the stabilisation of residual MSW
- Creating and Assessing Waste-Management-Options, Cost accounting
- OP-Infra and Cohesion Fund
- Manual and CD

The System L*andfill*



Sanitary Landfill: The Multi-Barrier-System



Safeguard 1:
Site selection (hydrogeology)

Safeguard 2:
Top sealing (capping)

Safeguard 3:
Leachate control (mineral liner, mineral + HDPE liner)

Safeguard 4:
Leachate collection and treatment

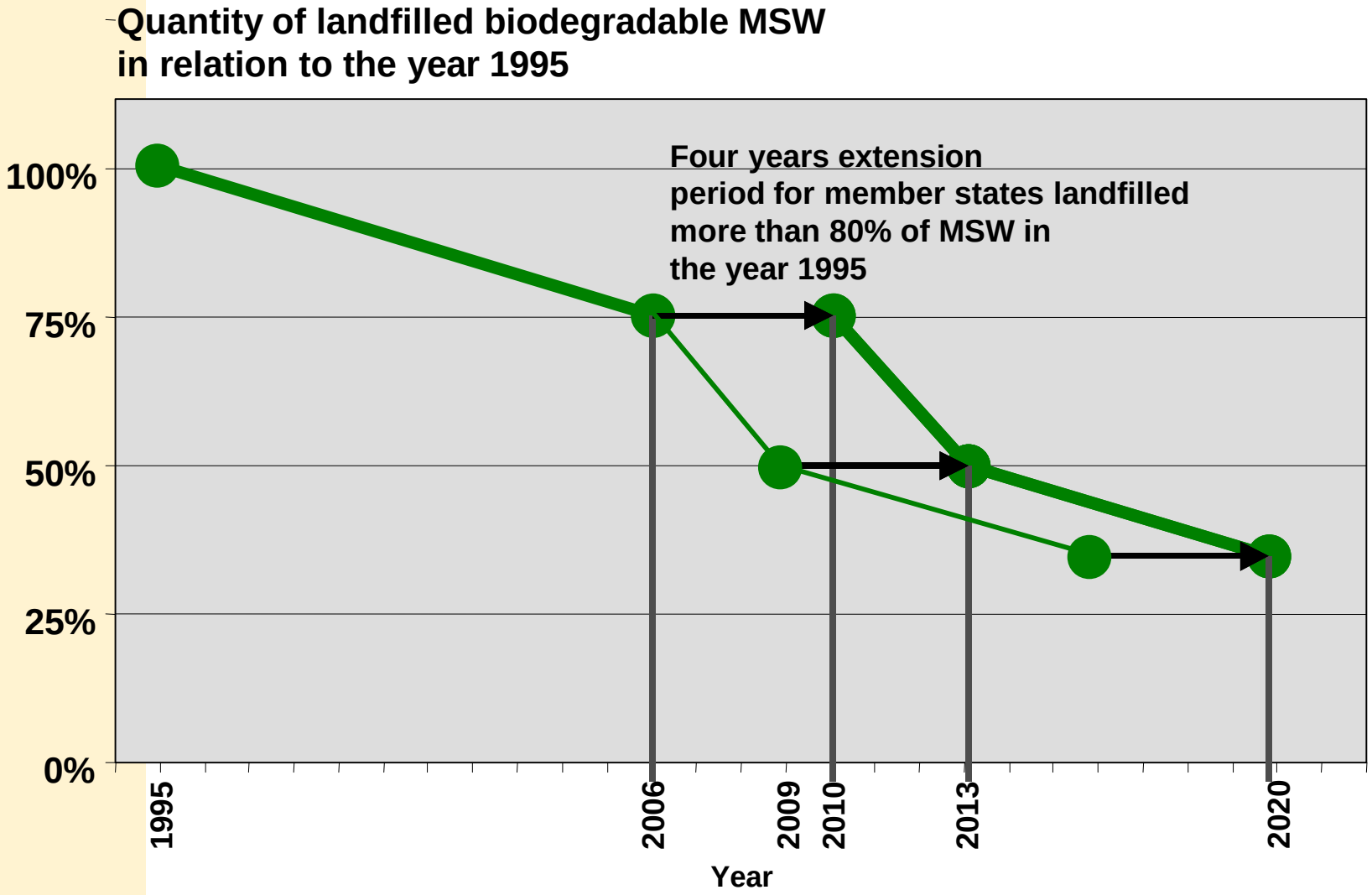
prescriptive
described
Technica
Standard

Safeguard 5:
Reduction of landfilling biodegradable waste

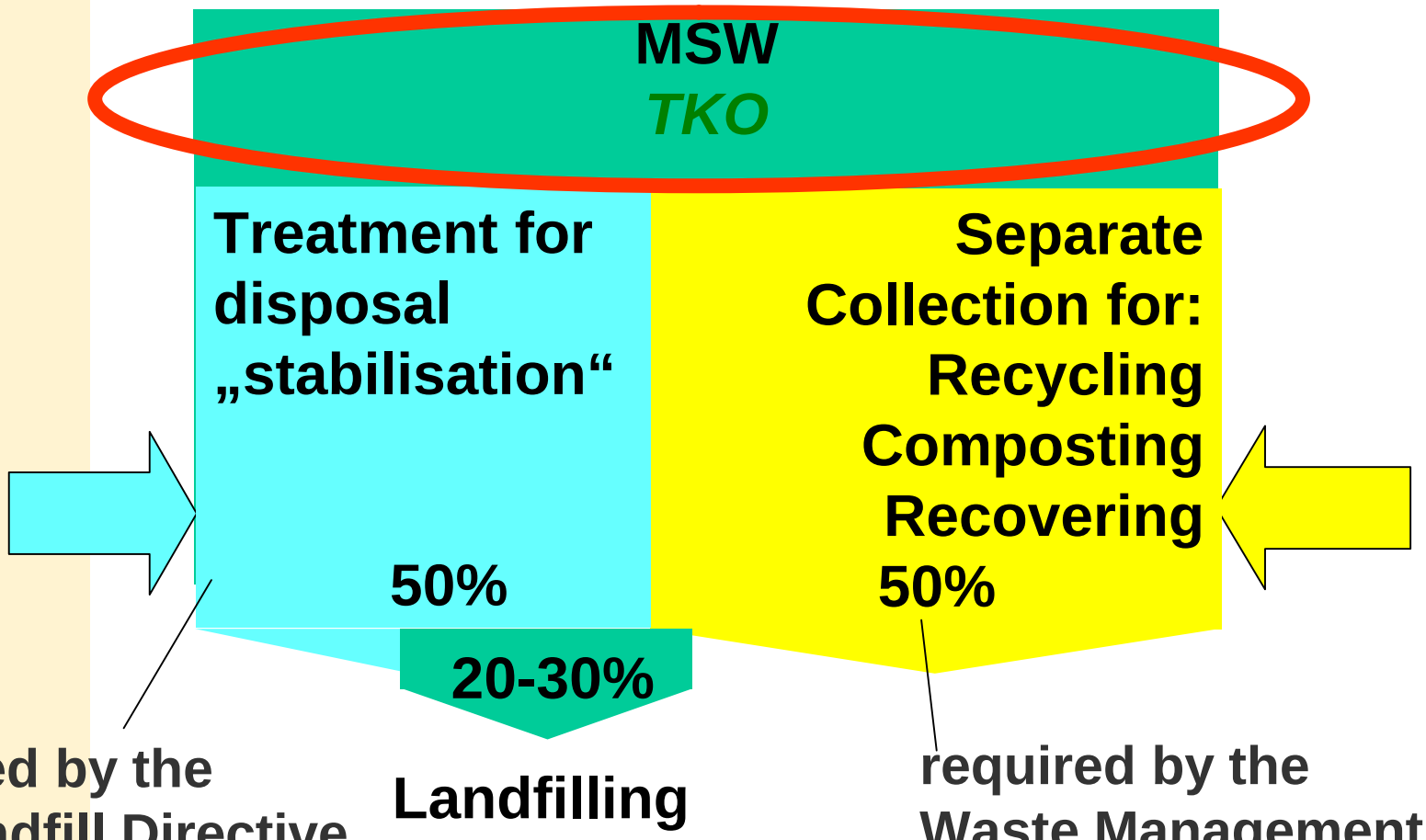
objective based targets

About the European approach...

Targets given by EC Landfill Directive



Waste Management Targets



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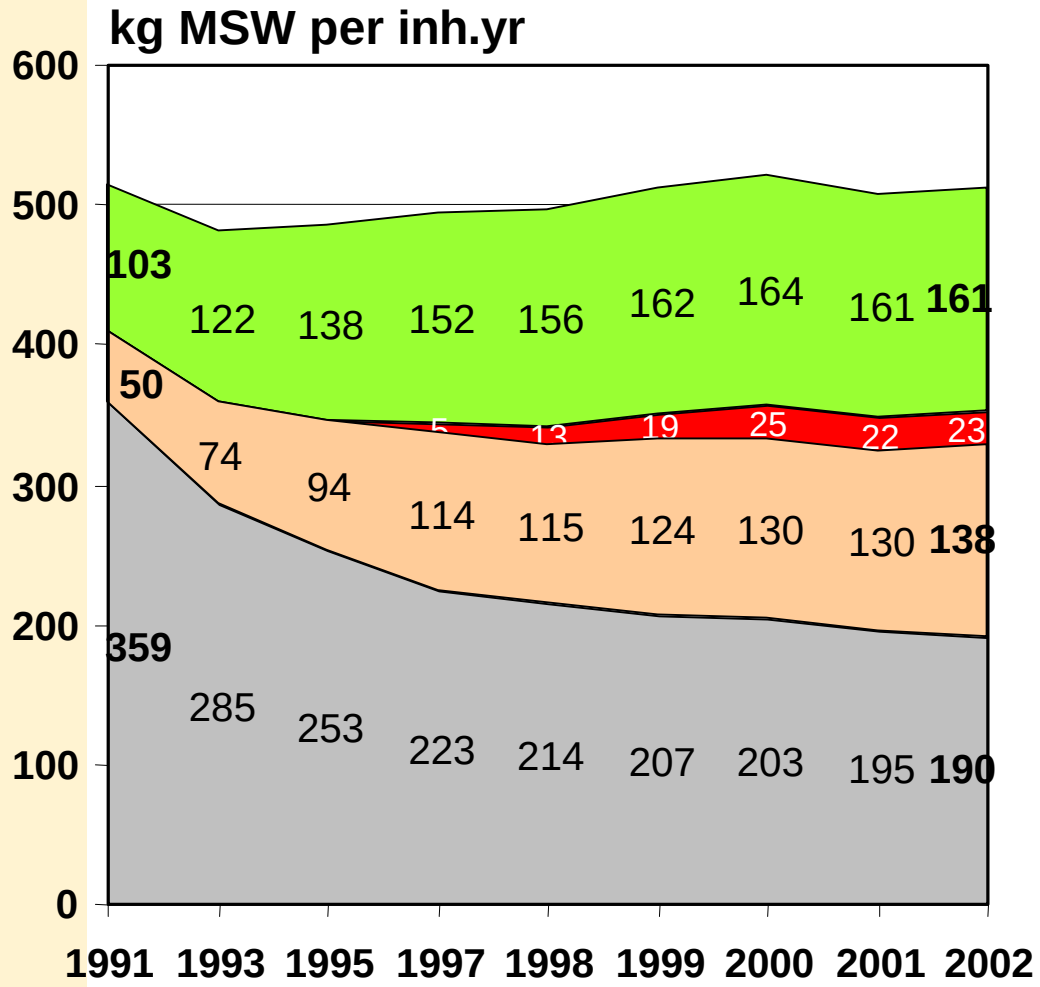
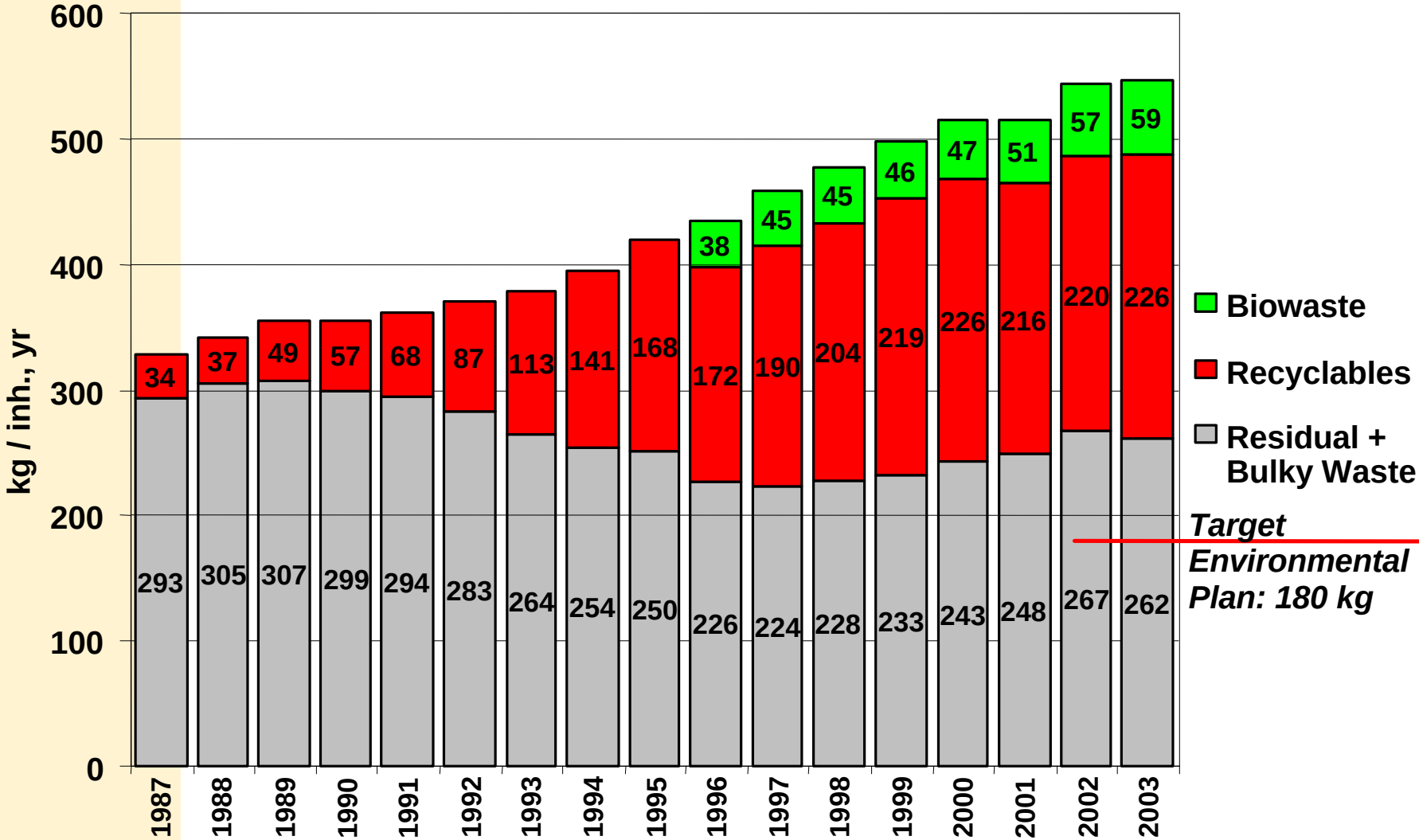
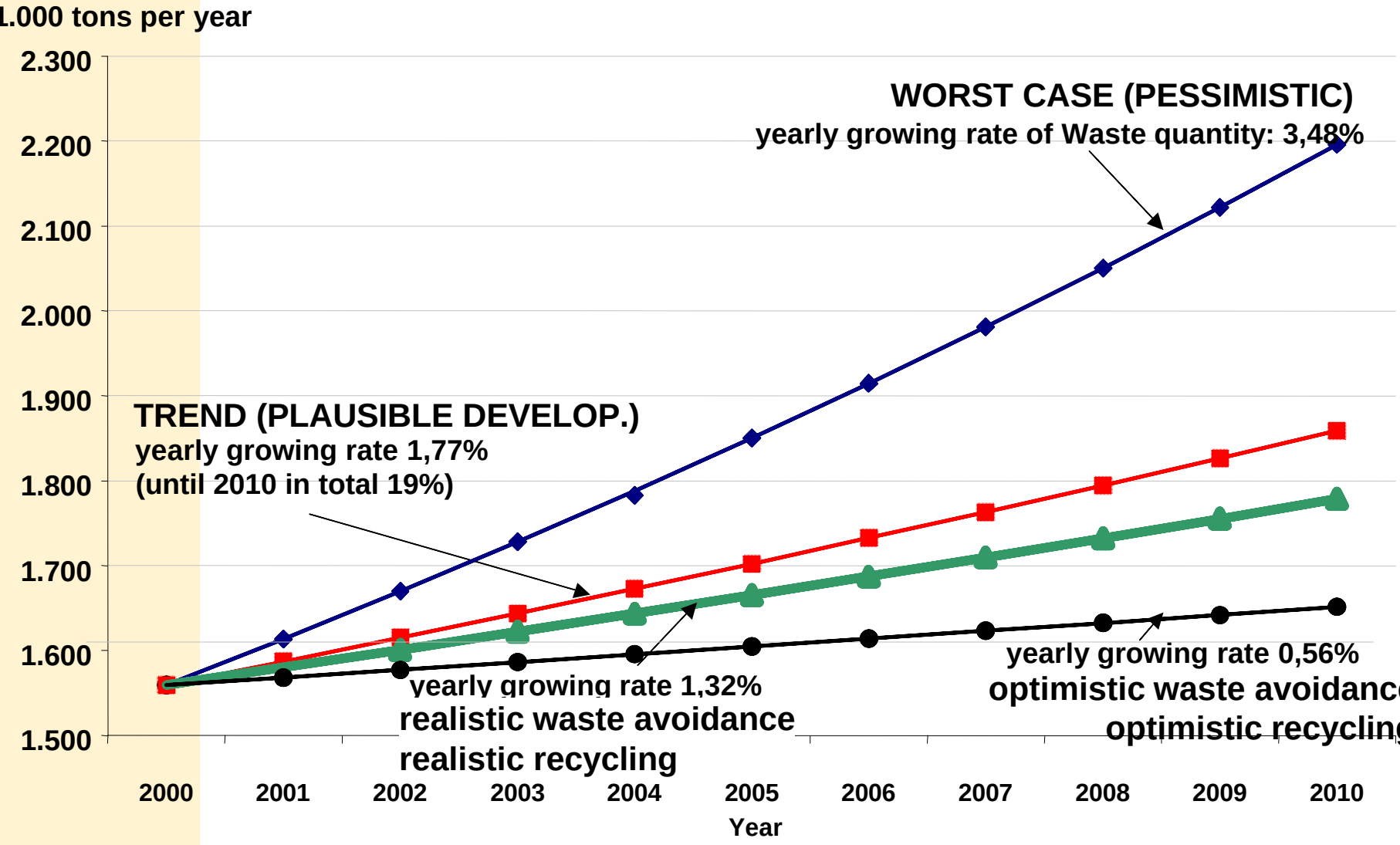
Example for the development of MSW-quantities - Federal State of Bavaria



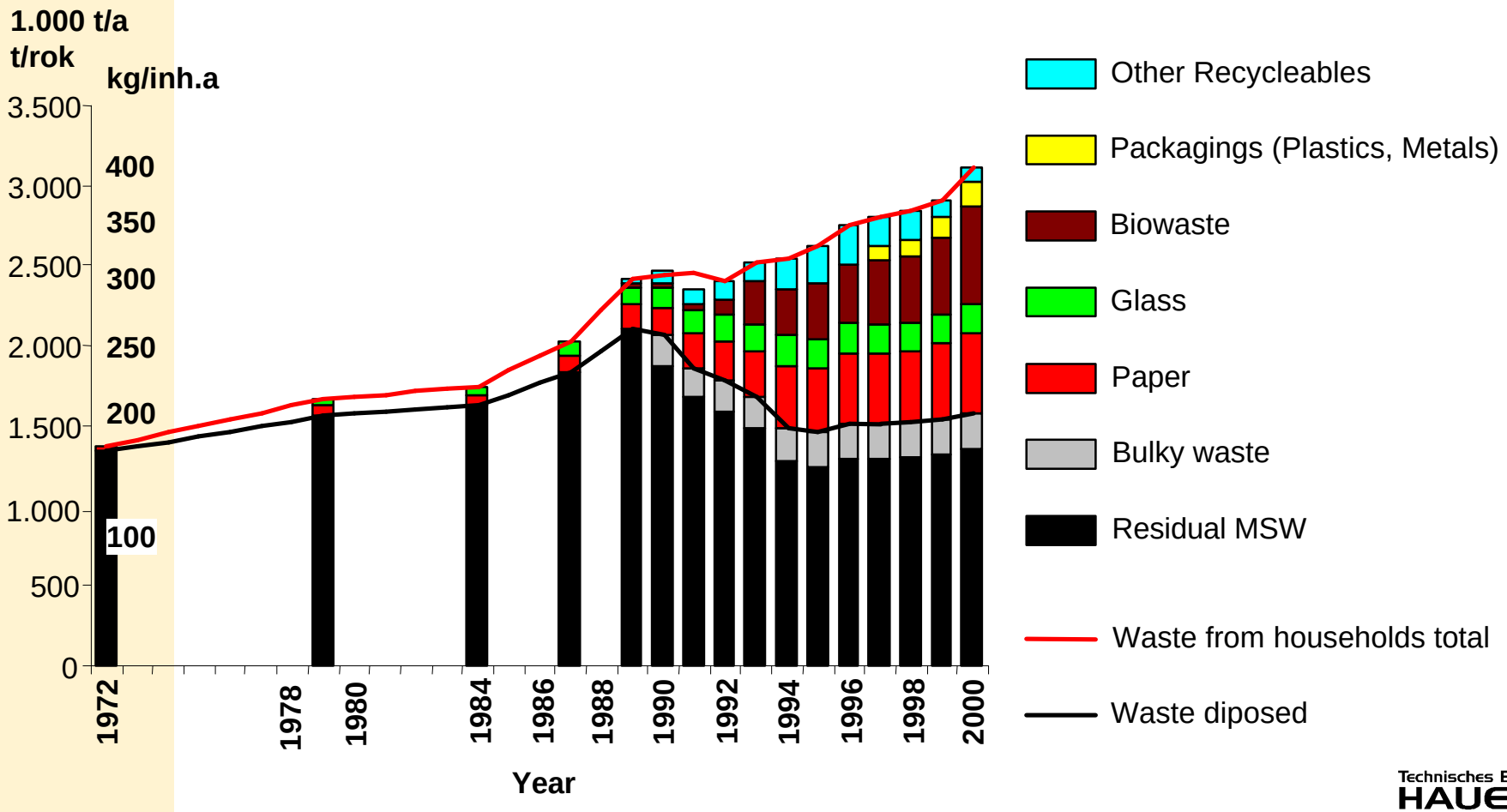
Example for the development of MSW-quantities - City of Innsbruck



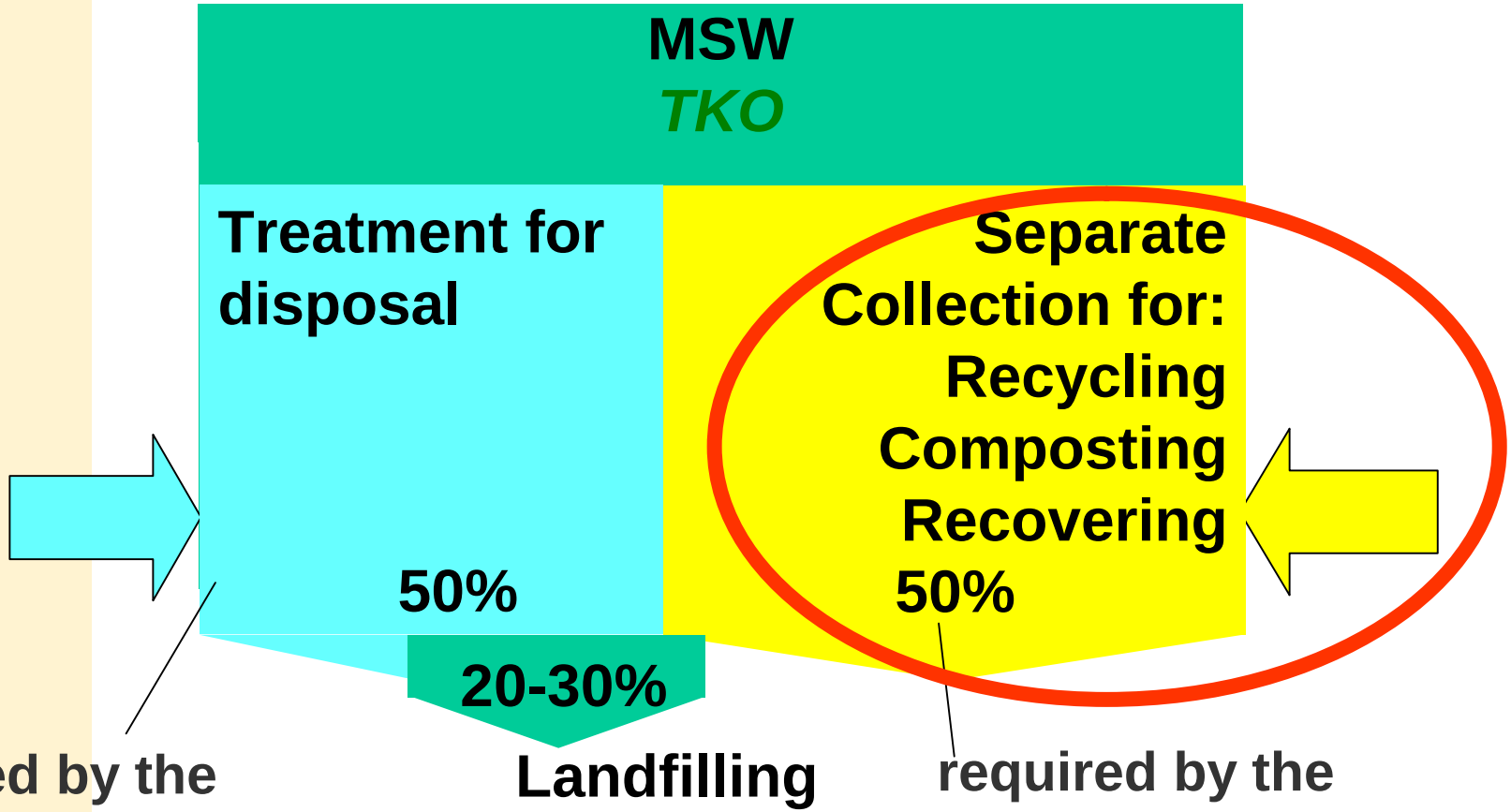
Example for forecast-scenarios of Waste-quantities - City of Vienna



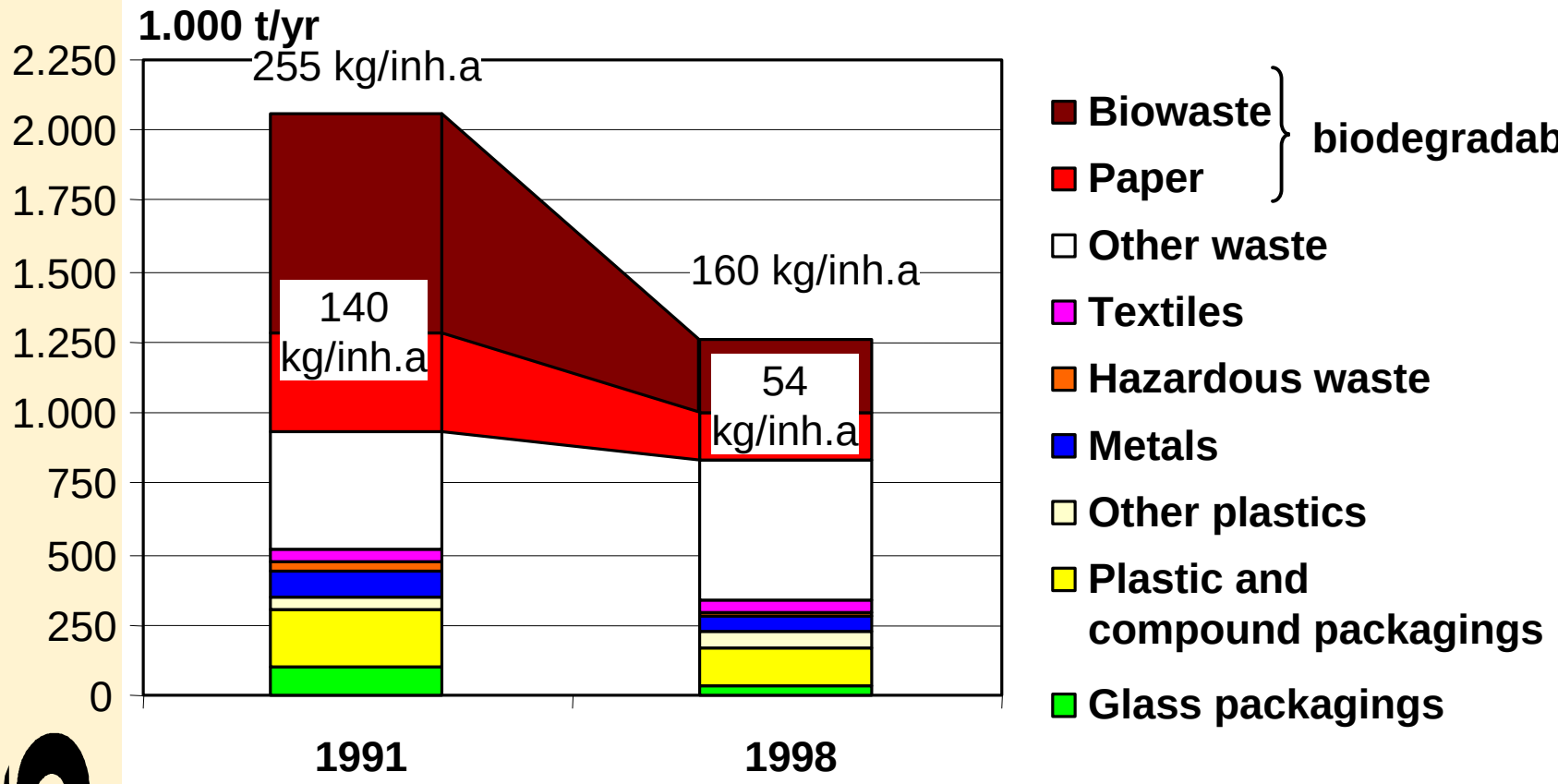
Development of MSW-Quantities in Austria



Waste Management Targets

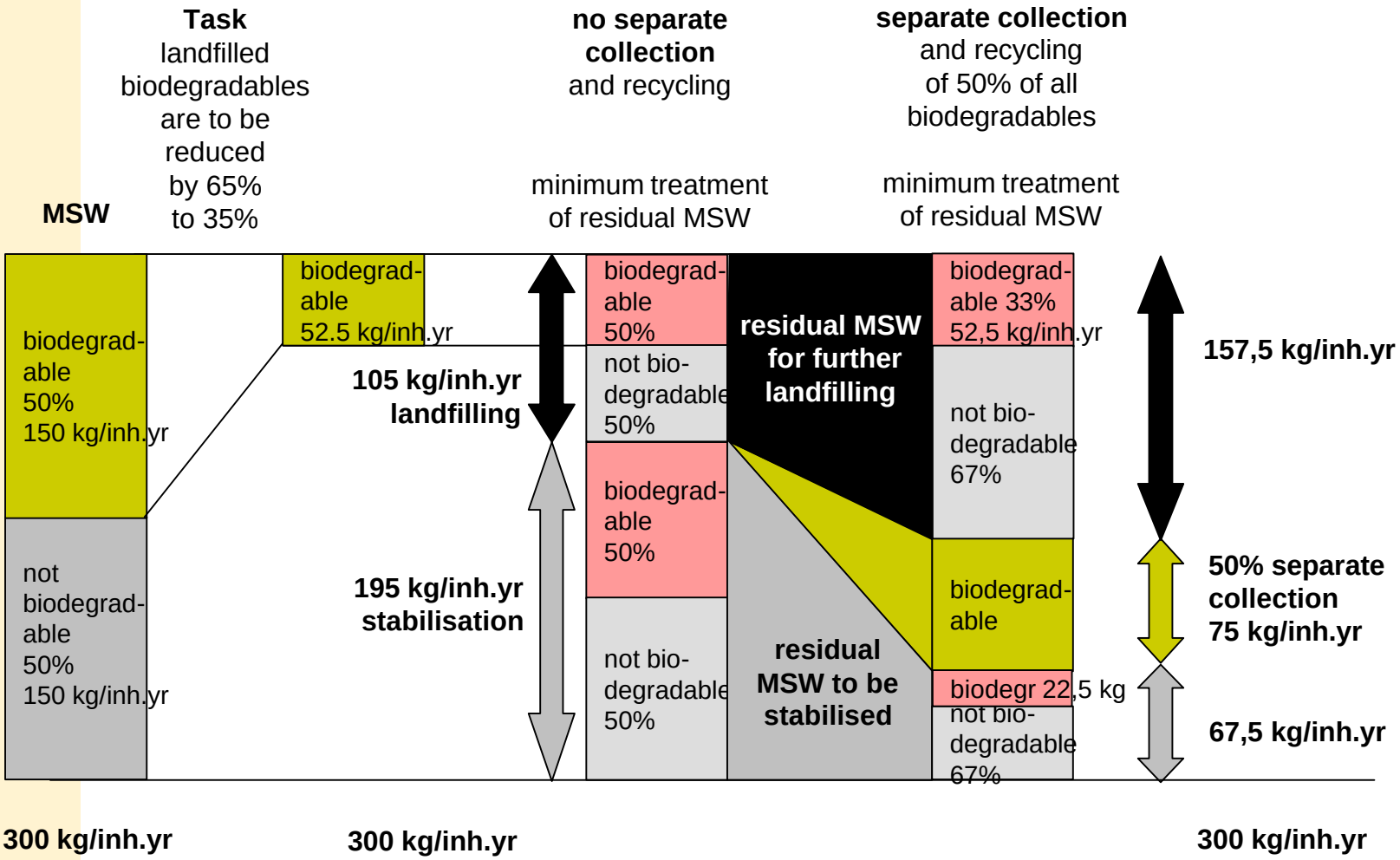


Quantity and composition of residual MSW in Austria, 1991 and 1998



Separate collection of Paper/Cardboard and Biowaste can deliver the highest contribution to the reduction of residual MSW-quantity

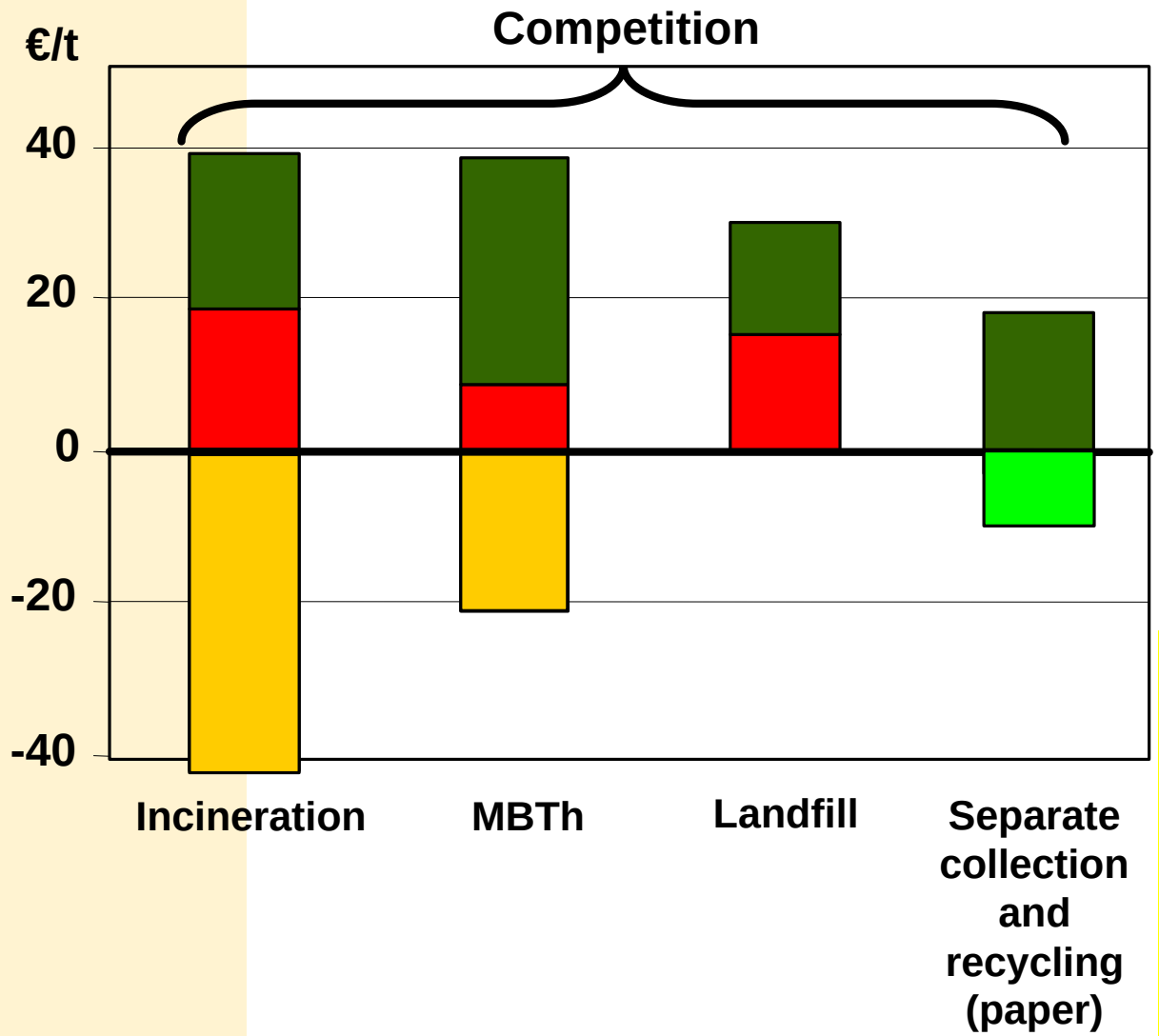
The effect of separate collection of biodegradable MSW - Example



Economic advantage of separate collection of biodegradable MSW

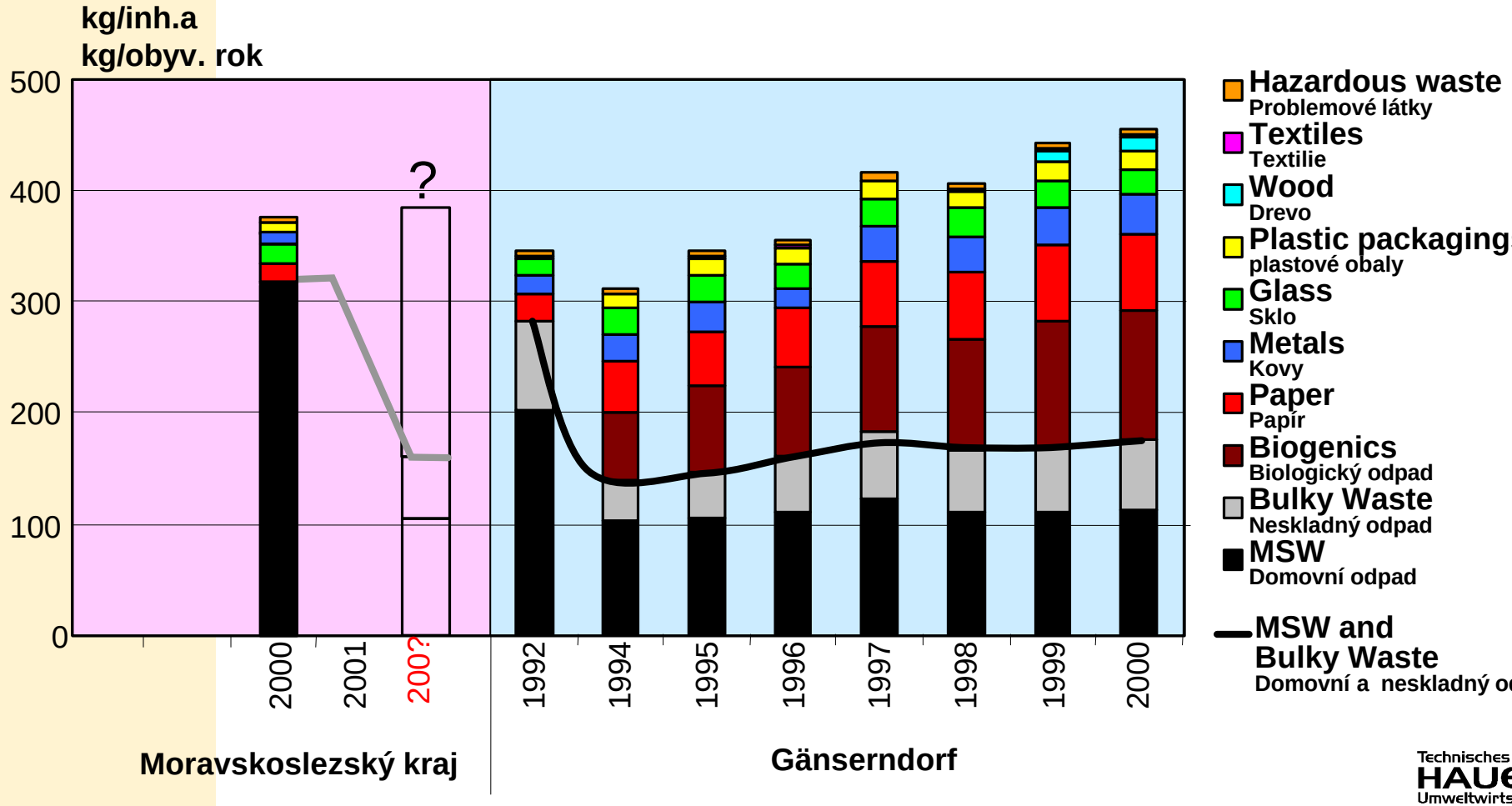
- Separate collection and recycling of biodegradable MSW (Paper, cardboard, biowaste) saves money even the separate collection has higher specific costs than MSW disposal
- in the example before separate collection can cost 2.500 Kc/t while MSW disposal costs Kc/t 2.000; landfilling calculated with Kc/t 1.300

Exemplary cost comparison of alternatives (for 2020)



Separate collection of biodegradable MSW, Splitting of residual MSW and landfilling of not biodegradable parts of MSW is advantagous

Possible Future
Možná budoucnost

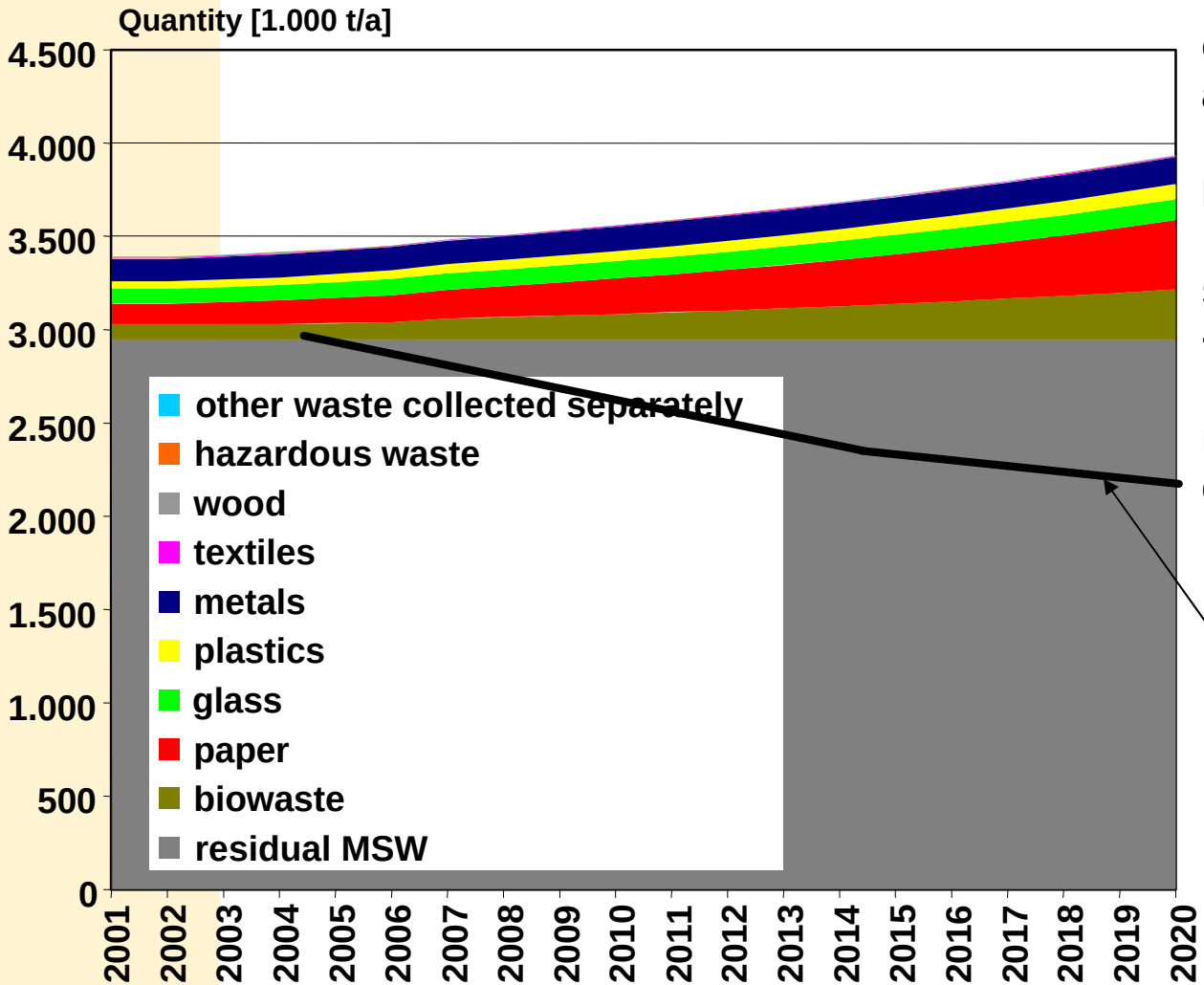


Technisches
HAUE
Umweltwirts


SKLO


FAUN

Prognosis for the CR



calculated average growing rates:

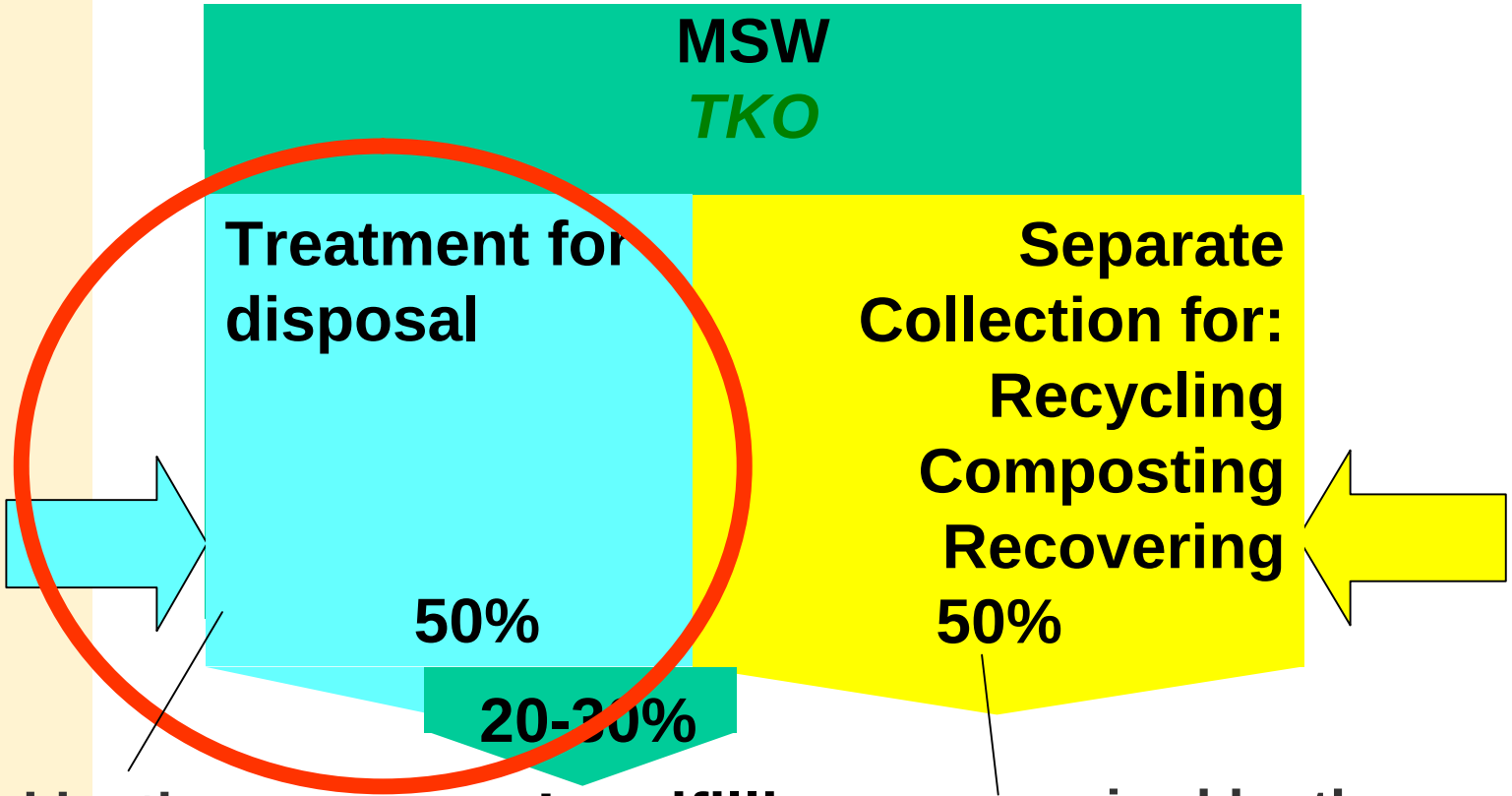
MSW: + 0,8% per year

separate collected MSW: + 4,1% per year

residual MSW: constant with 287 kg/inh.y

optimistic scenario minus 3%/a until 2013

Waste Management Targets



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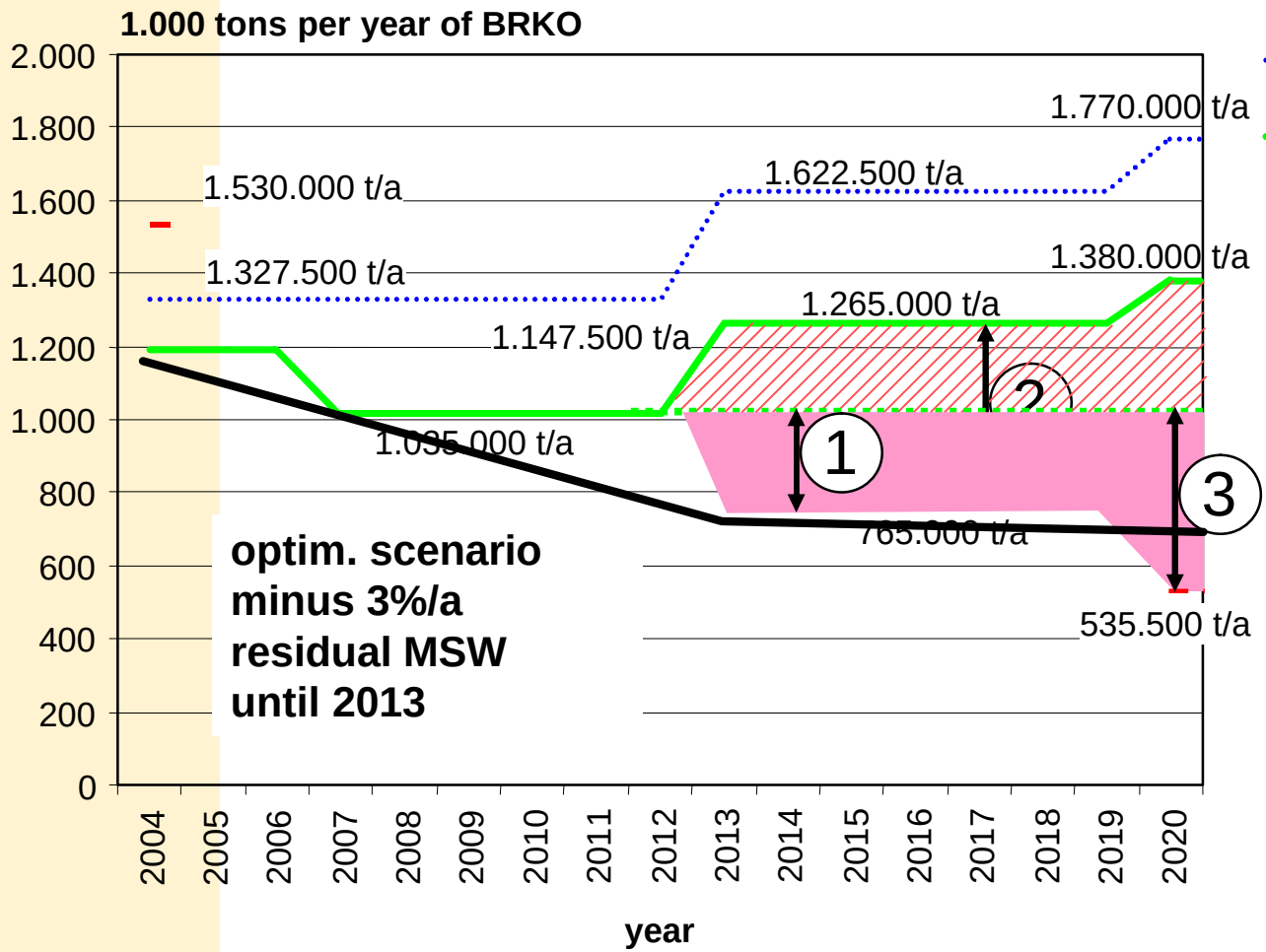
Targets of EC Landfill Directive and Situation in the CR



BRKO target

BRKO total

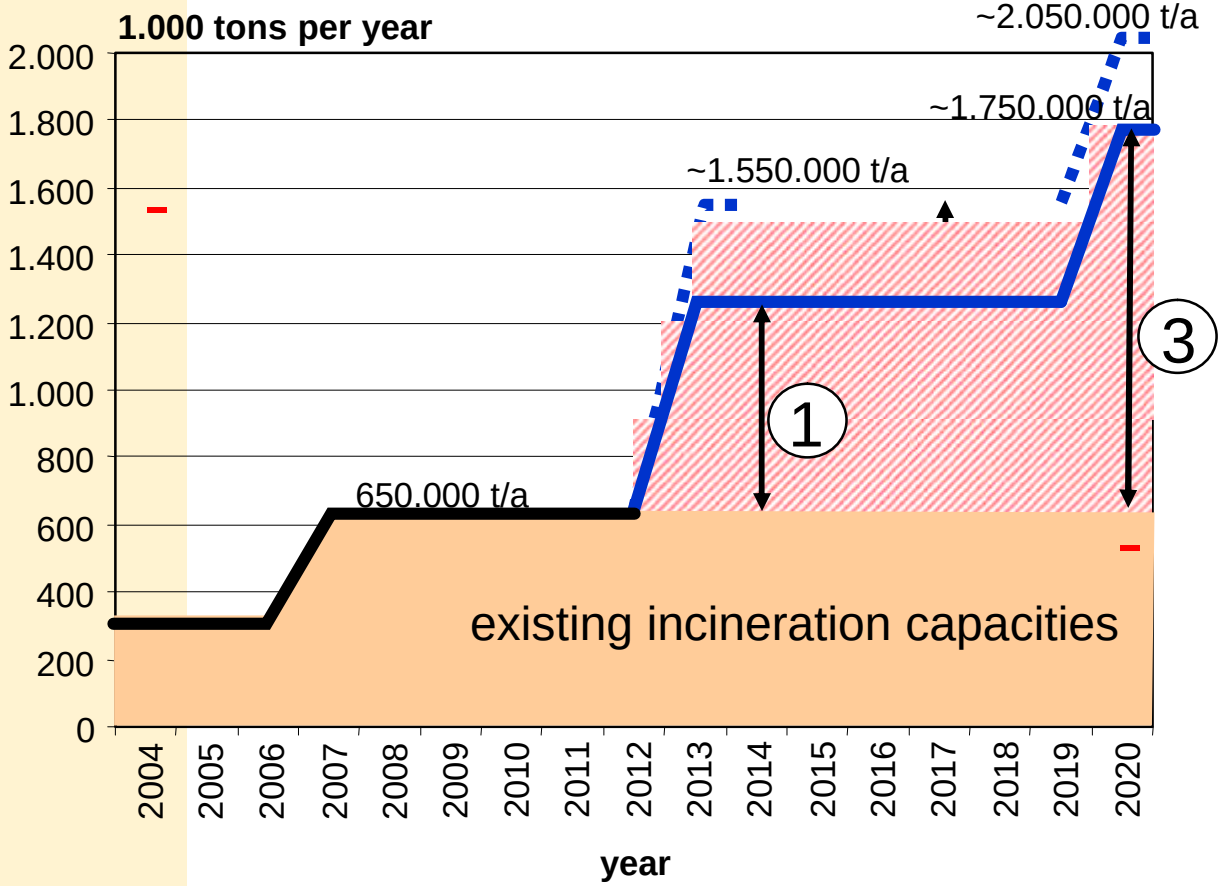
BRKO remaining for disposal considering existing incinerators

BRKO remaining for disposal considering existing incinerators without rising share

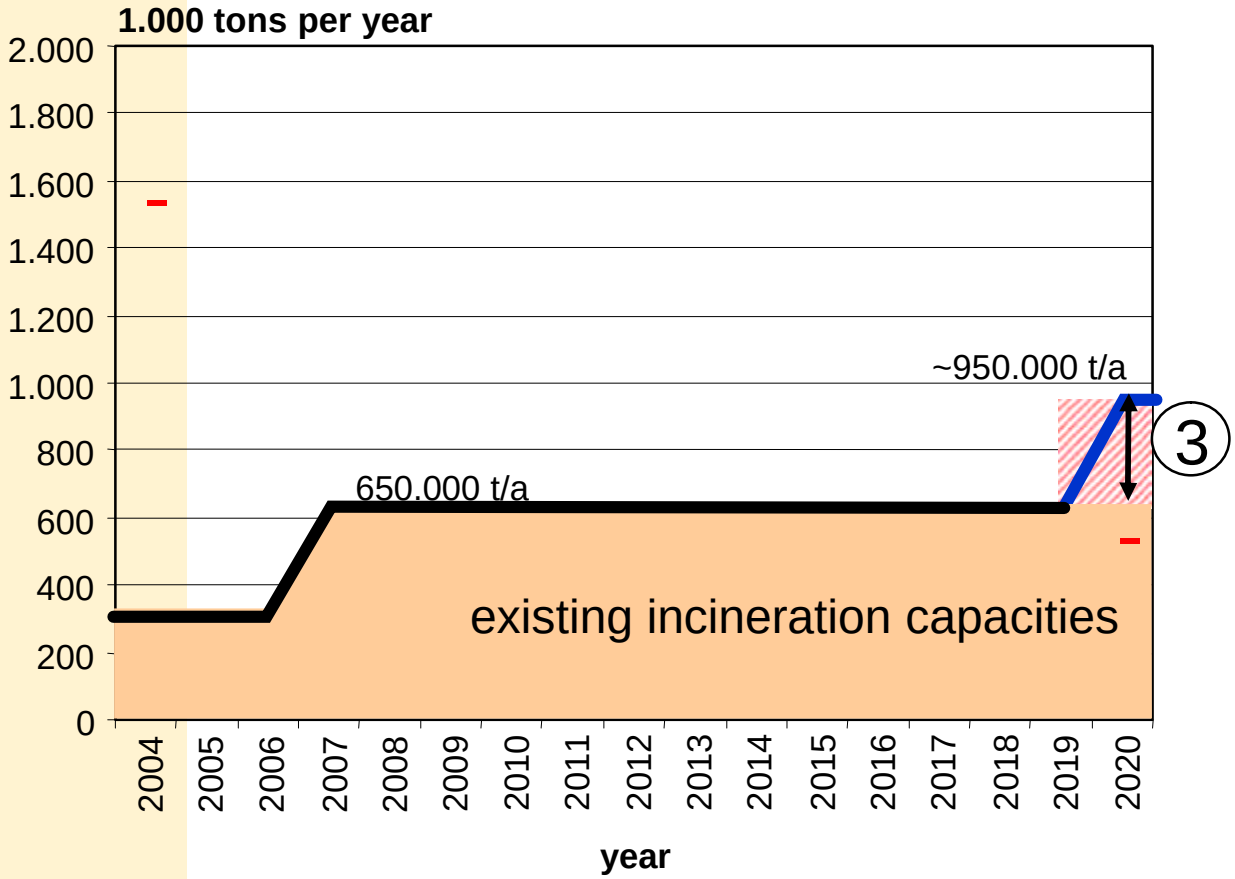
BRKO to be stabilised considering raising shares of biodegradable

BRKO to be stabilised considering stable shares of biodegradable

Capacities for stabilising residual MSW needed in the CR



Capacities for stabilising residual MSW needed in the CR - optimistic scenario



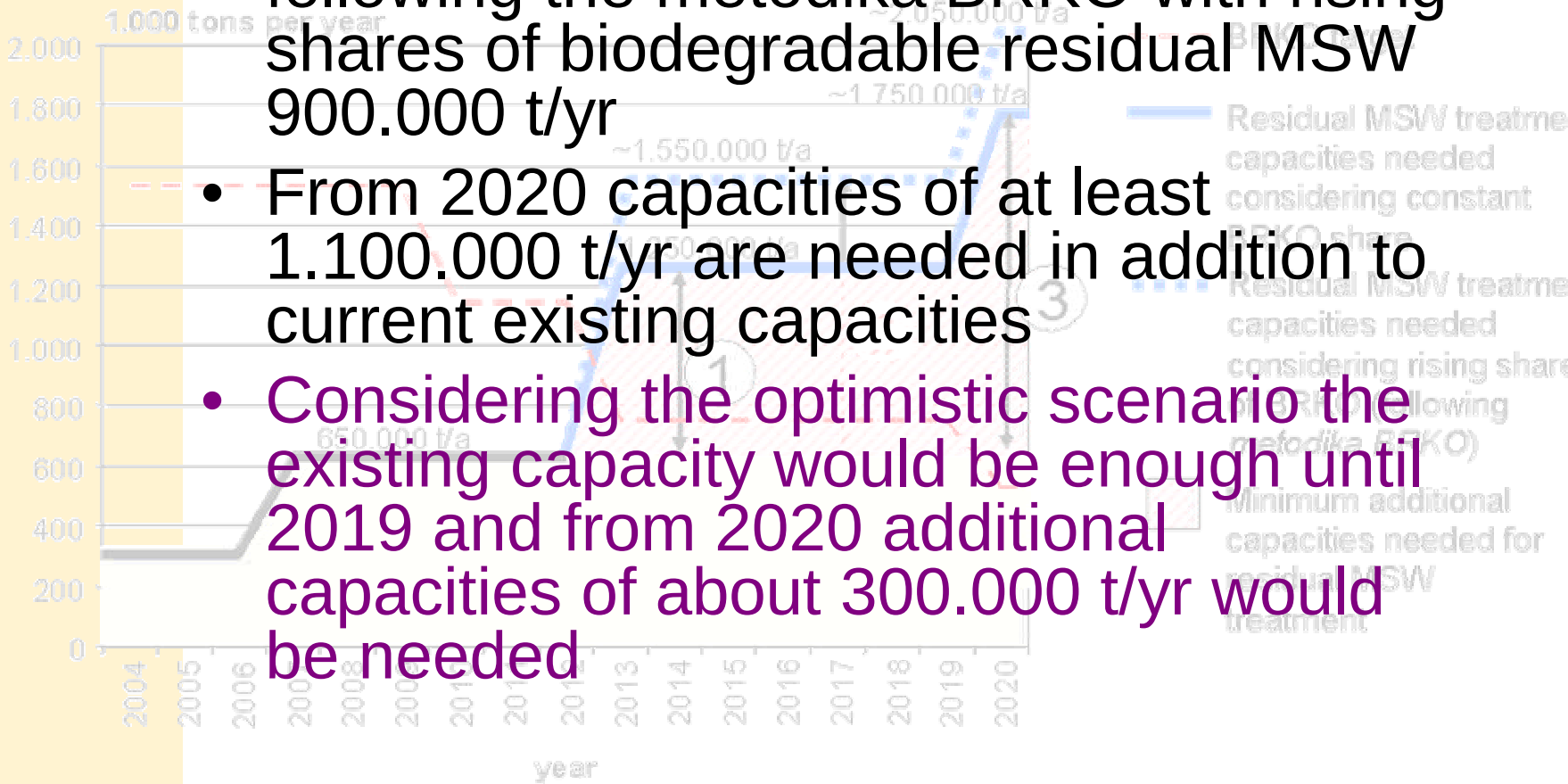
BRKO target

Residual MSW treatme capacities needed considering constant BRKO share

Minimum additional capacities needed for residual MSW treatment

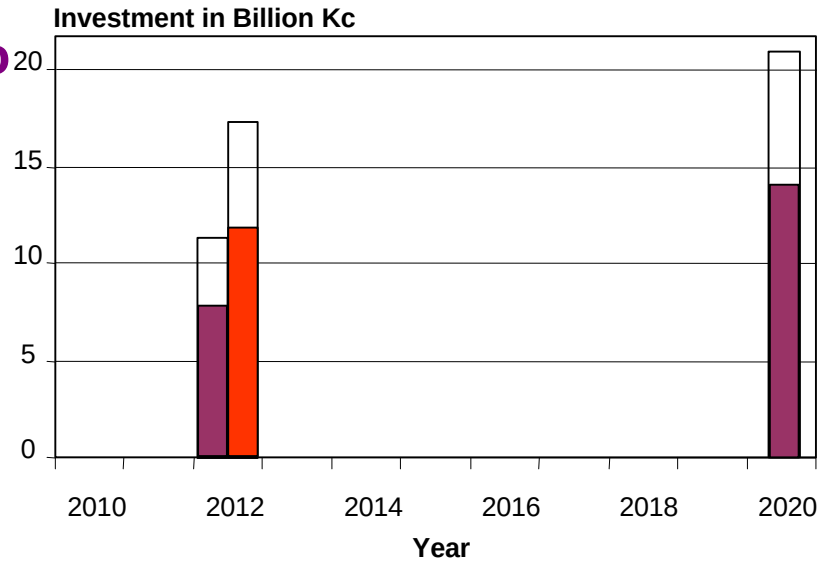
Capacities for stabilising residual MSW needed in the CR

- From 2013 at least 600.000 t/yr, following the metodika BRKO with rising shares of biodegradable residual MSW 900.000 t/yr
- From 2020 capacities of at least 1.100.000 t/yr are needed in addition to current existing capacities
- Considering the optimistic scenario the existing capacity would be enough until 2019 and from 2020 additional capacities of about 300.000 t/yr would be needed



Investments needed

- To install the additional capacities investments in a range of **Kc 7.8 billion to Kc 11.4 billion** respectively **Kc 11.8 - 17.3 billion** have to be estimated needed **until the year 2012**.
  The range of the investment is dependent from the chosen technology.
- **Until the year 2020 the investments** needed are to be estimated with a range of **Kc 14 billion to Kc 21 billion**.
- **In case of the optimistic scenario investments of Kc 4 billion to 6 billion until 2020 are sufficiant**
- The calculation uses the following input data:
  - specific investment costs for
    mass burn incinerator facilities:
    Kc/t 13,000 - 19,000
  - specific investment costs for
    mechanical biological treatment plants:
    Kc/t 4,500 - 7,500



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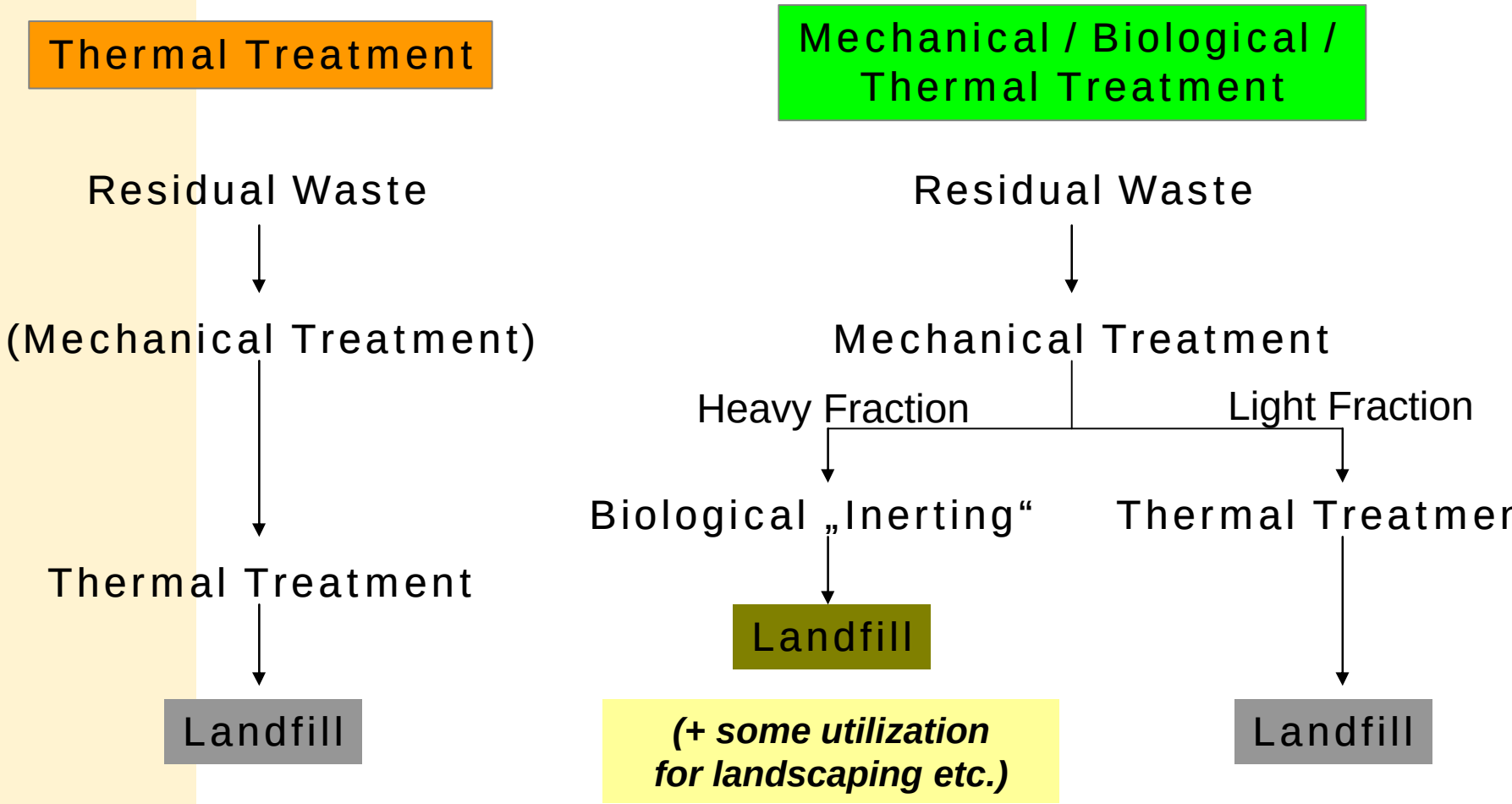
Basic technical alternatives for residual waste treatment prior to landfill



Mechanical-Biological-Thermal Treatment

Residual MSW
100%

Possibility for adding bulky waste

Shredding
Sieving
magn. Sep.

Heavy fraction
47%

Light fraction
50%

Metals 3%

rotting losses
25%

Biologic degradation

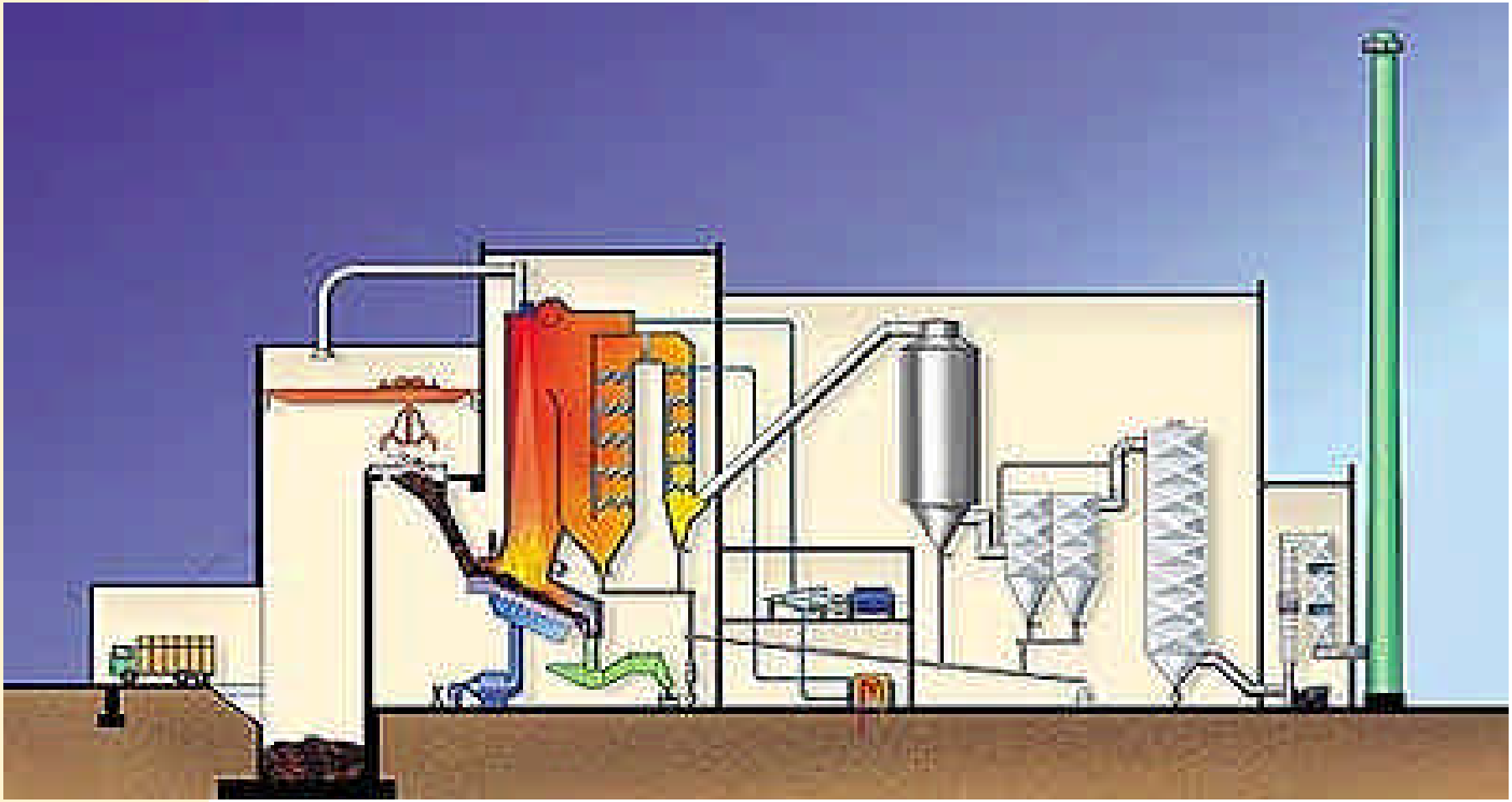
Recycling

Incineration

Landfill
0,47*0,75=35%

Possibility for adding sewage sludge

Conventional MSW Incineration Plant



Delivery Bunker

Grid

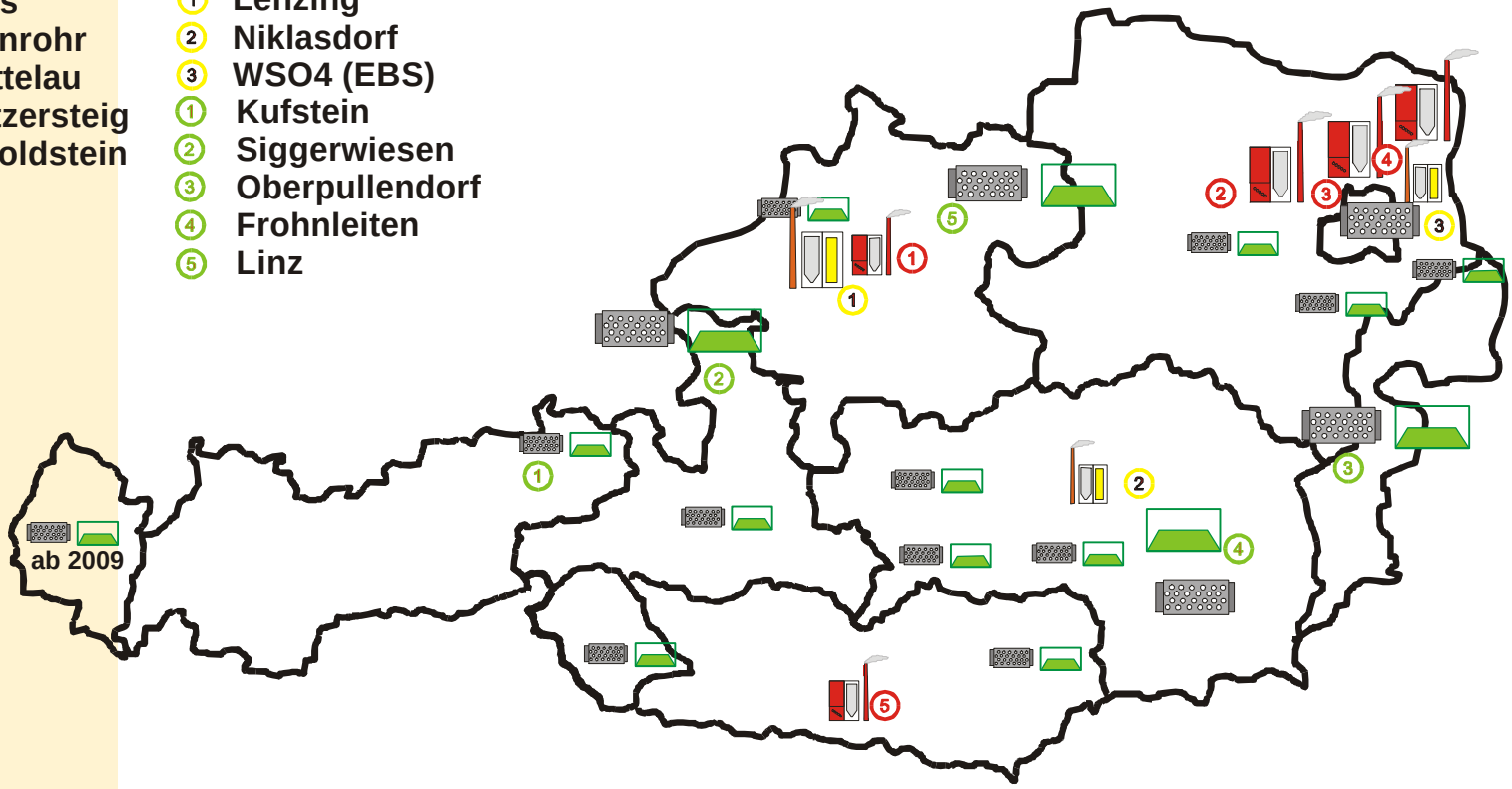
Energy recovery Vessel

Flue Gas Cleaning Unit

Technologies for Stabilisation of residual MSW used in Austria

1. Wels
2. Dürnrohr
3. Spittelau
4. Flötzersteig
5. Arnoldstein

1. Lenzing
2. Niklasdorf
3. WSO4 (EBS)
1. Kufstein
2. Siggerwiesen
3. Oberpullendorf
4. Frohnleiten
5. Linz



Mechanische Behandlung

Mechanisch-Biologische Behandlung
> 50.000 t/a

Mechanisch-Biologische Behandlung
< 50.000 t/a

Müllverbrennungsanlage (Rostfeuerung)
> 100.000 t/a

Müllverbrennungsanlage (Rostfeuerung)
< 100.000 t/a

Nutzung der hochkalor. Fraktion (Wirbelschichtfeuerung)
> 100.000 t/a

Nutzung der hochkalor. Fraktion (Wirbelschichtfeuerung)
< 100.000 t/a

Technologies for Stabilisation of residual MSW used in Austria

Federal "Land" *Kraj*	**Capital**	**Population (millions)**	**MSW management in 2004**
Vienna		1,70	Classical incineration, partially production of RDF
Lower Austria	St. Pölten	1,40	Mainly classical incineration
Burgenland	Eisenstadt	0,25	Mechanical Biological Thermal
Styria	Graz	1,10	Mechanical Biological Thermal
Carinthia	Klagenfurt	0,45	classical incineration
Salzburg	Salzburg	0,70	Mechanical Biological Thermal
Tyrol	Innsbruck	0,65	? Mechanical Biological Thermal
Vorarlberg	Bregenz	0,40	? Export
Upper Austria	Linz	1,35	Classical incineration and MBT
		8,0	**45-50 % Incin., 40-45 % MBT, 10 % Export / not yet decided**

Technical Standards
Best Available Technique BAT

- Incineration:
  Best Available Techniques for Waste Incineration
- MBT-plants
  Best Available Techniques for the Waste Treatment Industries
  - Definition of the term “stabilised” is needed

Details see CD

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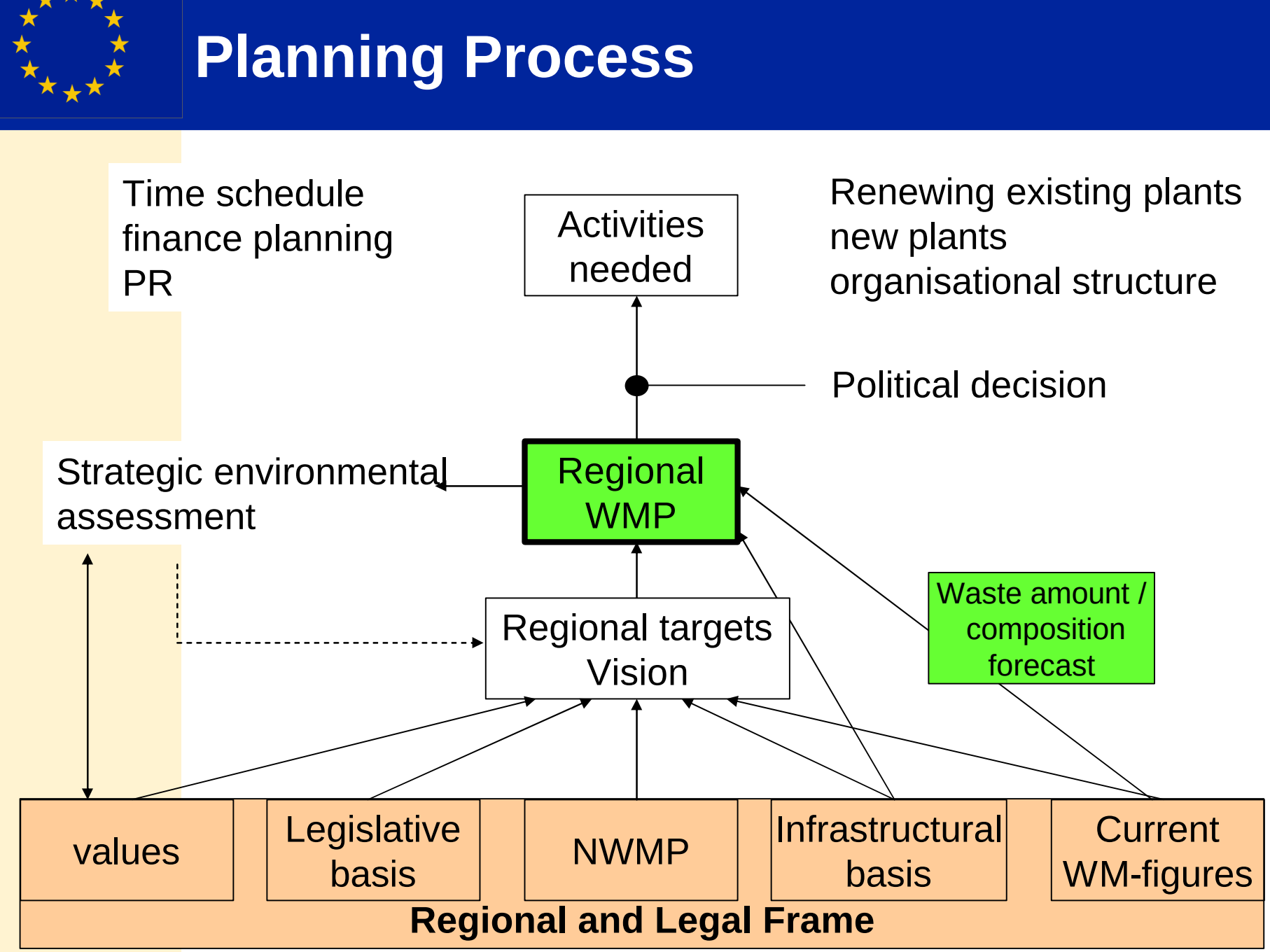
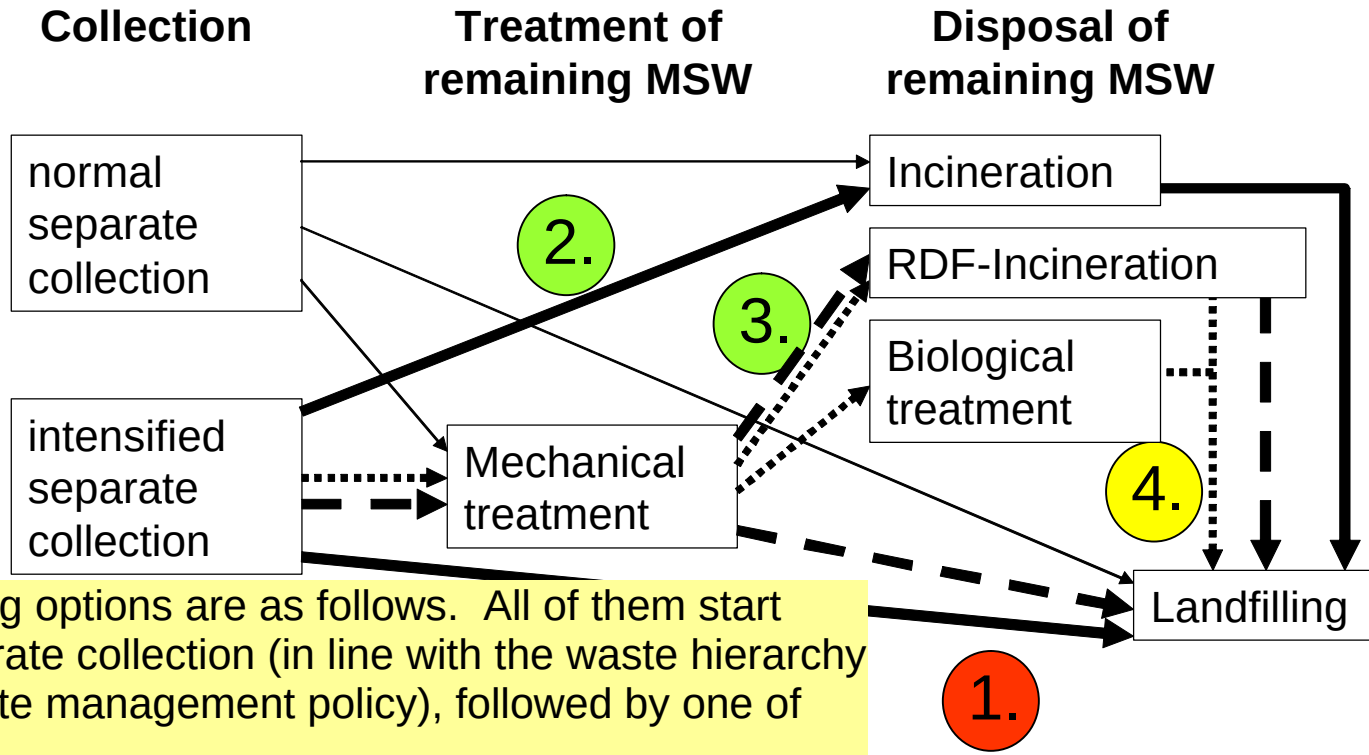
Planning Process



Creating Options



The four most interesting options are as follows. All of them start with more intense separate collection (in line with the waste hierarchy and EU and Czech waste management policy), followed by one of the following:

1. Landfilling of the remaining MSW (reference option)
2. Conventional incineration of the remaining MSW
3. Mechanical treatment of the remaining MSW followed by incineration or co-incineration of refuse-derived fuel for the high calorific fraction, and direct landfilling of the low calorific fraction
4. As for option 3 but also with biological treatment of the low calorific fraction

Not compliant

In compliance wit landfill directive

No need for MSW but e.g. for sludg

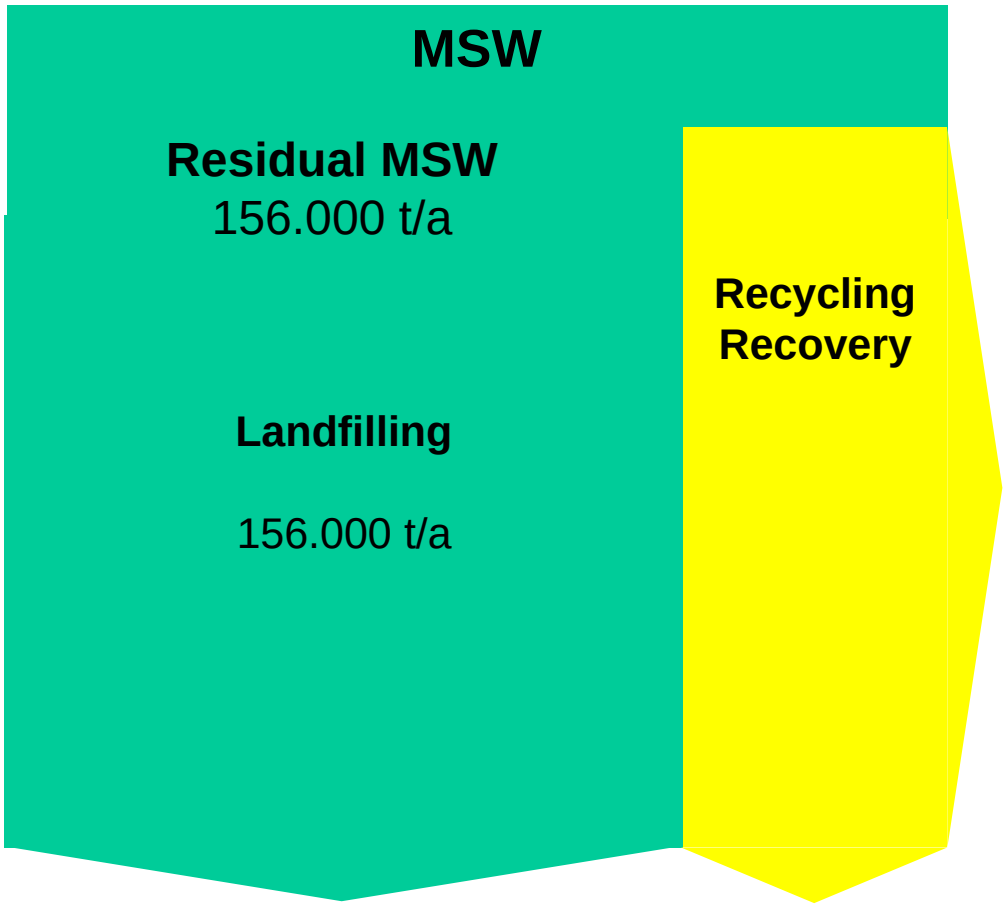
Calculation Principles

- All options are concerning the same system boundaries
- As few treatment as needed to meet EC-Landfilling-Directive requirements and Landfilling as much as possible
- Regional BRKO-target is calculated according to calculation method of MoE
- Share of BRKO increases in the future according to calculation method of MoE
- Treatment of sewage sludge is not included in the capacities needed

System Boundaries

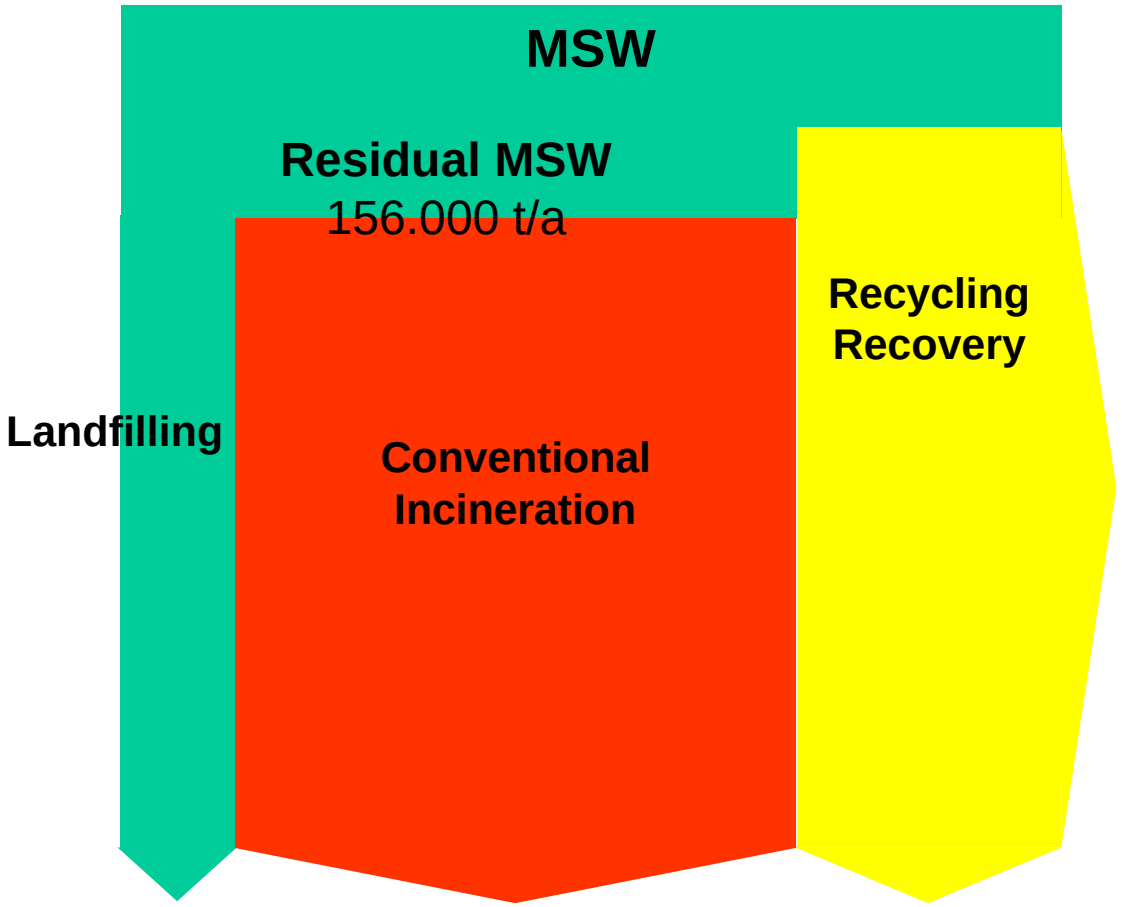
- **Inside the system boundaries (effects considered)**
  - Transport of waste from transfer stations to the facility (if any)
  - Utilization of energy as heat and/or electricity at the planned facility
  - Disposal / recovery of all output materials
  - Employment in direct connection with the planned facility
  - Effects of accidents within the facility - possibly for the risk assessment
- **Outside the system boundaries (effects not considered)**
  - Waste collection and transport direct to the facility or to transfer stations
  - Collection and treatment of other wastes than residual MSW
  - Distribution of energy (heat and/or electricity)
  - Production of by-products and operation materials
  - Environmental effects of the construction phase

Current Situation



Should be increased up to 50% until 2010

Option 1 Classical Incineration



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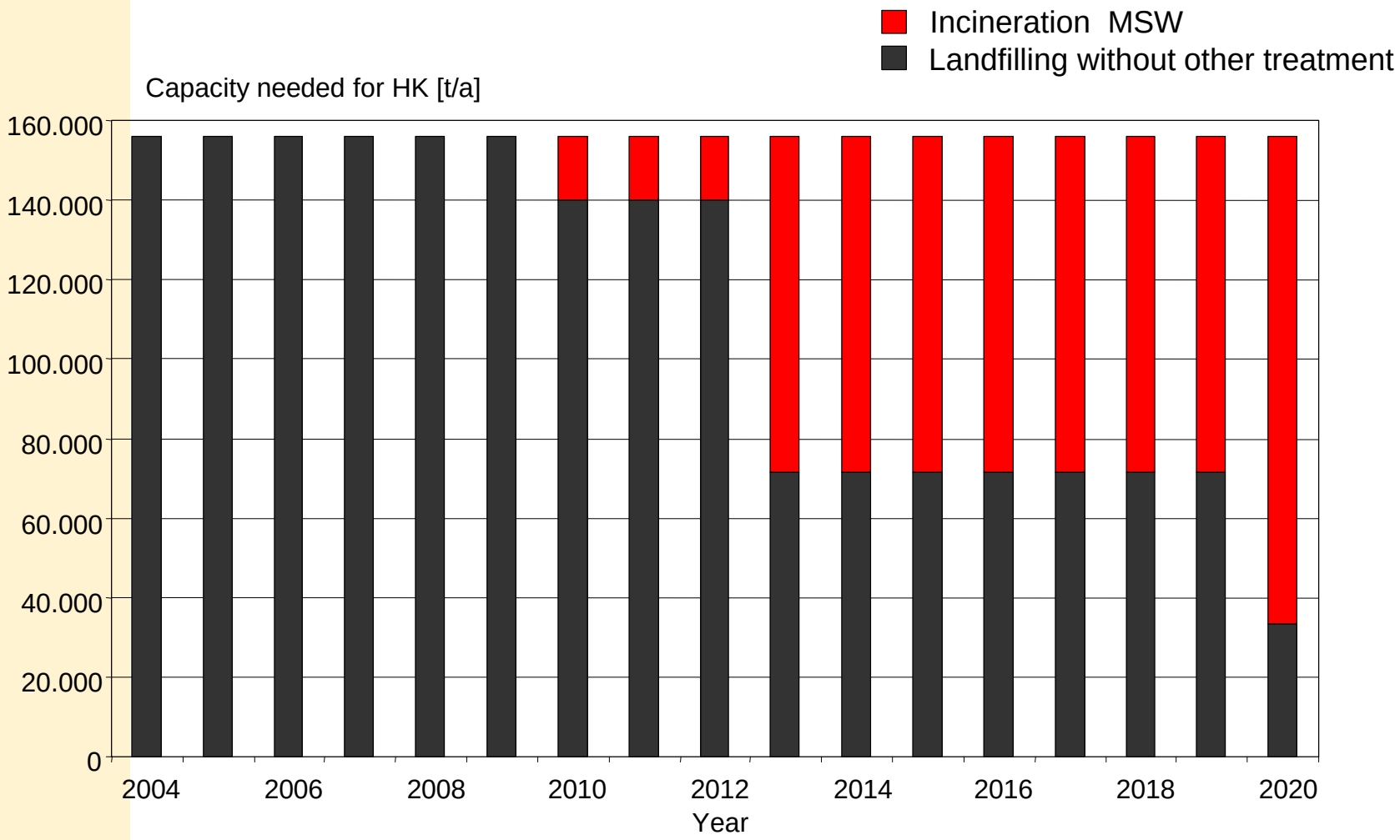
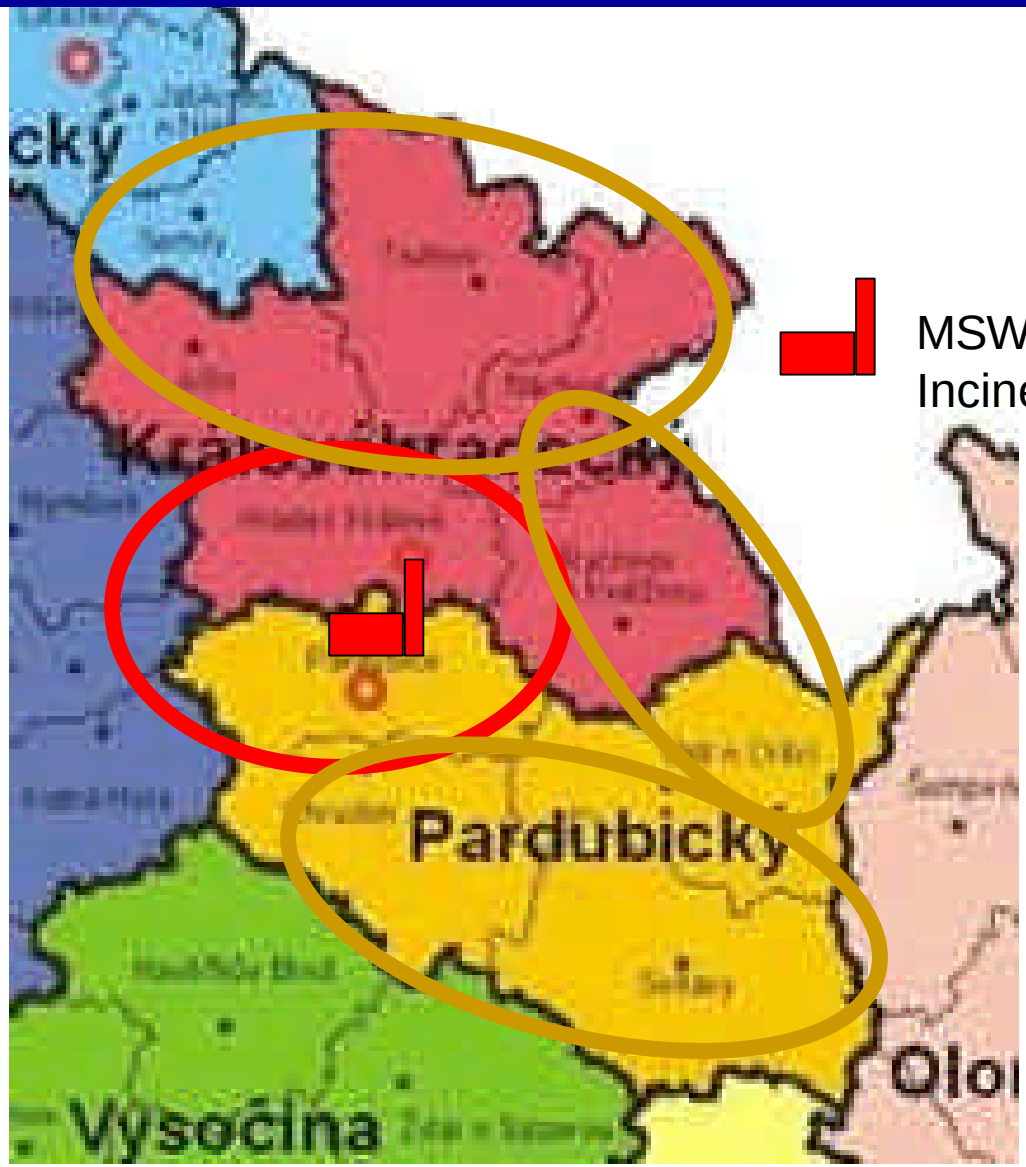


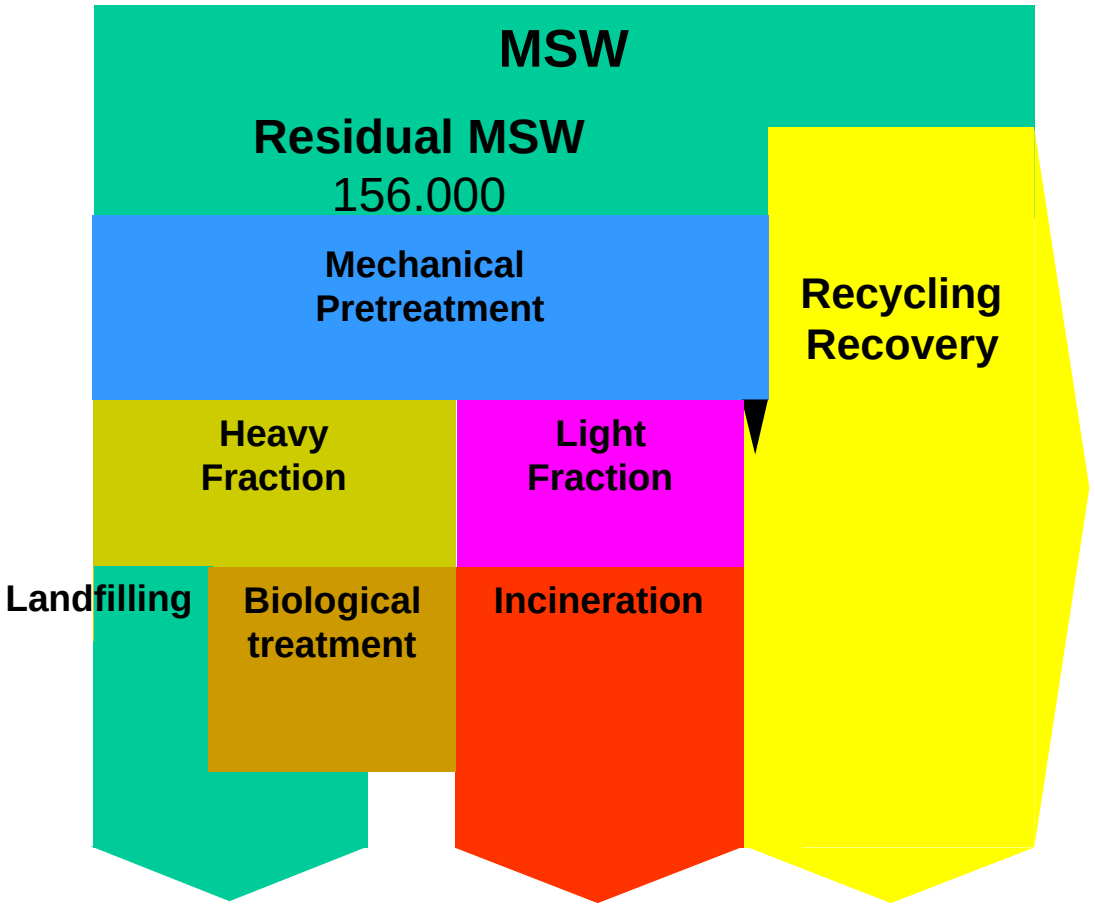
Option 1 - Classical Incineration
Regions of Hradec Králové and Pardubice



MSW-Incineration Plant

Catchment areas for landfilling

Option 2a – MBT with Priority on Incineration of Light Fraction



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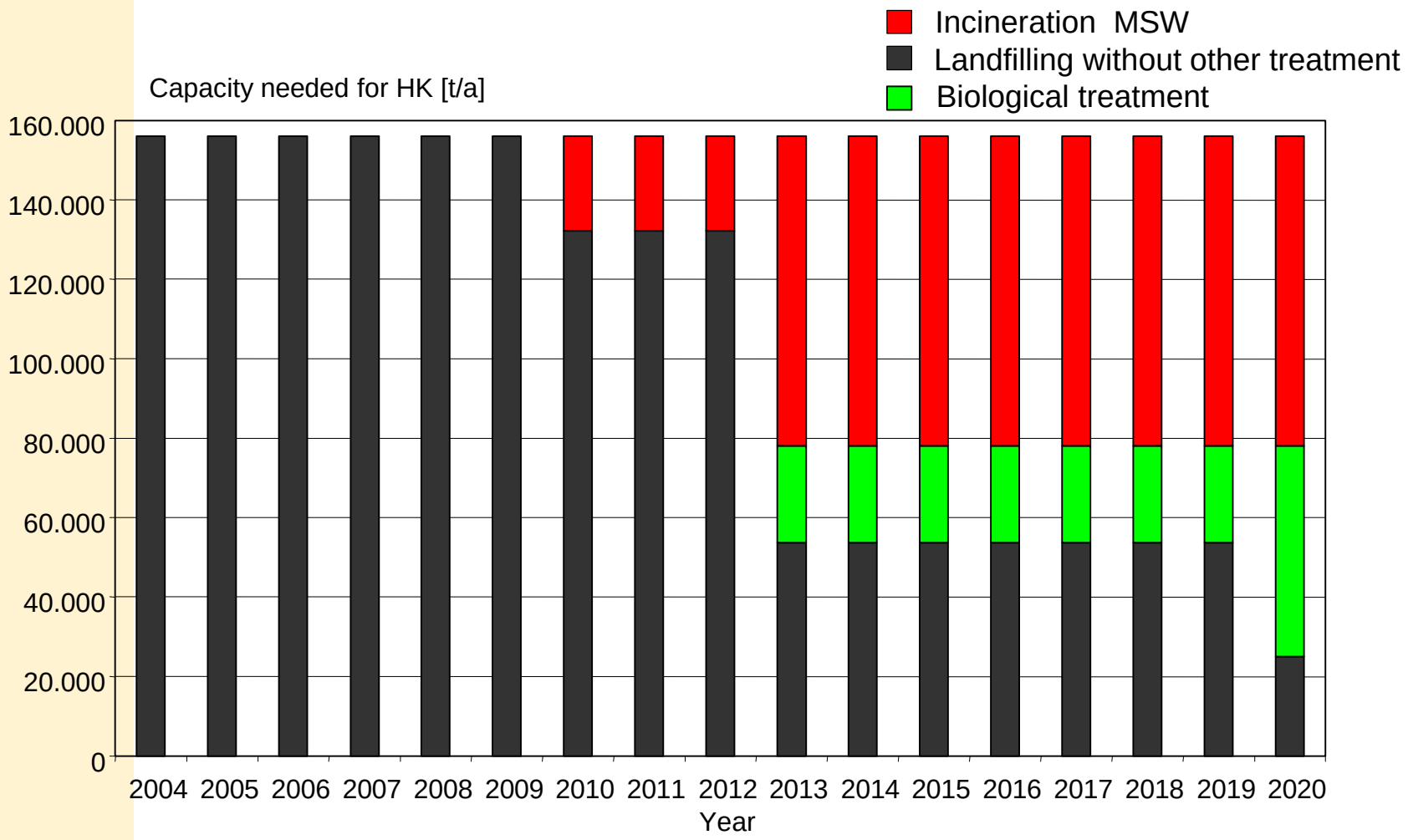
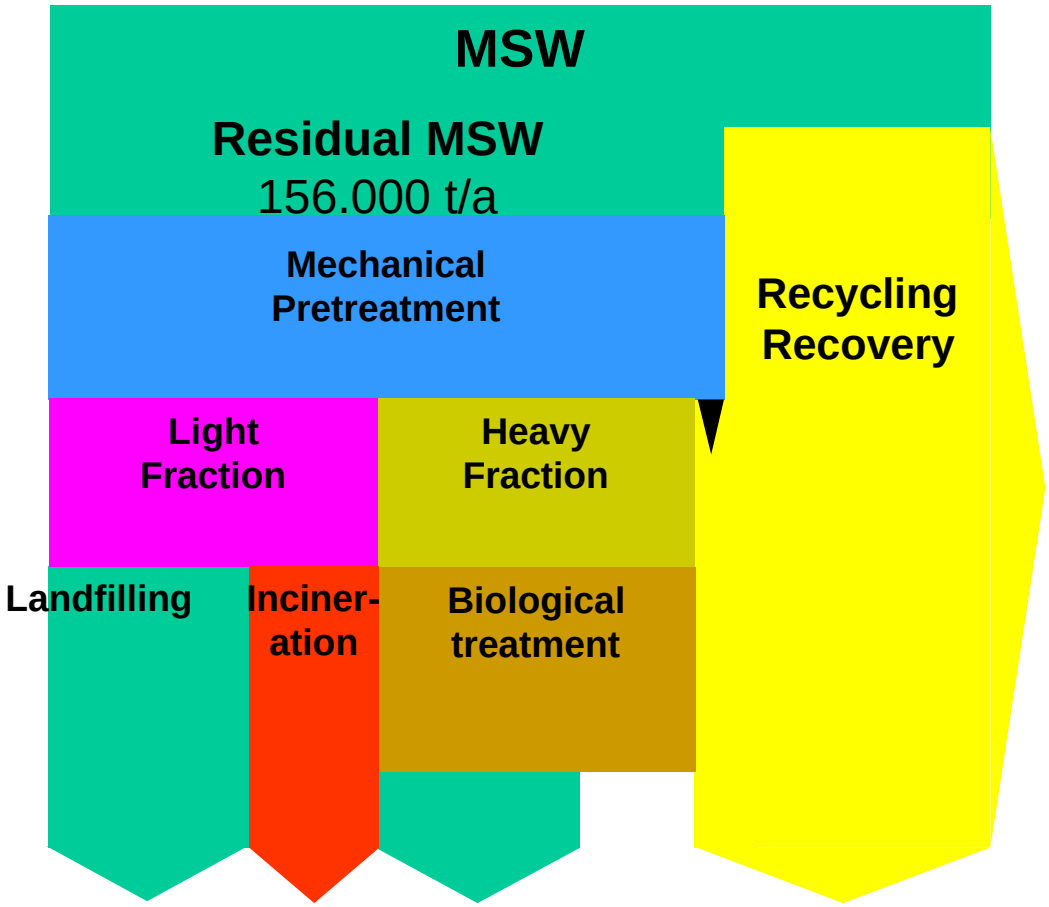
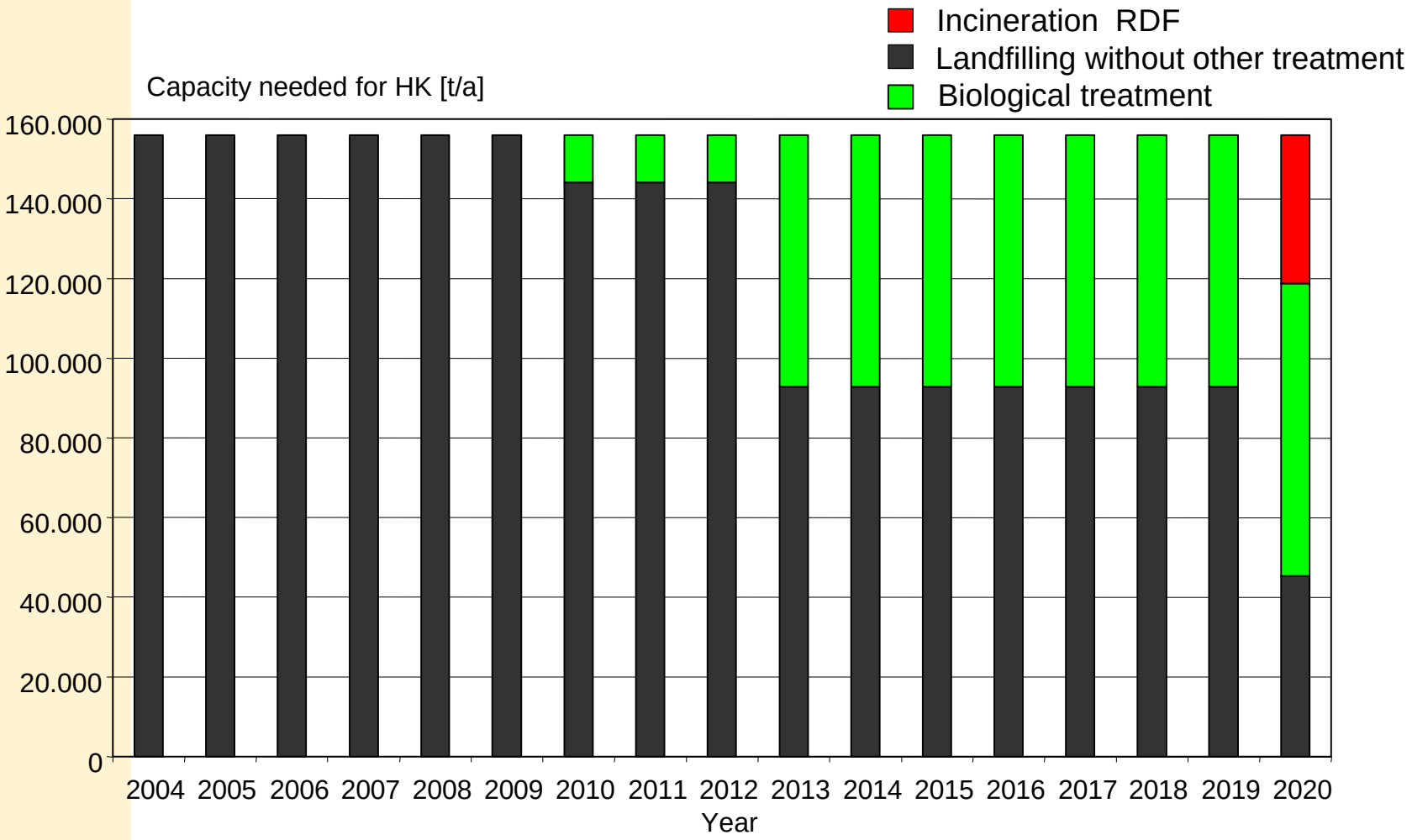


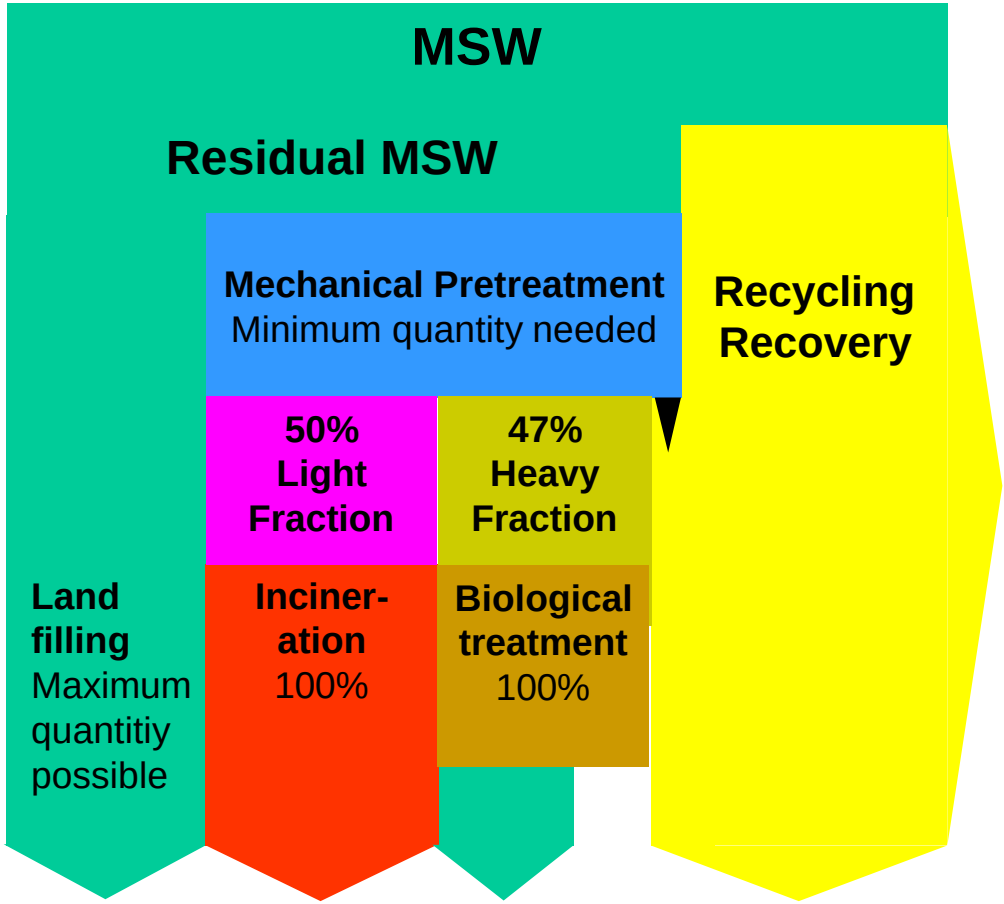
Option 2b – MBT with Priority on Biological Treatment of Heavy Fraction



Option 2b – MBT with Priority on Biological Treatment of Heavy Fraction



Option 2c – MBT with balanced treatmen of Light and Heavy Fraction



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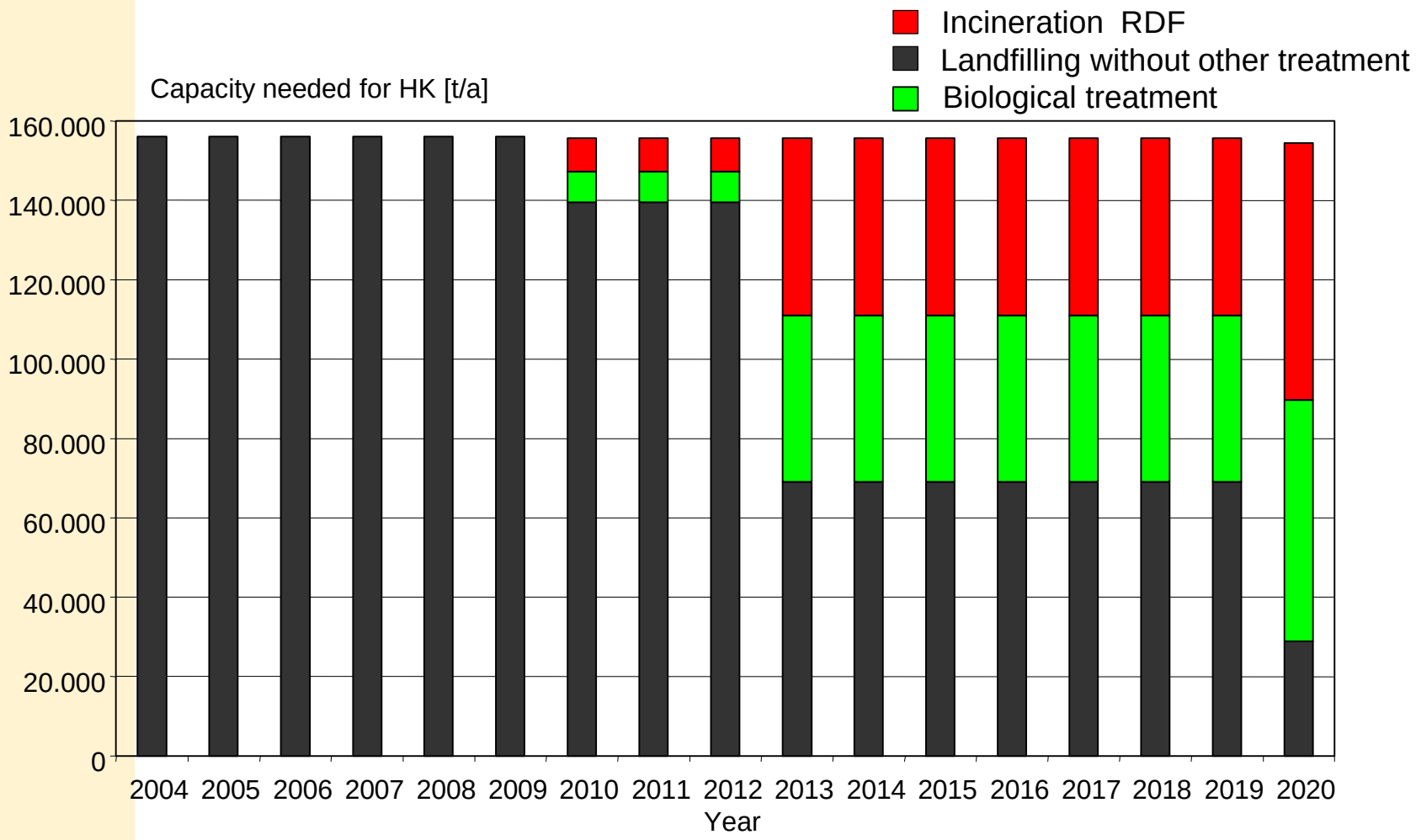
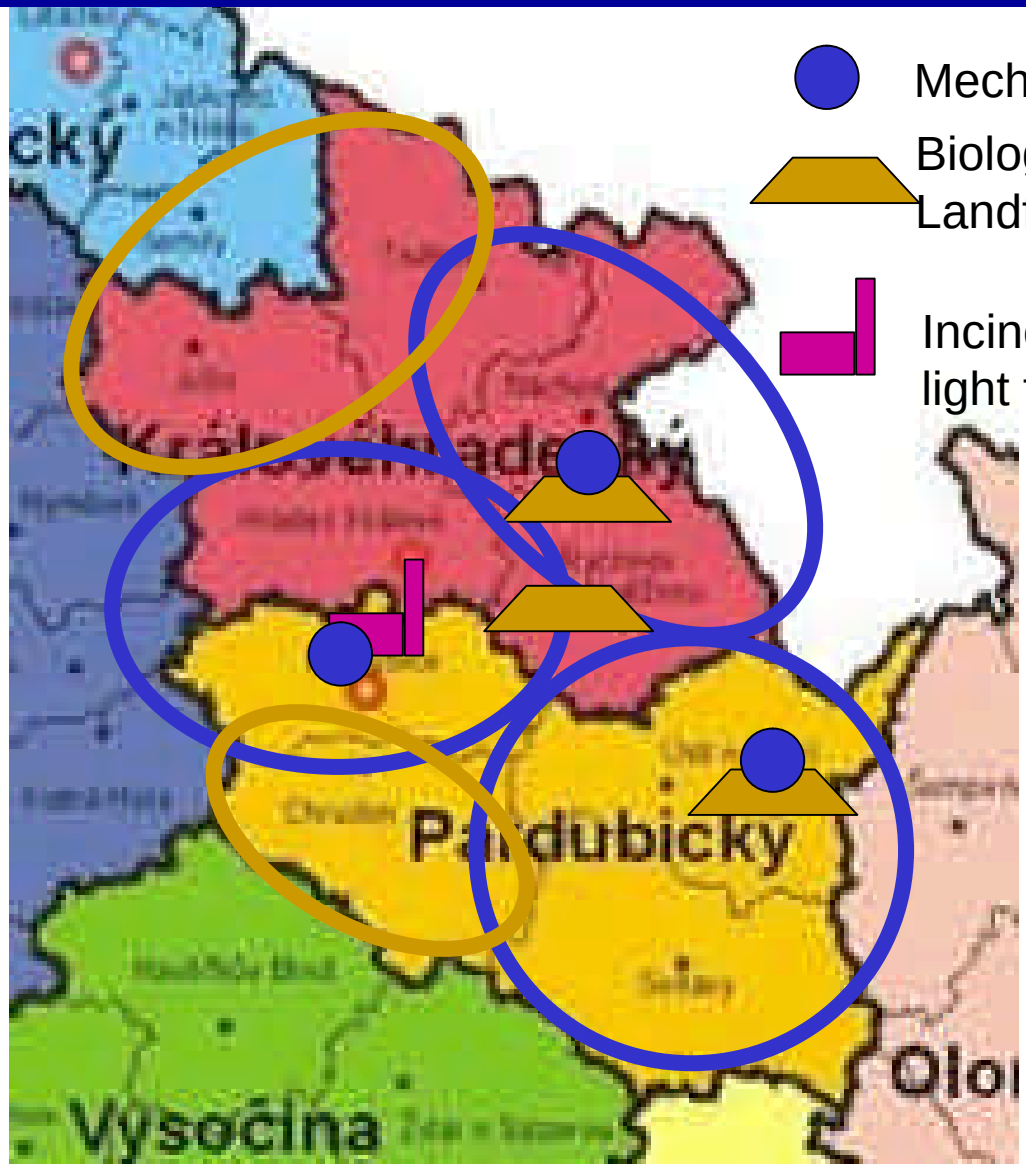


Option 2c - MBTh
Regions of Hradec Králové and Pardubice



Mechanical treatment Pla

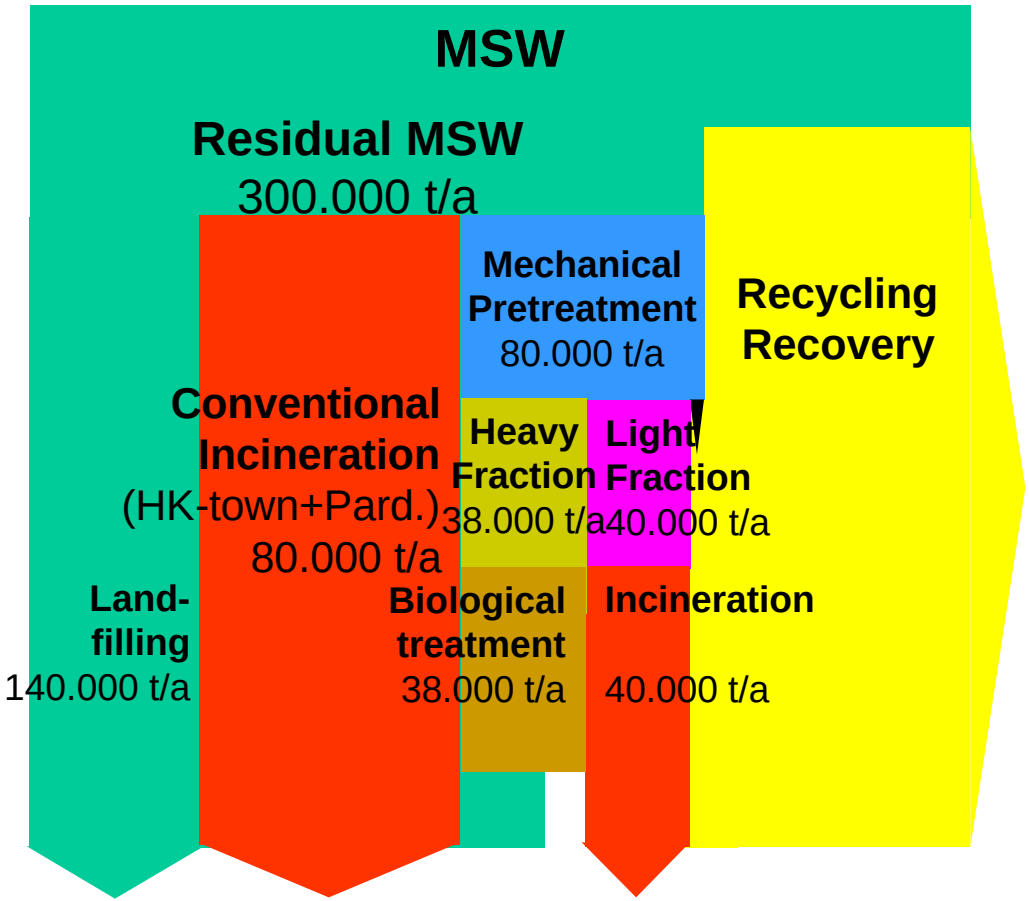
Biological treatment Plant

Landfill

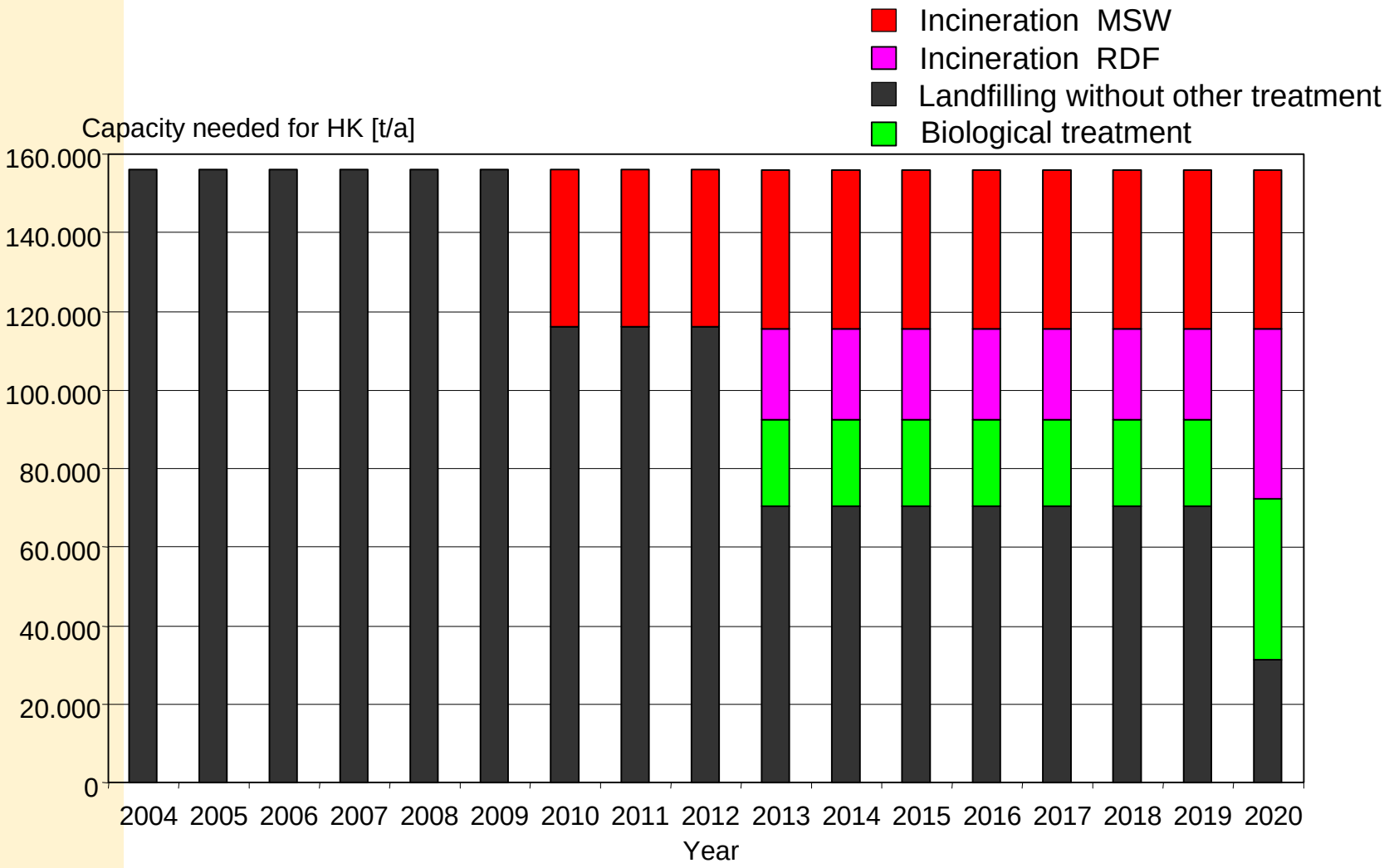
Incineration Plant
light fraction

Catchment
area for
landfilling

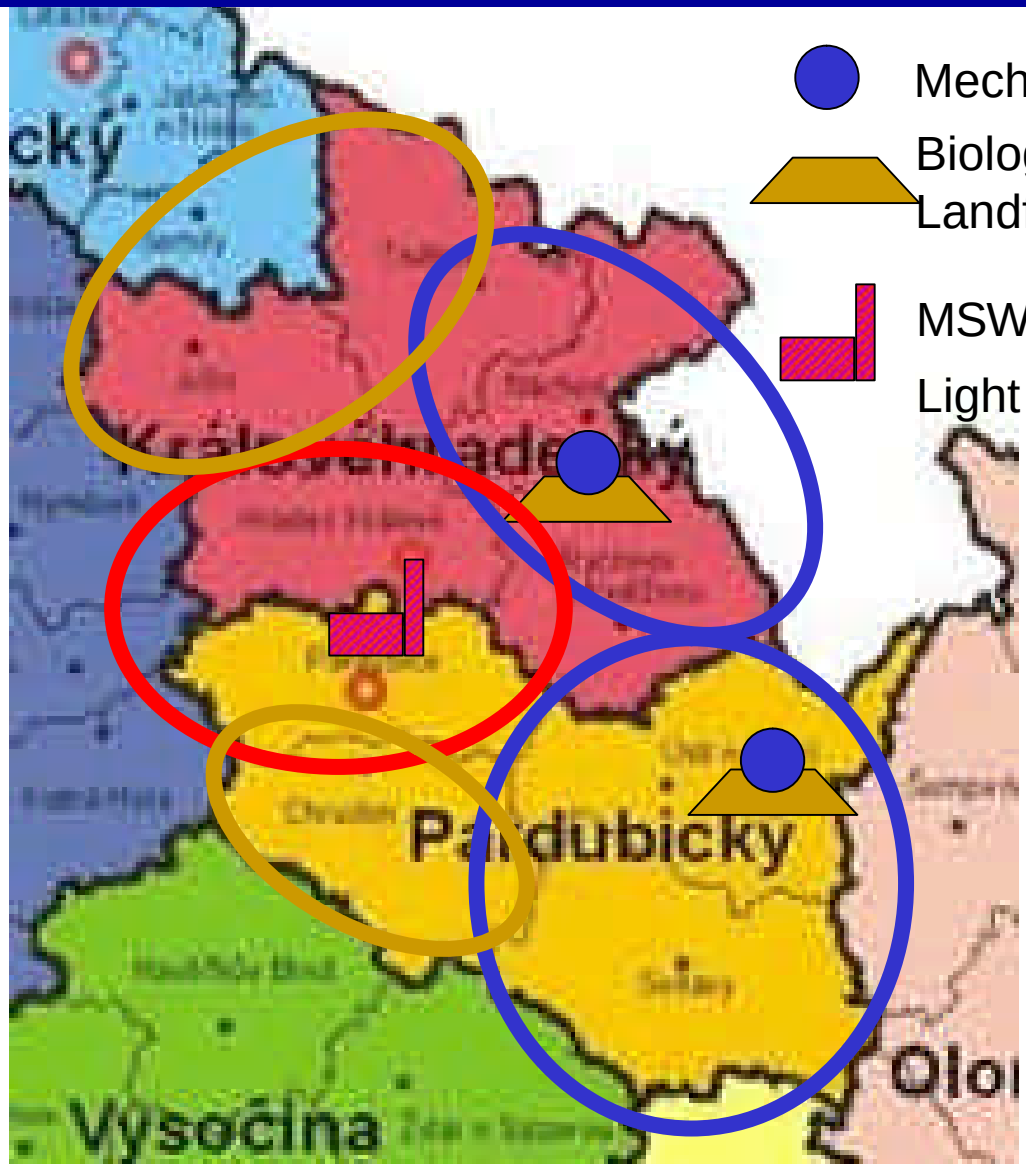
Combination of 1 and 2c, Year 2013
Regions of Hradec Králové and Pardubice



Combination of 1 and 2c
Figures only for region of HK



Combination of 1 and 2c
Regions of Hradec Králové and Pardubice



Mechanical treatment Pla

Biological treatment Plant

Landfill

MSW-

Light fraction-

Incineratio
Plant

Catchment
area for
landfilling

Uniform Collection Systems for MSW needed

- The collection system for MSW should be uniform at least for one region because of public relations / information
- The treatment of collected wastes can differ at each local/regional level

Economic Assessment

- Technical Standard BAT has to be considered
- Data have to be good enough, not necessarily as good as possible
- No subsidies have to be considered when evaluating and comparing options
- Clear distinction between
  - Operating Costs
  - Investment Costs

Basic structure of a calculation of operational costs

	Item	
Cost	•Annuities	
	•Repair and Maintenance	
	•Consumables	Energy, chemicals…
	•Staff	
	•Disposal of residues (including transport)	Incineration slag, residues of flue gas cleaning, …
	•Ancillary	Administration, insurance, …
Minus		
Revenues	•Secondary raw materials	Ferrous scrap
	•Energy	Heat, electricity
= net cost	**Given per ton (Kc/t)**	

Recommended Basis Data for Cost Calculation

Parameter	*comment*	*Value to be chosen*
Depreciation / Reinvestment period	for mobile equipment (as vehicles, container etc.)	7 years
	for machinery (fixed plant equipment)	10 – 15 years
	for civil works	25 years
Interest rate (for calculation of annuities)	Depending on current finance market conditions	…4 – 6 % …
Repair and maintenance cost	for mobile equipment	5 %
	for machinery	3,5 %
	for civil works	1,5 %
Utilization of Capacity	Not less than … should be assumed; and after start-up full capacity utilization should be assumed (no holding out of capacities to be eventually filled up by external sources at a later stage)	90 %
Staff	Including all charges, taxes, fringe benefits etc; a typical average value for the CR at present seems to be	300.000 Kc/staff.yr

Example for calculation of Investment Costs

MSW Treatment Center

Data on investment:

	amount	price per unit	
Civil Works			**31.900.000 Kc**
Access arrangements, site preparation	1	5.000.000 Kc	5.000.000 Kc
Building (30 x 40 x 8 m), insulated, with doors, ...	9.600 m3	2.500 Kc	24.000.000 Kc
Planning, gathering of approvals, documentation	based on total investment	10%	2.900.000 Kc
M & E-part			**46.305.000 Kc**
Shredder (multifunctional: bag opener MSW, volume reduction bulky waste...)	1	8.000.000 Kc	8.000.000 Kc
Separation unit	1	7.000.000 Kc	7.000.000 Kc
Magnet	2	1.000.000 Kc	2.000.000 Kc
Conveyors	3	1.000.000 Kc	3.000.000 Kc
Container press	1	2.000.000 Kc	2.000.000 Kc
Ventilation	1	1.500.000 Kc	1.500.000 Kc
Control system	1	1.500.000 Kc	1.500.000 Kc
Steel structure	1	2.000.000 Kc	2.000.000 Kc
Biologic treatment step (´medium´ lumpsum eg. for triangular windrows ..)	1	15.000.000 Kc	15.000.000 Kc
Contingencies	based on total investment	5%	2.100.000 Kc
Planning, gathering of approvals, documentation	based on total investment	5%	2.205.000 Kc
Mobile equipment			**2.770.000 Kc**
Feeding device (shovel loader, mobile crane...)	1	3.000.000 Kc	3.000.000 Kc
3 axle truck equipped with roll-on/roll off system	1	2.000.000 Kc	2.000.000 Kc
Container (open, ca. 33 m3)	4	65.000 Kc	260.000 Kc
Container (closed, for RDF transport)	6	85.000 Kc	510.000 Kc
Planning, gathering of approvals, documentation	based on total investment	0%	0 Kc
Total			**81.000.000 Kc**

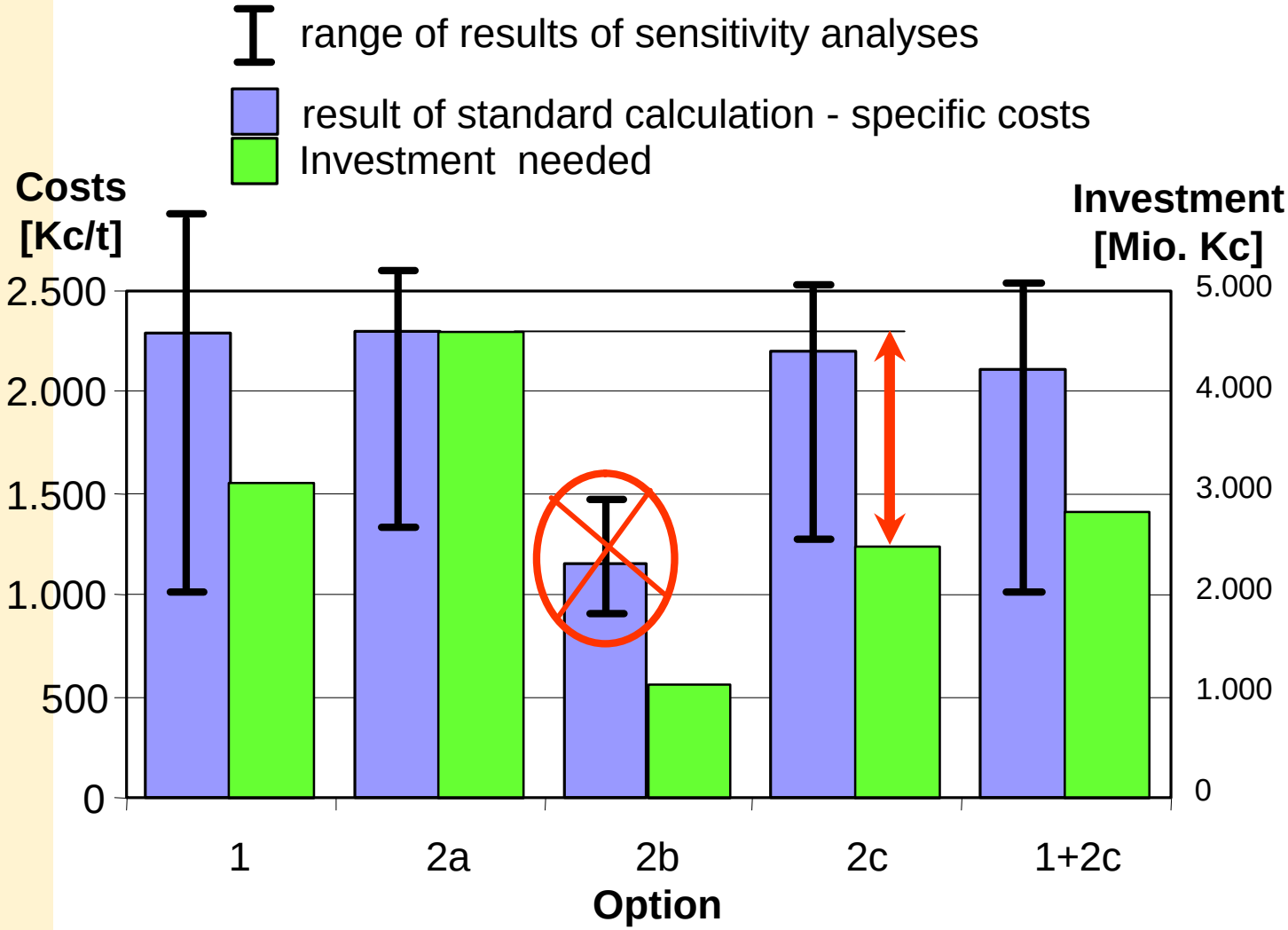
Typical prices / costs for mass burn incineration

	Facility / facilities	*Cost / gate fee*	*Remarks*
①	**Medium sized (< 150.000 t/a) Bavarian incinerators (Schwandorf, Augsburg, Kempten…)**	**125 … 180 €/t**	Top values: 250 €/t (South Bavaria). This group of plants is altogether characterized by much less attractive conditions for marketing the produced energy compared to potential sites in the CR evaluated within the present project (Plzen, Opatovice).
②	**Result of recent tenders (BOO, Austria, capacity 150.000 … 250.000 t/a)**	**120 … 130 €/t**	Lower Austria: ~ 120 €/t (2002), Upper Austria 130 €/t (2003) – Carinthia even 141 €/t ! (however only 80.000 t/a)
③	**Result of recent tenders (BOO, Germany, capacity ~ 300.000 t/a)**	**100 €/t**	Dictum German waste treatment industry: “100 € in the price envelope works, but 95 € is ruinous”
④	**Result of in-depth cost estimates performed for CR (capacity > 100.000 t/a)**	**75 … 85 €/t**	Treatment costs 15 - 25 % lower compared to the ‘German tender cost line’ are due to (slightly) lower costs for civil works, sites which are already developed, lower disposal cost for residuals and good conditions for energy marketing (heat sale all year round)

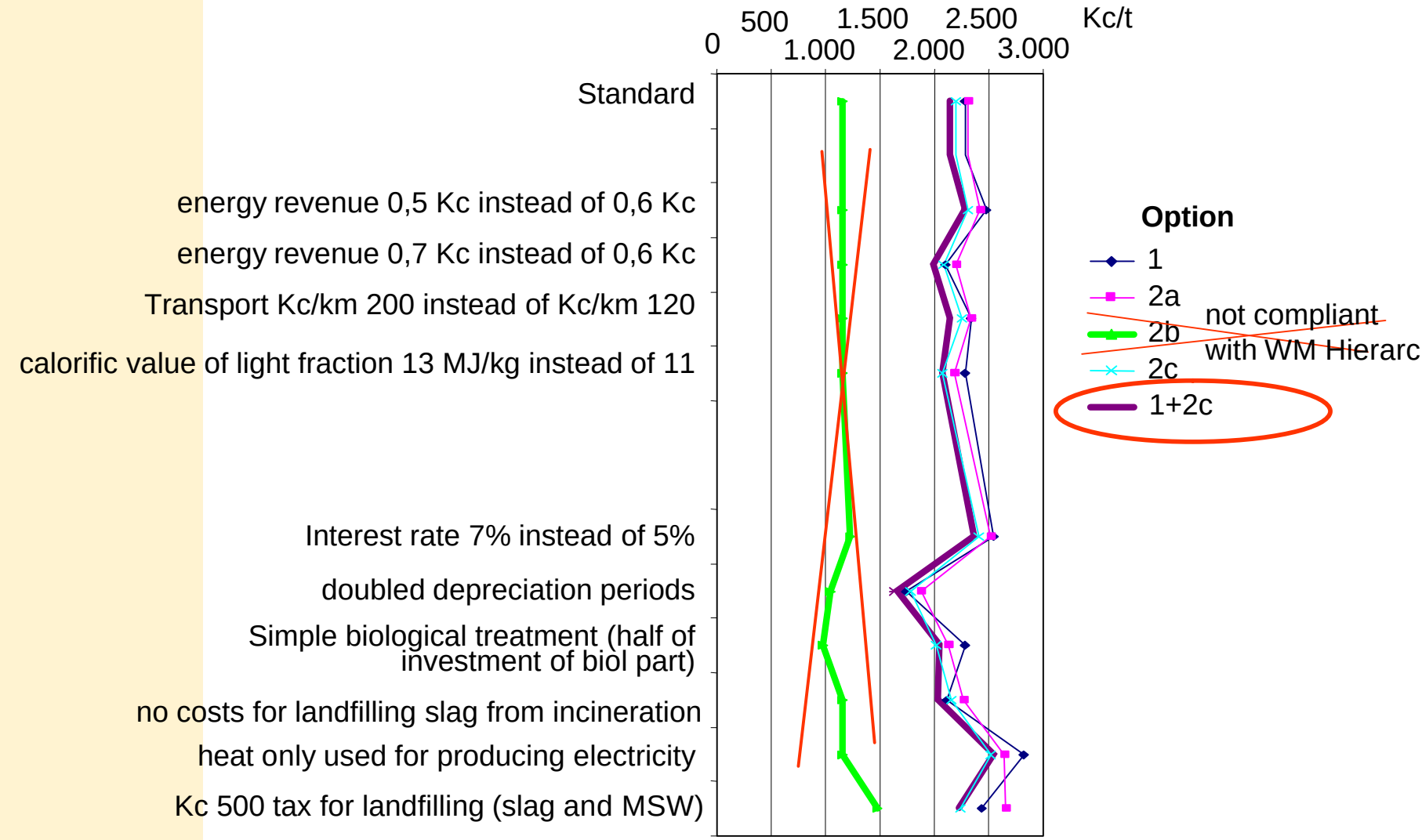
Example for the results of an economic assessment in the CR

Option 1		Thermal	MBT	Transport	**Therm+MBT**	Landfilling	**Total**
tons		165.000	0	111.150	**165.000**	135.000	
specific costs	Kc/t	2.210	1.032	111	**2.284**	800	
costs per year	Mio Kc/a	365	0	12	**377**	108	**485 Mio Kc/a**
							300.000 t/a
total average costs including operational costs and depreciation							**1.616 avg Kc/t**
investment	Mio Kc	3.136			3.136		3.136 Mio Kc
specific investment	Kc/t	19.006			19.006		10.453 avg Kc/t
Option 2a		Thermal	MBT	Transport	**Therm+MBT**	Landfilling	**Total**
tons		150.000	300.000	150.000	**300.000**	0	
specific costs	Kc/t	2.220	1.156	83	**2.308**	0	
costs per year	Mio Kc/a	333	347	13	**692**	0	**692 Mio Kc/a**
							300.000 t/a
total average costs including operational costs and depreciation							**2.308 avg Kc/t**
investment	Mio Kc	3.338	1.281		4.618		4.618 Mio Kc
specific investment	Kc/t	22.250	4.269		15.394		15.394 avg Kc/t
Option 2b		Thermal	MBT	Transport	**Therm+MBT**	Landfilling	**Total**
tons		0	260.000	0	**260.000**	40.000	
specific costs	Kc/t		1.156	0	**1.156**	800	
costs per year	Mio Kc/a	0	301	0	**301**	32	**333 Mio Kc/a**
							300.000 t/a
total average costs including operational costs and depreciation							**1.109 avg Kc/t**
investment	Mio Kc		1.110		1.110		1.110 Mio Kc
specific investment	Kc/t		4.269		4.269		3.700 avg Kc/t
Option 2c		Thermal	MBT	Transport	**Therm+MBT**	Landfilling	**Total**
tons		80.000	165.000	120.000	**165.000**	130.000	
specific costs	Kc/t	2.220	1.032	120	**2.196**	800	
costs per year	Mio Kc/a	178	170	14	**362**	104	**466 Mio Kc/a**
							300.000 t/a
total average costs including operational costs and depreciation							**1.554 avg Kc/t**
investment	Mio Kc	1.780	704		2.484		2.484 Mio Kc
specific investment	Kc/t	22.250	4.269		15.057		8.281 avg Kc/t
Option 1+2c		Thermal	MBT	Transport	**Therm+MBT**	Landfilling	**Total**
tons		120.000	80.000	40.000	**170.000**	140.000	
specific costs	Kc/t	2.283	1.032	40	**2.107**	800	
costs per year	Mio Kc/a	274	83	2	**358**	112	**470 Mio Kc/a**
							300.000 t/a
total average costs including operational costs and depreciation							**1.567 avg Kc/t**
investment	Mio Kc	2.500	342		2.842		2.842 Mio Kc

Results of an Economic Assessment



Sensitivity Analyses concerning cost calculation



Competition with Landfilling
Support from OP-Infra and Cohesion Fund

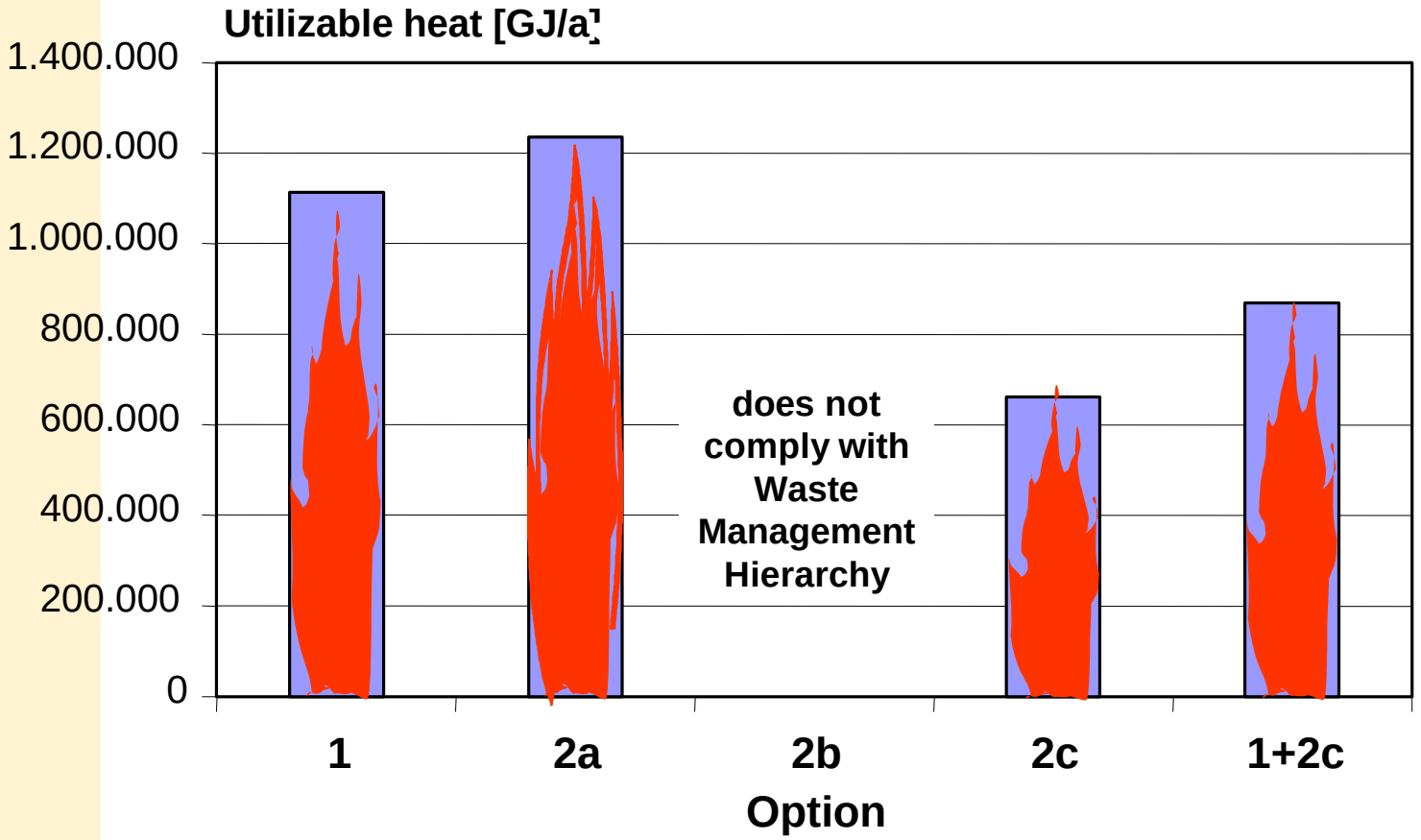
The current prices for landfilling MSW in the Czech Republic are very low.

With these prices no stabilisation technologies are competitive.
The challenge of new facilities is to become competitive with landfilling.

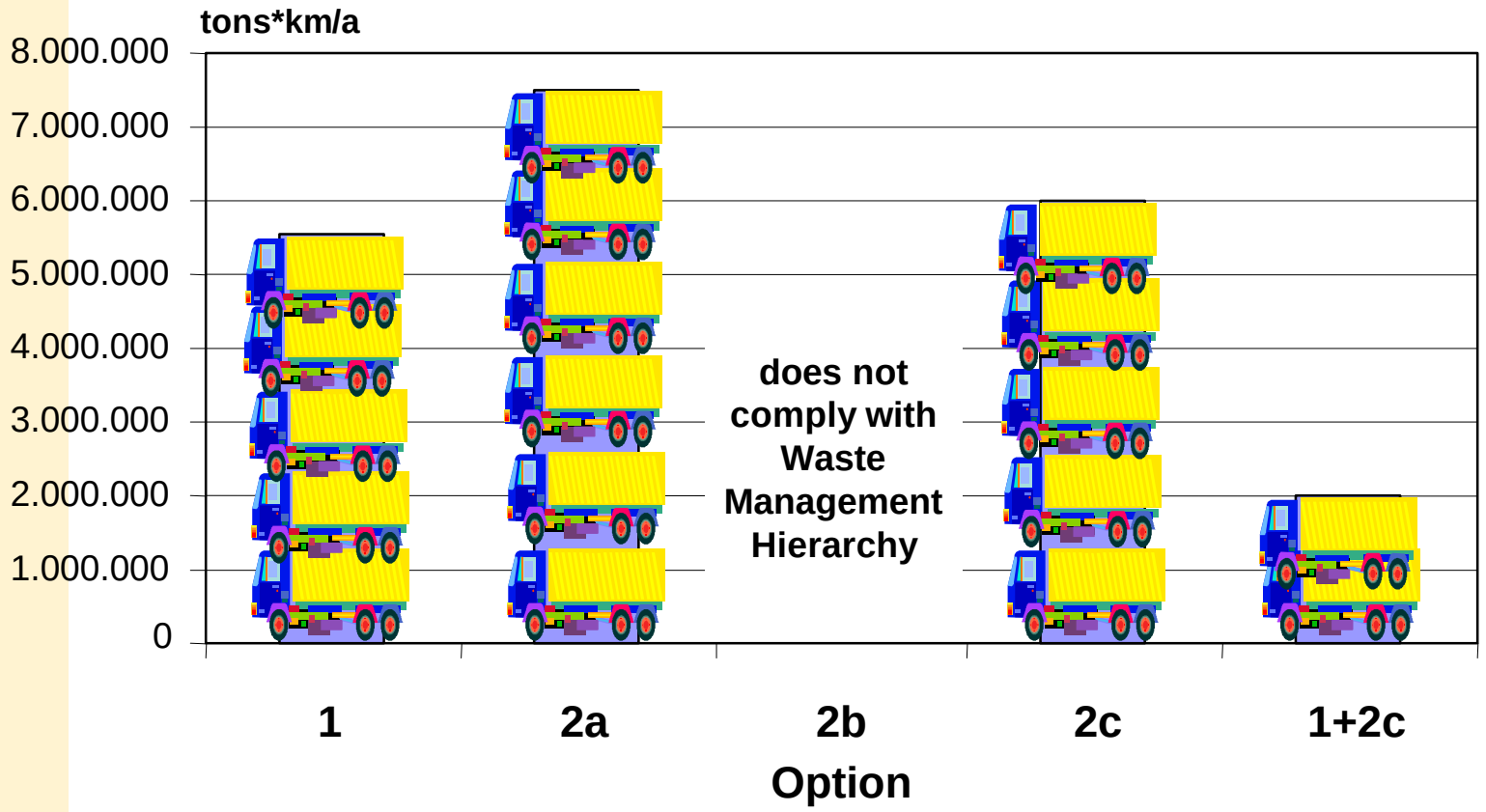
Otherwise the facility cannot survive in a free market.

Making facilities which represent the state of the art competitive is one main task of the EC funds OP-Infra and Cohesion Fund.

Comparison of Utilizable Energy



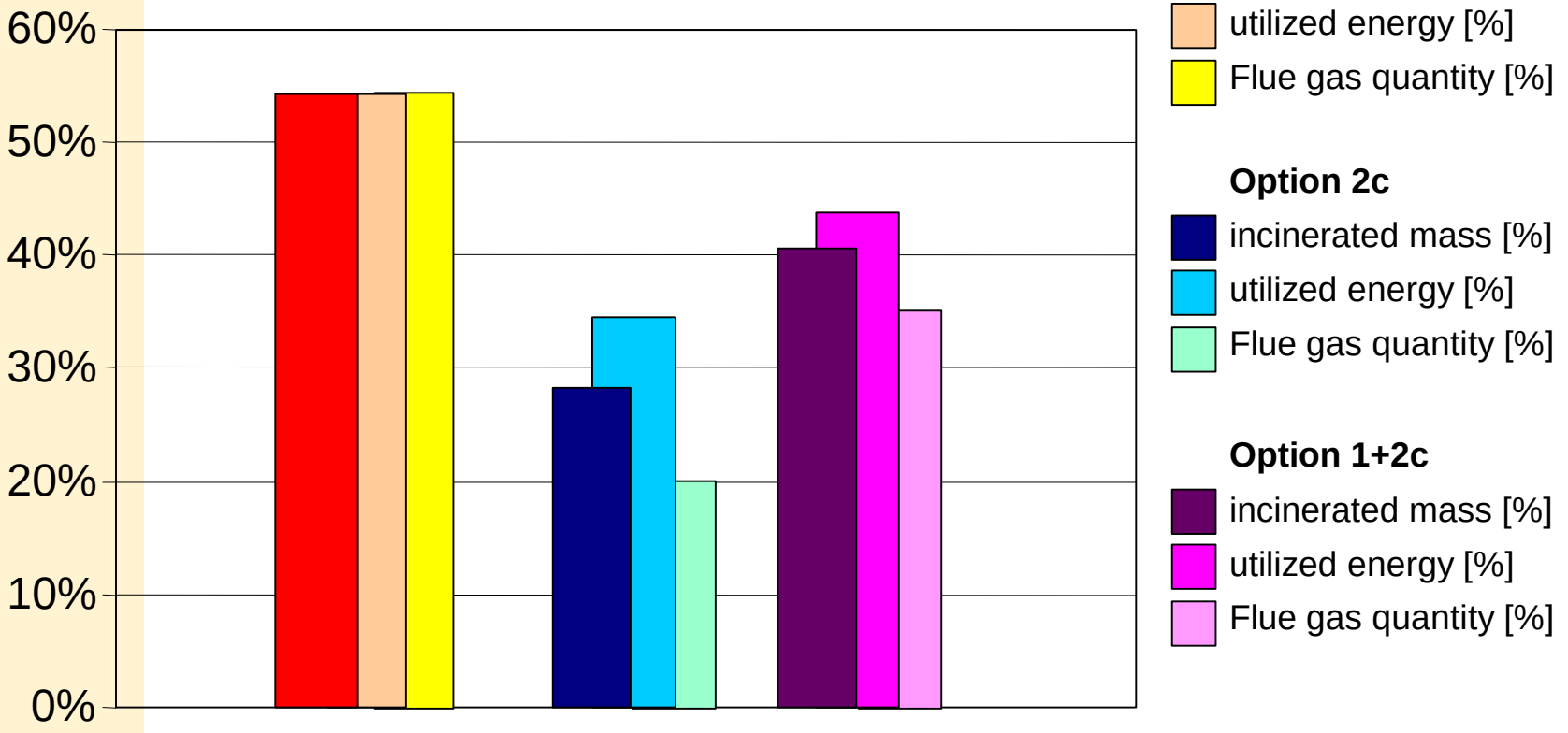
Comparison of Transport



Comparison of Options, Period 2013-2019
Share of Incineration and Heat Recovery

If biological treatment would be done by anaerobic methods
the energyy recovery could be increased in options 2

Mass burn incineration of 100% of the MSW gives 100%



Multi Criteria Analyses Example

	Option				
	1	2a	2b	2c	1+2c
Legal assessment	1	1	Not compliant	1	1
Economic assessment	4	5	1	3	2
Ecologic assessment	3	3	1	3	2
Utilizable energy	2	1	5	4	3
Emissions to the air	5	5	1	2	3
Transport	3			4	2
Risk assessment	No special disadvantages				
Total	3	4	Not compliant	2	1

Note: For the purpose of a submittion to the Cohesion Fund the economic aspects have to be weighted with at least 50% of the total weight

Content

- EC Landfilling Directive
- Waste quantities, currently and prognosis, examples, contribution of separate collection
- Capacities needed for stabilisation of residual MSW and investments nedded in the CR
- Basic Technologies for the stabilisation of residual MSW
- Creating and Assessing Waste-Management-Options, Cost accounting
- OP-Infra and Cohesion Fund
- Manual and CD

Cohesion Fund - Guidance Assessment of Options

- Listing of different options which could solve the problem
- Qualitative presentation of advantages and disadvantages of options
- **Justification** of why some options are not taken into further consideration
- Description of the evaluation method
- Sensitivity analysis
- Risk analysis
- Clear explaination of the final choice

Cohesion Fund - Guidance
Descriptiion of the chosen Option

- Description of treated types of waste and their sources
- Catchment area
- Summary technical description of the chosen option
- mass and energy balance
- If other wastes than MSW are to be treated: how is the Polluter Pays Principle to be implemented?
- Availability of waste for the planned plant

Cohesion Fund - Guidance Costs

- Pre-project costs
- Planned Investment
- Operational costs
- Earnings, total and specific
- Expected rate of support based on achieving cost competitiveness with landfilling
- Approximate financial plan

Cohesion Fund - Guidance Organisation

- Basic data concerning the investor
- Basic data concerning the operator
- Relationship between owner/investor and operator, including method of selection of any private partner
- Basic data on owner of any other infrastructure linked to the project
- Time schedule with milestones

Content

- EC Landfilling Directive
- Waste quantities, currently and prognosis, examples, contribution of separate collection
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Manual, CD, www

Financing Tools to Implement Acquis in the Environment Sector

Twinning number CZ02/IB/EN/04

Waste Management

Manual

Twinningový Projekt

FINANČNÍ NÁSTROJE

pro implementaci *acquis* v oblasti životního prostředí

Waste Management
Hospodaření s odpady

Walter HAUER
Martin STEINER
Tim YOUNG

September 2004

CD

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Vision

The environment will be the winner

Vítezem bude životní prostredí

Who is the environment?

Kdo je životní prostredí?

We / Humans are the environment

My / lidé jsme životním prostredím