

LABORATORY OF HEAT TRANSFER and
ENVIRONMENTAL ENGINEERING

DEPARTMENT of MECHANICAL ENGINEERING
ARISTOTLE UNIVERSITY THESSALONIKI

ISTEAC

Paper Recycling



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Partners: TU Dresden, Hanoi University of Science,

Miriam College

Project duration: 24 months

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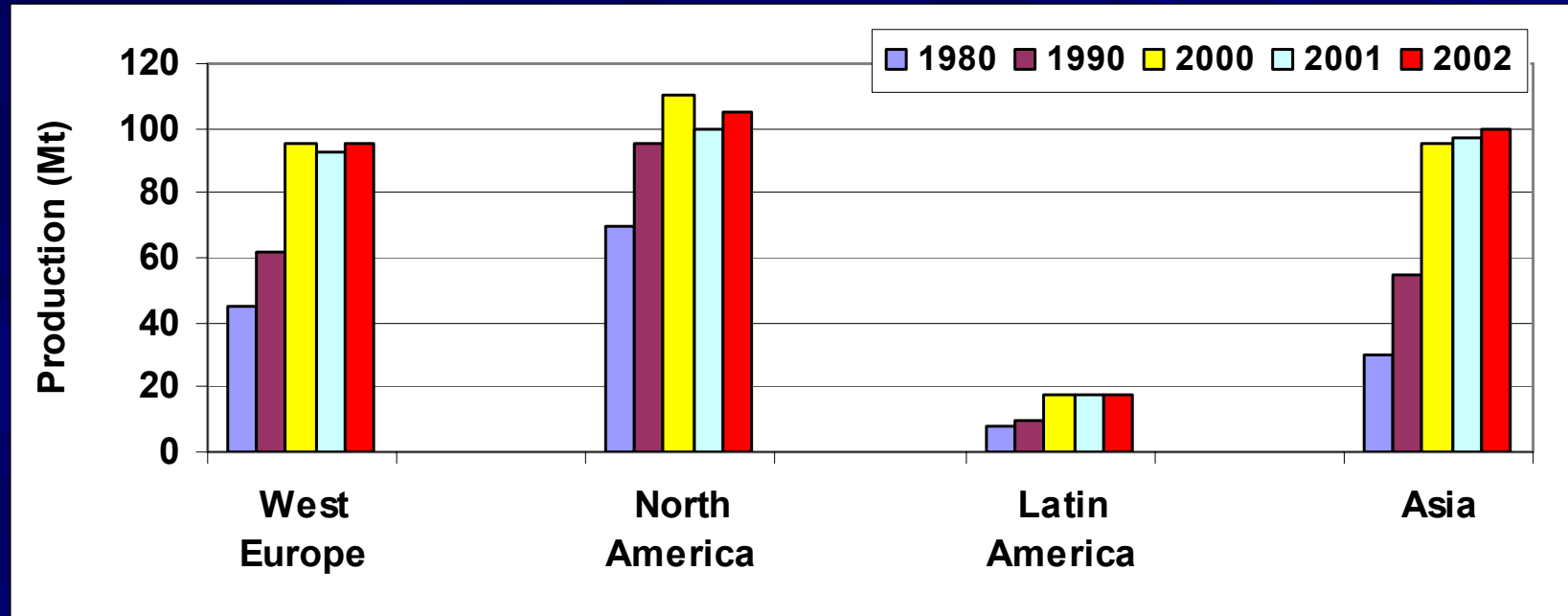
- Paper and paperboard market worldwide.
- Recovered paper worldwide.

- Paper and paperboard market in Europe.
- Recovered paper in Europe.

- The Hellenic paper and paperboard market.
- Paper recycling projects in Greece.
- Conclusions.

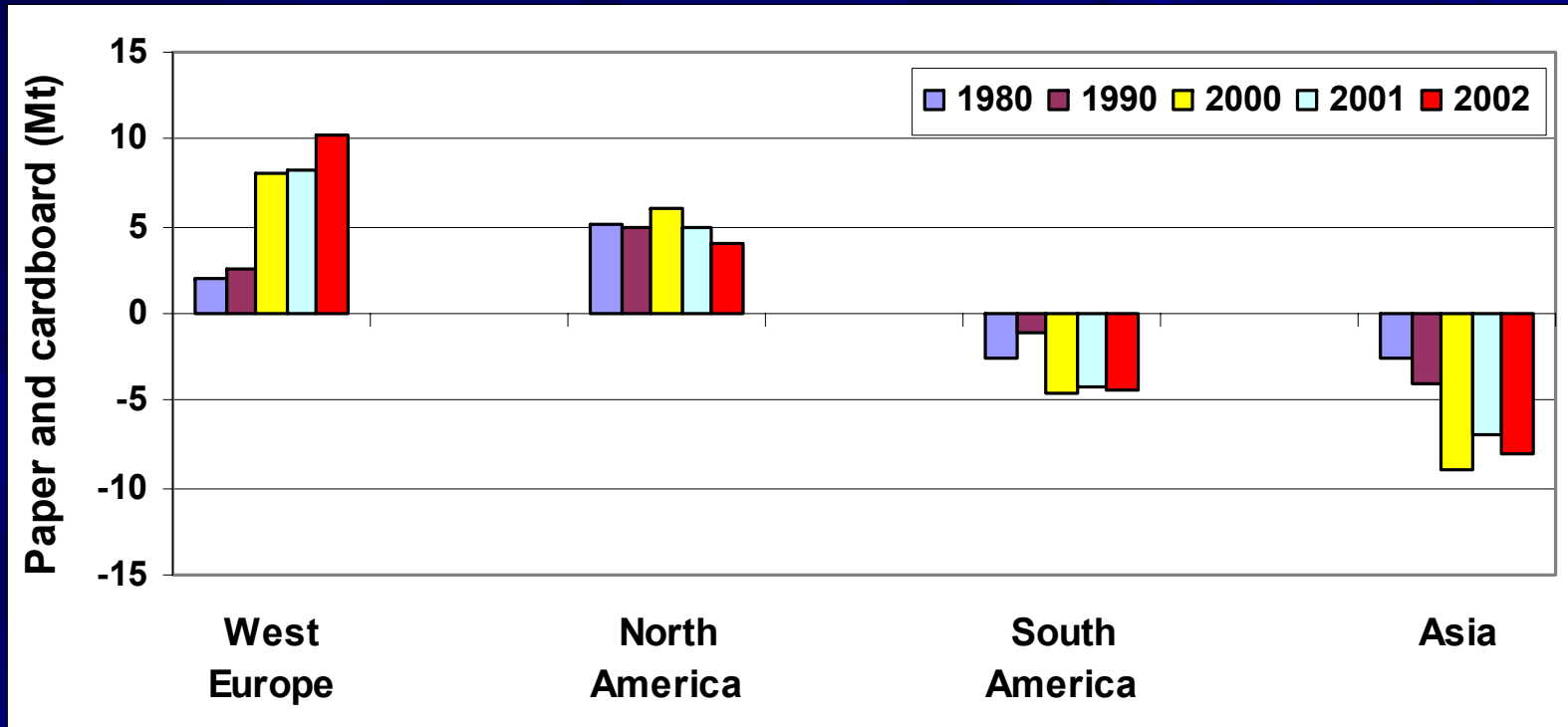
Paper Issues Worldwide

1. Paper and board market worldwide



- Historical data shows that significant growth on paper production took place in Asia (roughly 80%, between 1990-2002).
- The production of paper and board in Western Europe increased by more than 1/3 during 1990-2000.

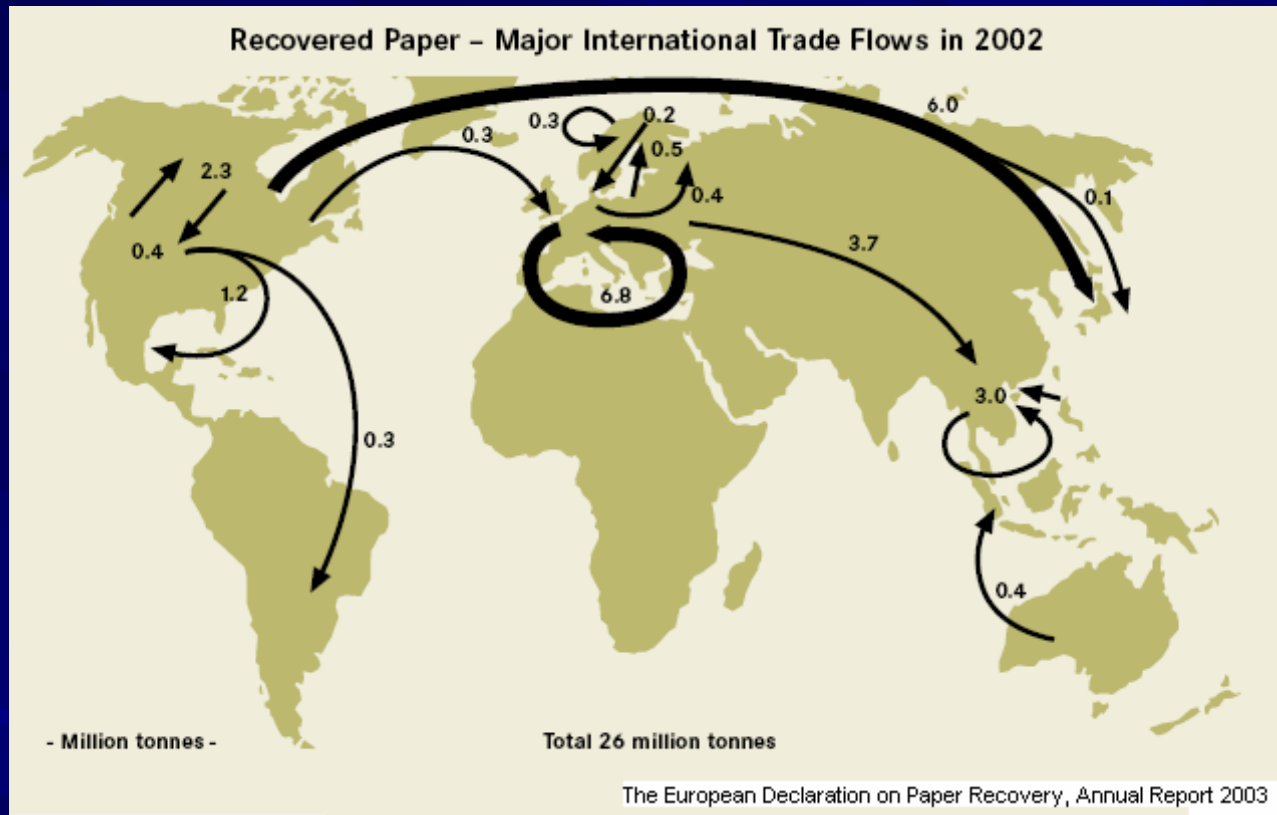
2. History of paper and board net trade



- Europe is the largest paper and board exporting area in the world.
- The European Industry increased its exports of paper and board by 75% between 1990-2000, which represents the most positive evolution in the world.
- In 2002, more than 12 Mt were exported.

Source: CEPI, 2003

3. Recovered paper trade flows in 2002

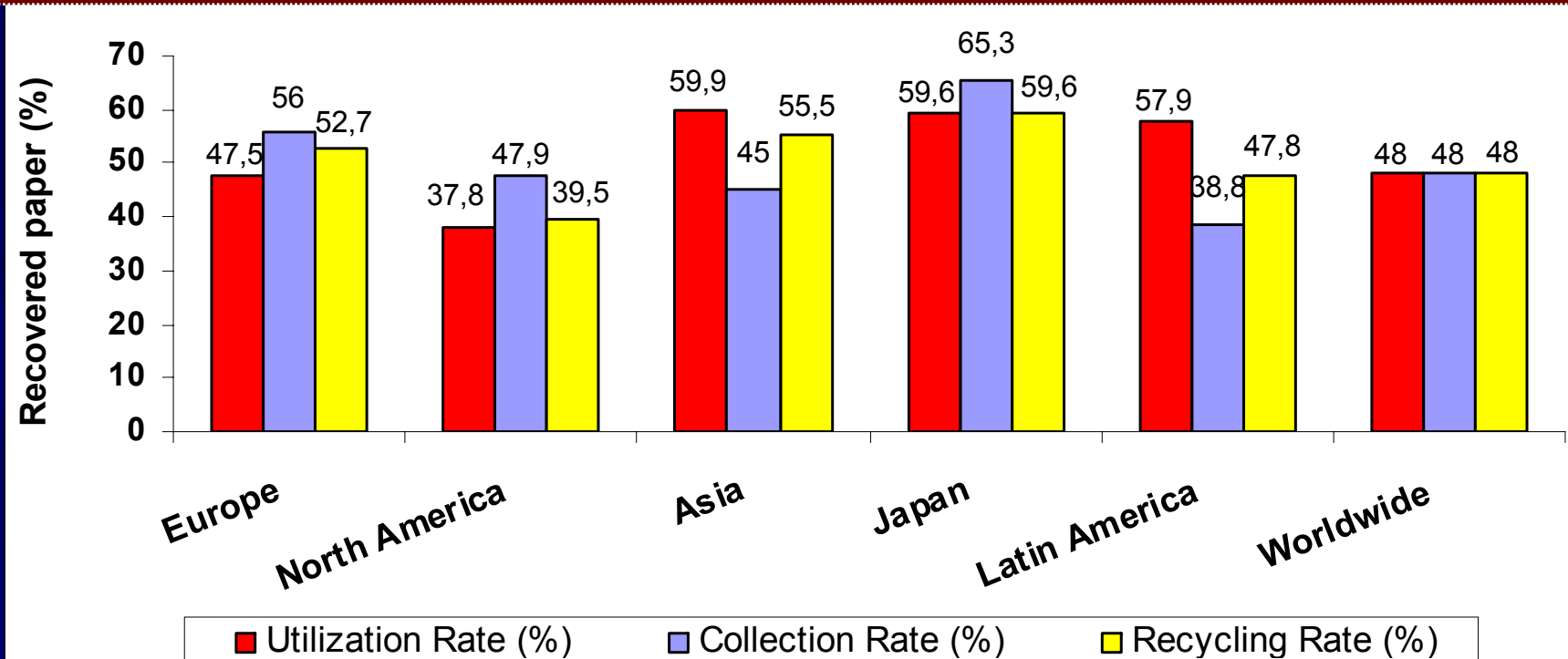


The international recovered paper trade was 26 Mt in 2002.

The most important trade flows were:

- ✓ between European countries,
- ✓ from USA to Asia,
- ✓ from Europe to Asia,
- ✓ between Asian countries,
- ✓ from USA to Canada and Mexico.

4. Recovered Paper (Utilisation, Collection and Recycling) comparison among Regions in 2002



- The European recycling rate is well above the North American level.
- USA should increase their collection activity to be able to increase collection volumes and satisfy the growing Asian import demand for recovered paper.

Source: *The European Declaration on Paper Recovery, Annual Report 2003*

5. Paper Recycling in USA

- In 2003, 50,3% of the paper was recovered (1990: 33,5%).
- The total quantity of recovered paper amounted 49,3 Mt (in 2003) (+3,4% from 2002 and +69% from 1990).
- Corrugated boxes and newspapers, were recovered 75% and 73%, respectively, in 2003.
- National Goal: to recover 55% of all paper consumed in the USA by 2012.
- In 2003, more than 85% of the Americans had access to paper recycling projects.
- China imported more about 6 Mt of US recovered paper in 2003.
- While exports to South Korea, India, Japan and Western Europe declined in 2004, China increased its purchases of US recovered paper by 8.8%.

Europe

1. Introduction

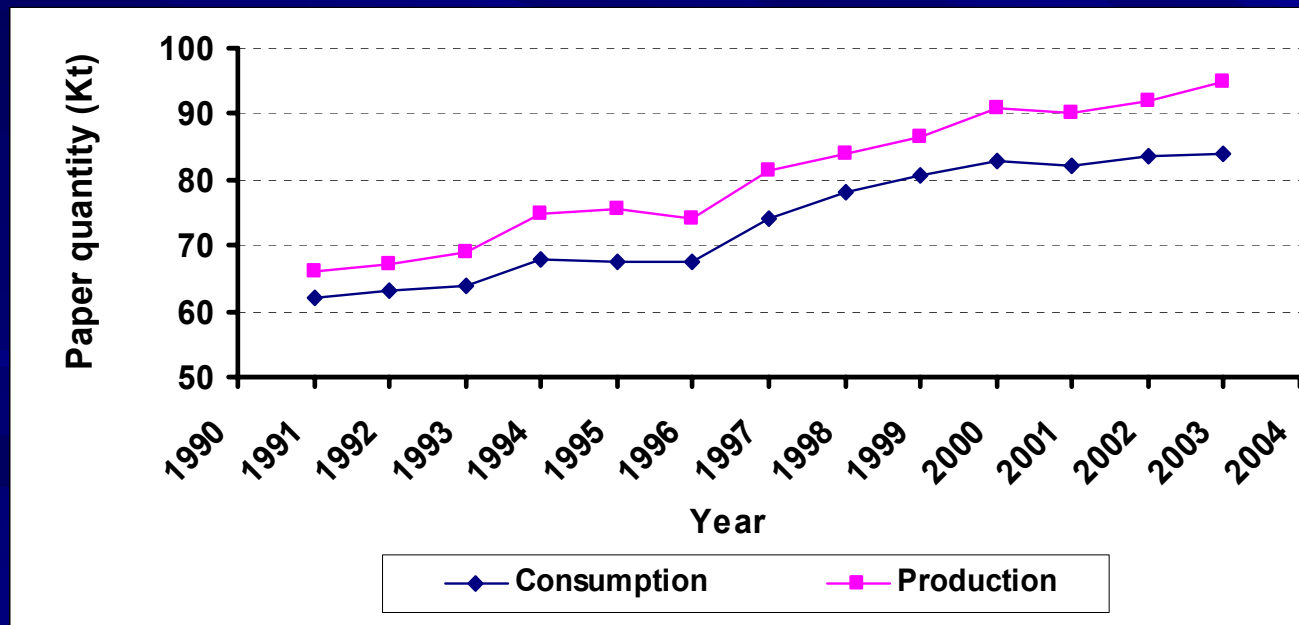
- Main characteristic of the EU is the big differences among the member states with respect to:
 - the produced paper quantities,
 - demands of raw material, consumption,
 - collection and utilization of recovered paper.
- Although EU is net exporter of recovered paper, it is net importer of the chemical pulp.
- Pulp production in EU does not cover the demands for paper production.
- The demands of imported chemical pulp were 23% of the total demand of 31,2 Mt which is estimated to reach 34 Mt in 2020.

2. European paper and board market

Production and consumption

Year	1991	2003
Production (Mt)	67	95
Consumption (Mt)	62	85

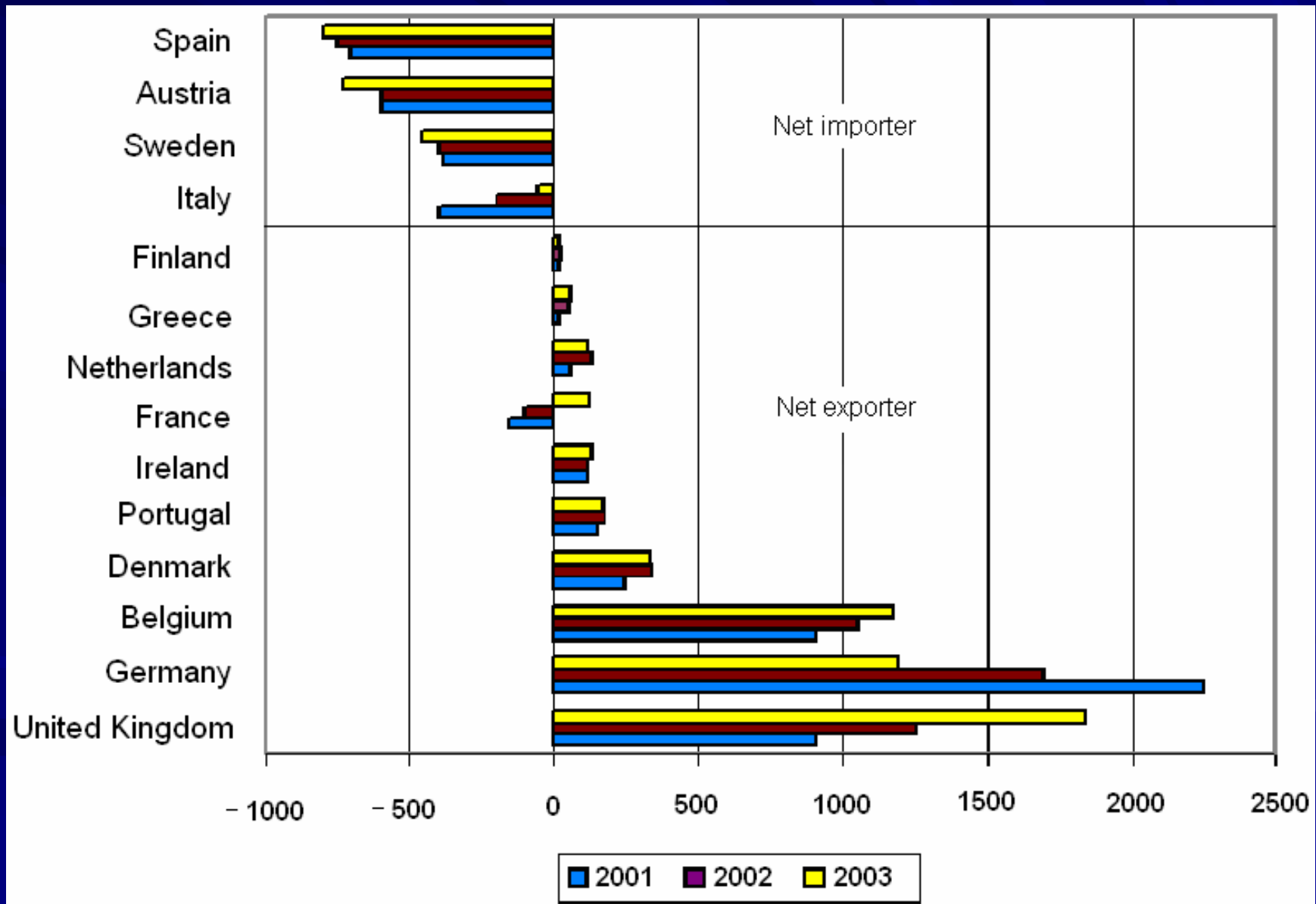
- Paper and board production is continuously increasing in EU, from 47Mt in 1885 to 95 Mt in 2003.
- The total production is estimated to reach 115Mt in 2020.



- Consumption was roughly 89% of the production in 2003.
- It is estimated to reach 90% of the production in 2020.

Source: CEPI, 2003

3. Recovered Paper Trade Balance by Country (kt)



4. Comments on the recovered paper trade balance chart

- The United Kingdom has emerged as the biggest net exporter of recovered paper, before Germany, which has seen new production capacity leading to higher utilisation of recovered paper.
- France is for the first time, in the category of net exporters, and Italy has dramatically reduced its deficit and is close to a balance.
- In Spain, Sweden and Austria the net imports of recovered paper continue to increase.
- Greece is also among the countries that export recovered paper (62kt in 2003).
- Net exports of recovered paper amounted to 4.2 Mt in 2003 compared to 3.8 Mt in 2002 (+10%).
- China remains the largest importer of European recovered paper because of huge investments in new paper recycling capacities.

5. Collection of recovered paper

- In 2003 an extra 1.3 Mt (+2.8%) of recovered paper was collected.
- Collection rate reached in a year 57.3% after 56.2% in 2002.

$$\text{Collection rate} = \frac{\text{Collection of recovered paper}}{\text{Paper and board consumption}}$$

- At European level, around 50% of the collected volumes come from trade and industry sources, 40% from households and the remaining 10% from offices.
- These proportions differ greatly between countries as well as collection systems.
- In Finland, Germany, Sweden and the Netherlands, the collection rate has been close or even beyond 70% for many years and these rates cannot be expected to increase largely.

6. Utilization of recovered paper

- Recovered paper utilization continued its steady increase; 700 Mt or 1.6% in 2003.

$$\text{Utilization rate} = \frac{\text{Recovered paper utilization}}{\text{Total paper and board production}}$$

- As production of paper and board (+2.1%) increased more than utilization of recovered paper (+1.6%), the utilization rate reduced.
- Recovered paper utilization rates are very high in packaging grades, e.g. 90% in case materials.
- Newsprint is also a big user of recovered paper: its utilization rate of recovered paper has increased steadily over the years and reached 74% in 2003.

7. Paper recycling

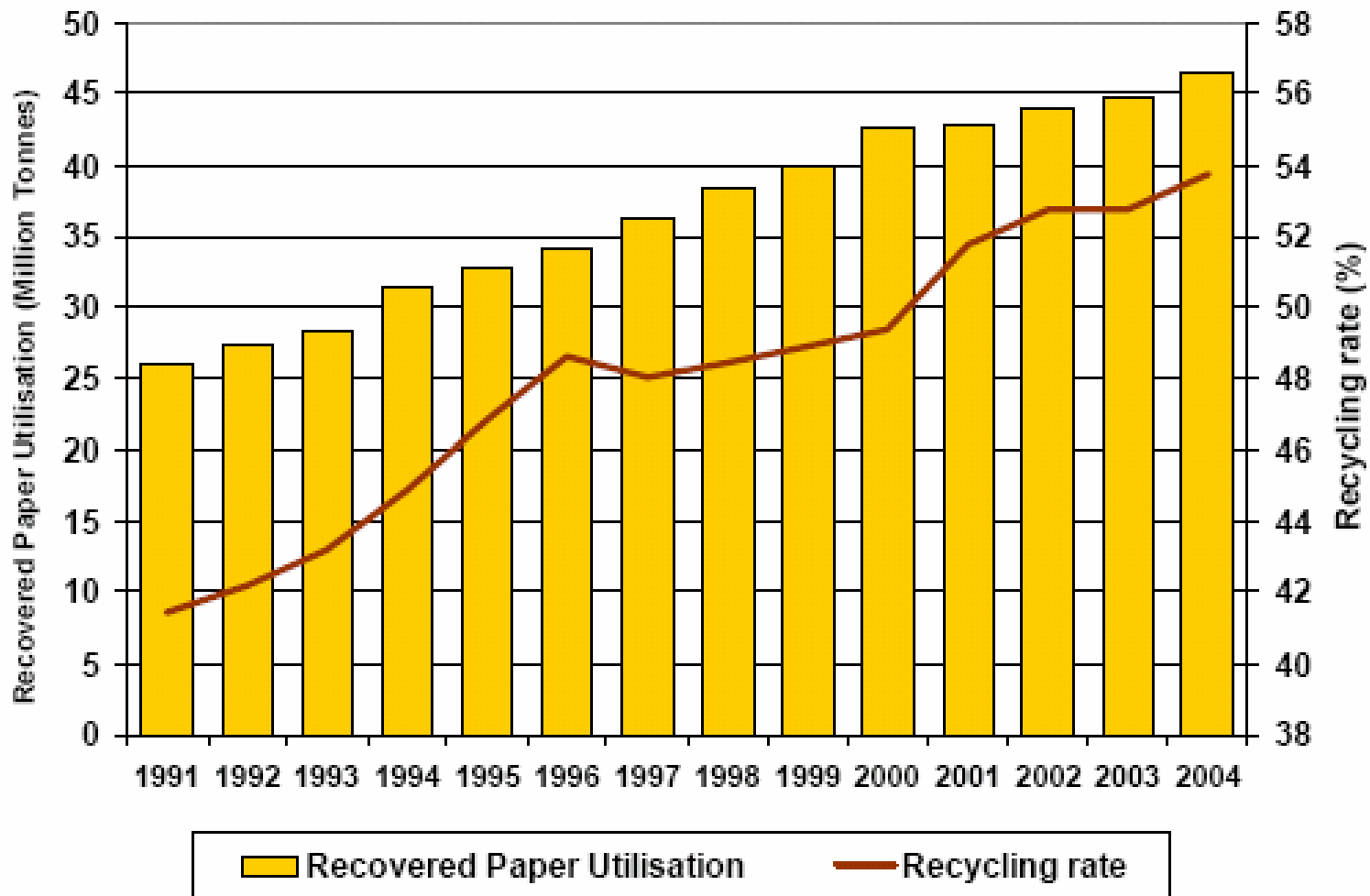
- The recycling rate from 38,8% in 1990, reached 49,4% in 1999 (+16 Mt).
- It registered an increase in 2003 reaching 53.2% after 52.8% in 2002.
- The European paper industry utilized an extra 700 Mt of recovered paper compared to 2002.
- The total amount of recovered paper that was recycled in 2003 was 44.7 Mt.

$$\text{Recycling rate} = \frac{\text{Recovered paper utilization}}{\text{Total paper and board consumption}}$$

Countries	Utilization rate (%)	Collection rate (%)	Recycling rate (%)
Austria	43,6%	62,0%	97,8%
Belgium	38,4%	53,4%	19,4%
Denmark	108,1%	53,1%	29,0%
Finland	5,3%	72,9%	66,9%
France	58,2%	54,4%	53,3%
Germany	64,5%	73,7%	67,2%
Greece	69,7%	33,3%	28,2%
Ireland	109,3%	37,6%	9,8%
Italy	56,0%	47,0%	47,5%
Netherlands	71,1%	67,7%	68,2%
Portugal	21,3%	46,5%	30,4%
Spain	81,7%	50,5%	61,6%
Sweden	17,4%	67,6%	87,4%
United Kingdom	72,8	51,1%	36,3%
Czech Republic	41,0%	43,6%	33,0%
Hungary	68,3%	55,9%	52,4%
Norway	20,9%	67,6%	53,6%
Poland	38,4%	37,3%	33,4%
Slovak Republic	37,3%	47,9%	61,1%
Switzerland	58,3%	69,9%	65,6%
TOTAL CEPI	47,0%	57,3%	53,2%

Although Greece is among the countries with low collection and recycling rate (33.3% and 28.2% respectively), appears high utilization rate (69.7%).

Source: CEPI, 2003



Evolution of the Recovered Paper Utilization and the Recycling Rate in CEPI countries 1991-2004.

Greece

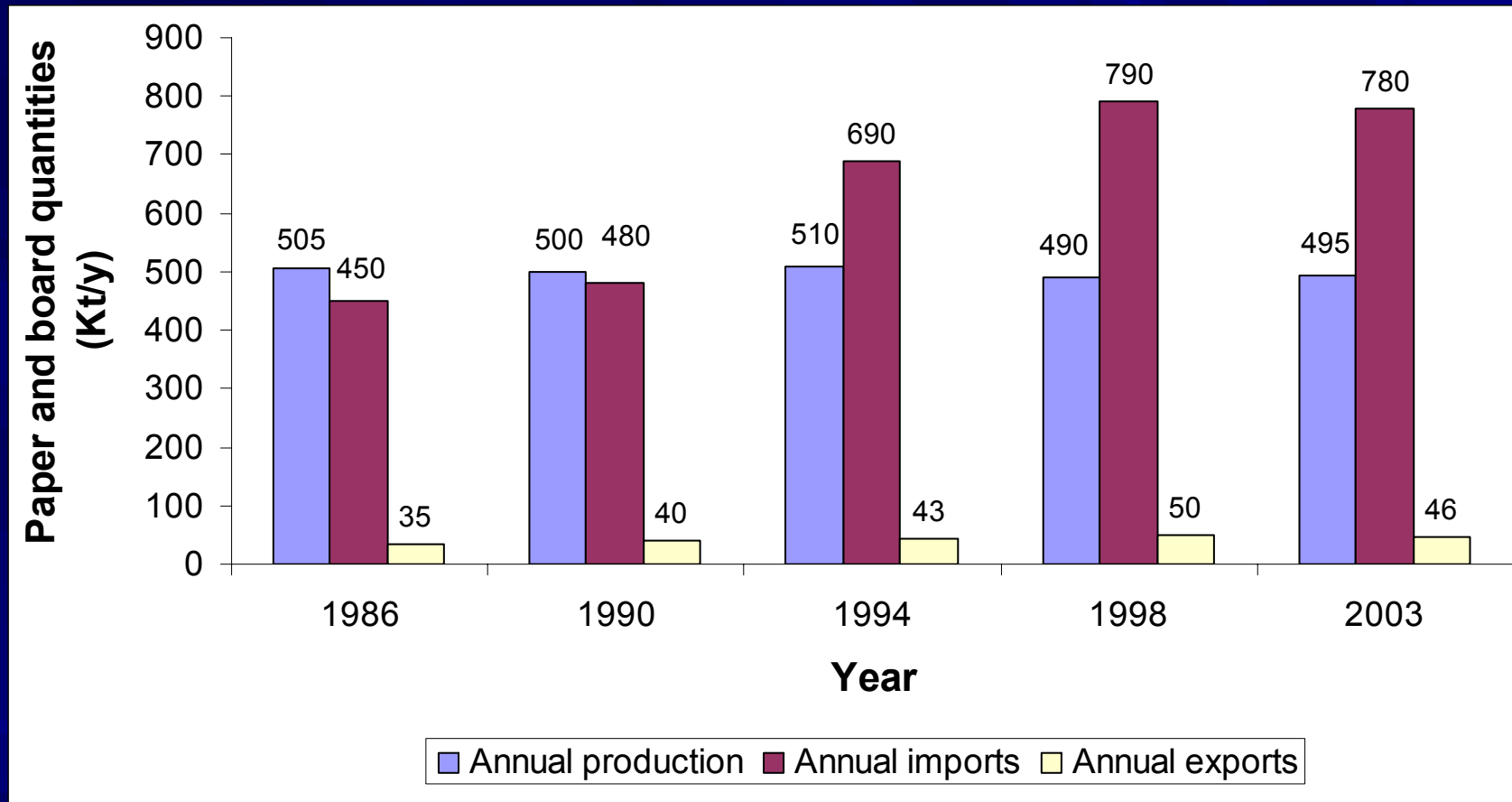
1. Introduction

- Greece is among the EU countries with low paper and board production and consumption.
- The collection and recycling rates are also low.
- Greece is a net importer of paper and board products and during the last years small amounts of recovered paper were exported (62kt, 2003).
- In 1998, 250 kt of recovered paper were collected, while in 2003 the collection reached 407 kt.
- The Hellenic paper industry consists of 151 enterprises and 8,350 employees; 14 of them are papermills.

■ Paper mills in Greece and their production (t/day)



2. Paper and board trade balance in Greece



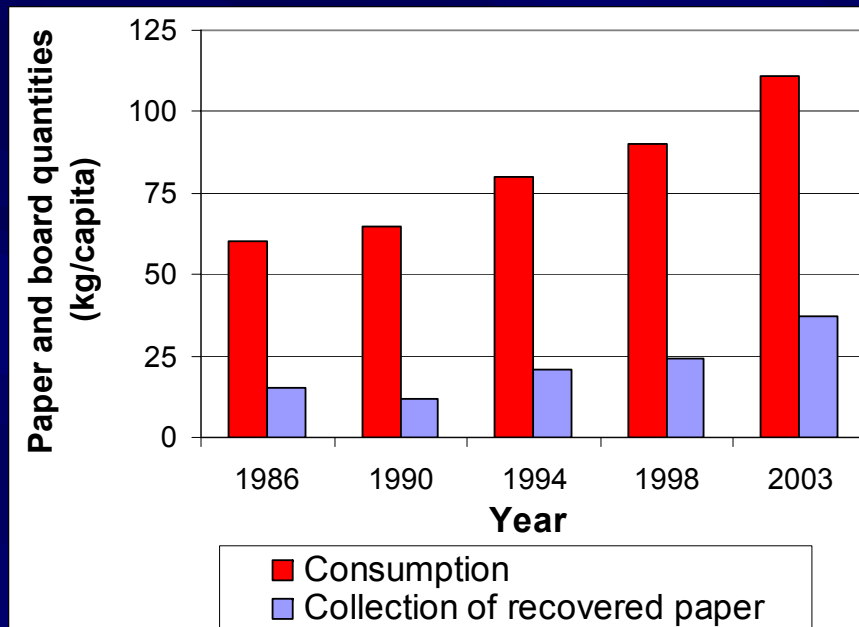
3. Paper imports in Greece

- The increased paper demands are covered through extra imports from other countries.

Data from the National Statistical Service of Greece showed that

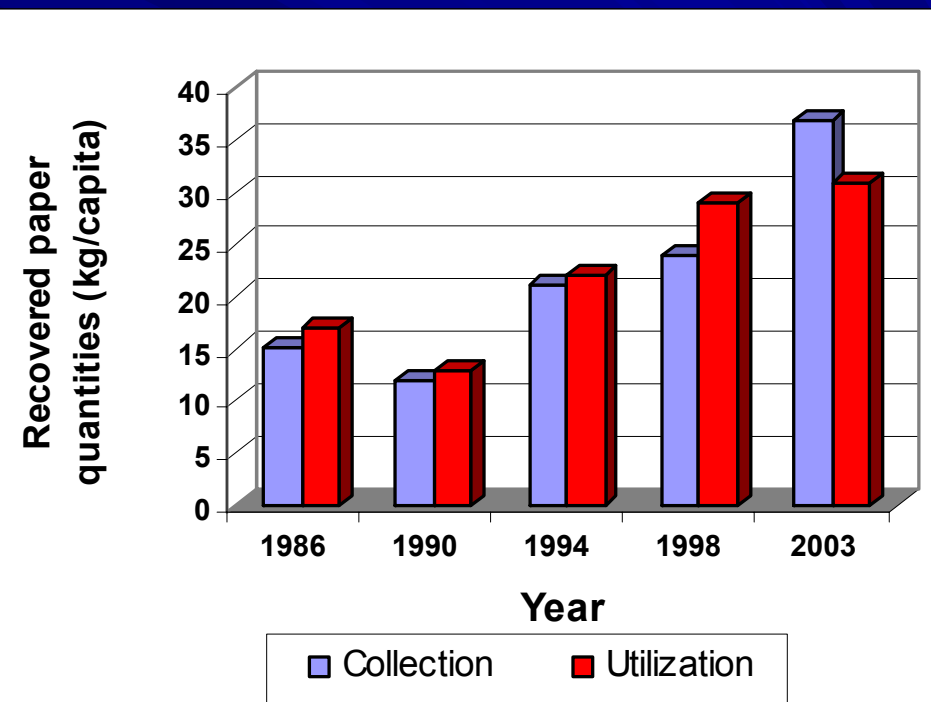
- ✓ 80% of the paper and board imports come from EU countries (Germany (12%), Italy(19%), Finland (13%), the Netherlands).
- ✓ 1990-1998: imports of paper quantities were increasing with an average annual rate of 8%.
- ✓ 1993-1999: imports of paper pulp were increasing with an average annual rate of 9.2%.
- ✓ In 2000, pulp imports amounted 122,046 t (Main suppliers: Russia, Morocco, Canada, USA and Sweden).

4. Consumption and collection in Greece

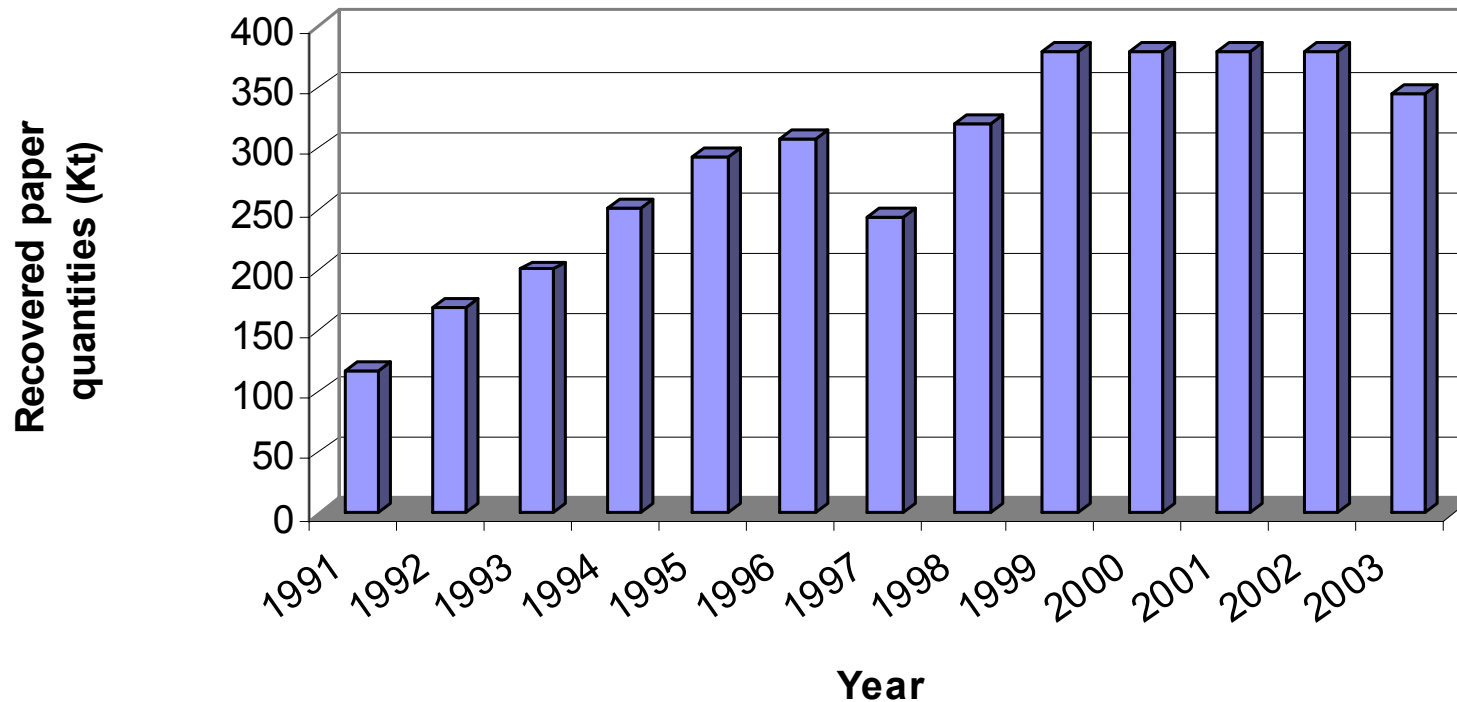


Annual paper consumption and annual collection of recovered paper

Annual collection and utilization of recovered paper



5. History of paper recycling in Greece



- Data shows the weakness of the Hellenic paper industries to accept an annual quantity of recovered paper more than 380 kt.
- The capacity of the domestic paper industries was also decreased due to the fact, that several paper industries terminated their operation.

6. Recent data

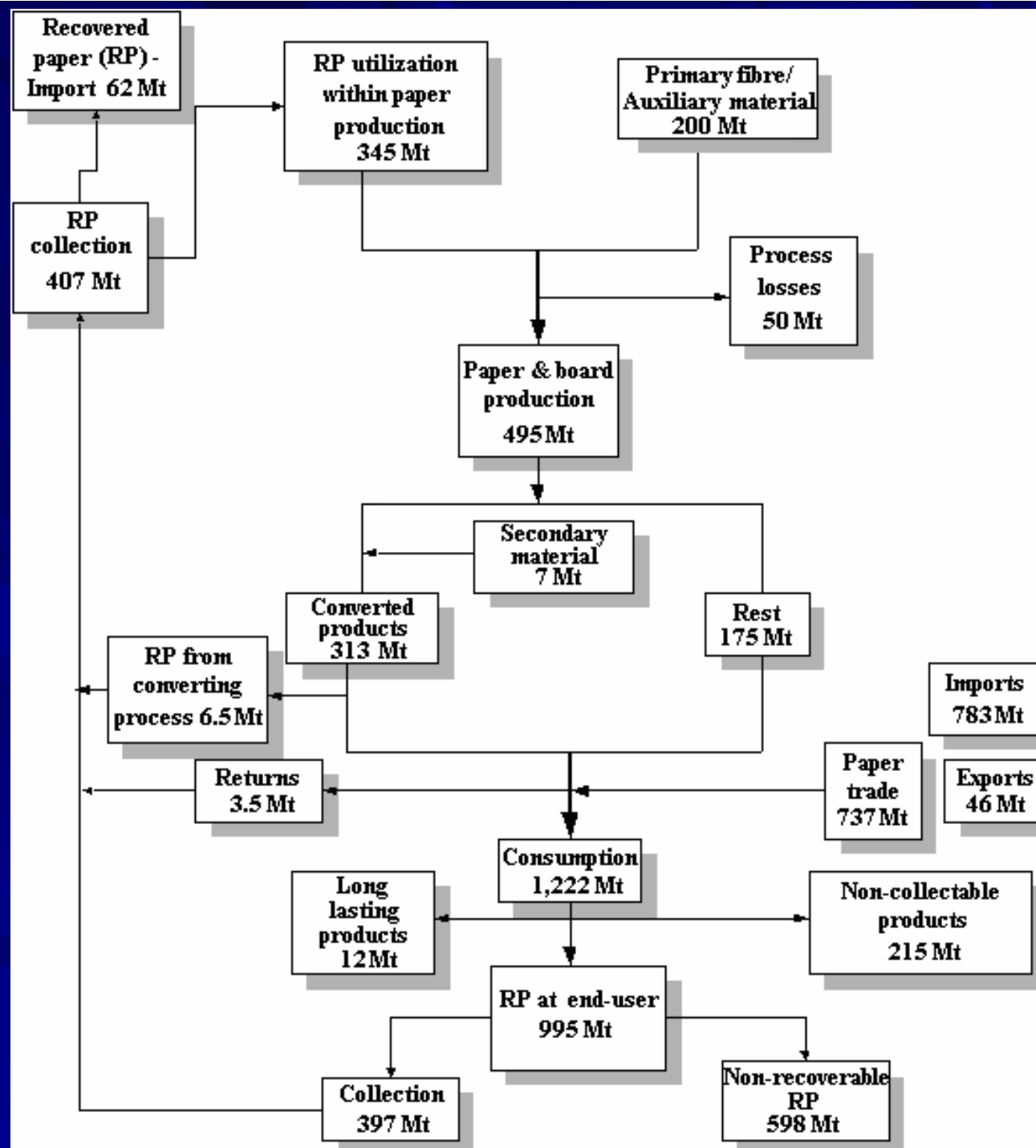
In 2003:

- Hellenic paper and board production amounted 495 kt (+0.4% from 2002).
- 145 kt were tissue paper and 350 kt were packaging paper (70kt board and 280 kt wrapping paper).
- No production of printing paper after the termination of an industry's operation with capacity 200t/day in Drama.

Raw material used:

- 345 kt of recovered paper.
- 193 kt pulp.
- 7 kt other.

Paper mass flow in Greece for 2003



7. Recycling projects in Greece

Hellenic Recovery Recycling Corporation (HERRCO)

- Recycling projects: Athens, Patra, Zakynthos, Pieria (coverage 650,000 residents).
- New projects by 2007: Thessaloniki, Lamia, Kalamata, Trikala, Karditsa, Heraklion, Corfu, Chania (coverage 1,500,000 residents).

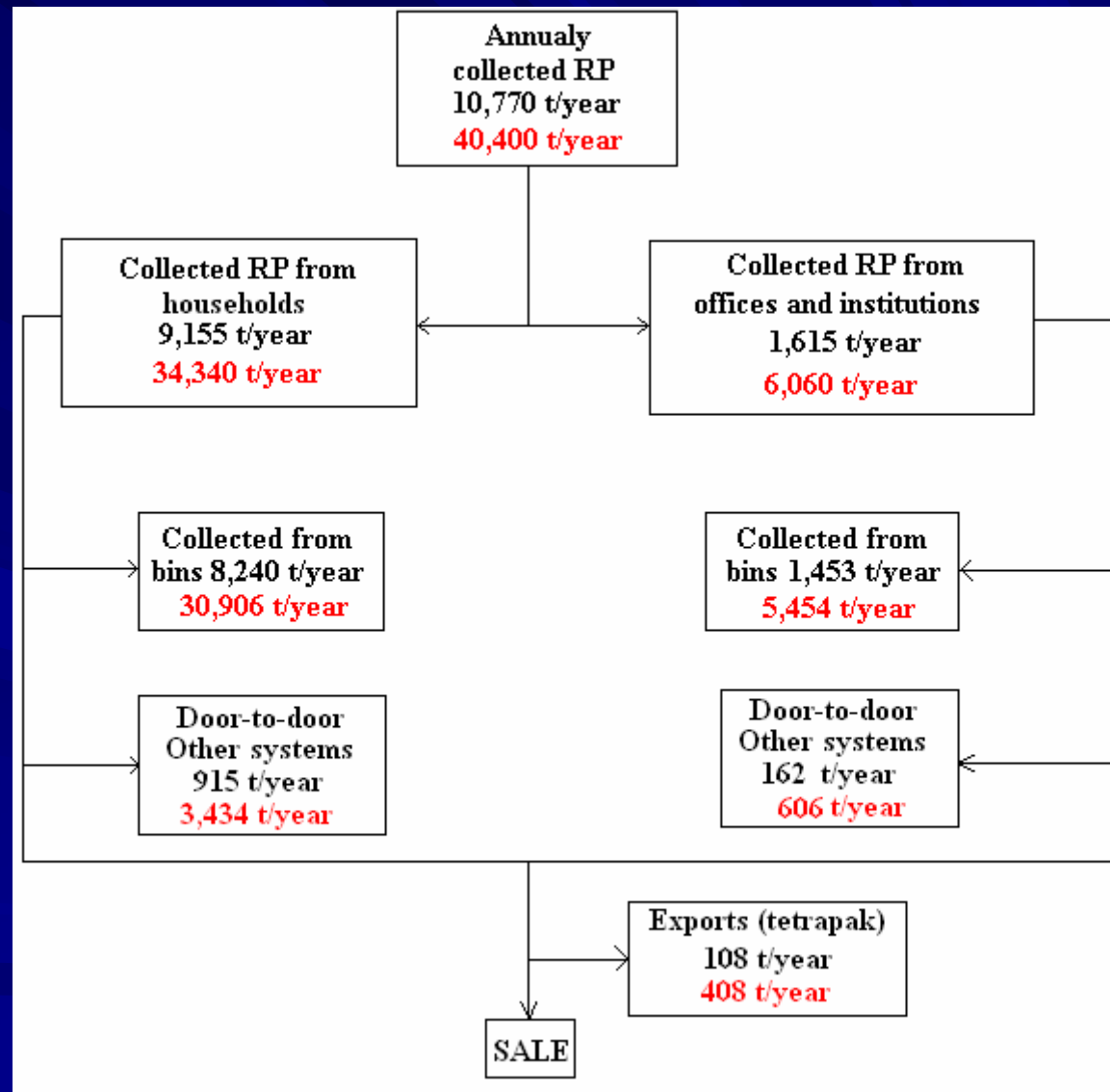
Recycling projects in Athens (HERRCO and Association of Communities and Municipalities in the Attica Region (ACMAR))

- 2 projects for 2,350,000 residents of 71 local authorities.
- It is estimated that in 2007 the collected paper quantities will be increased by 30% (by optimising the collection systems and using more bins).

Recycling projects in Thessaloniki (Association of Local Authorities of the Greater Thessaloniki Area and Municipality of Thessaloniki)

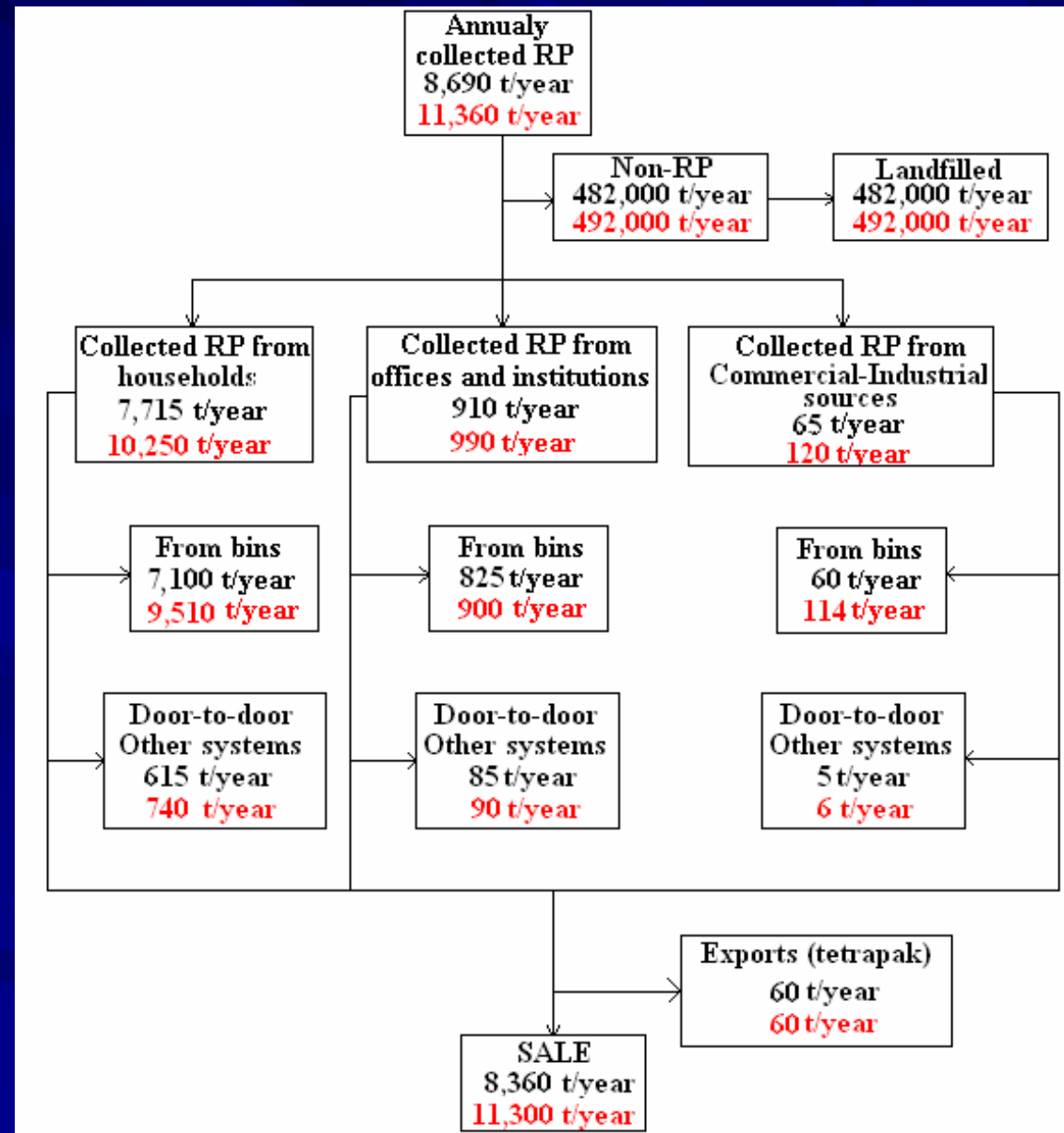
- 2 projects for 1,000,000 residents.
- It is estimated that in 2007 the collected paper quantities will be increased by 20% (co-operation between the Association and HERRCO, more bins).

7.1 Hellenic Recovery Recycling Corporation (HERRCO)



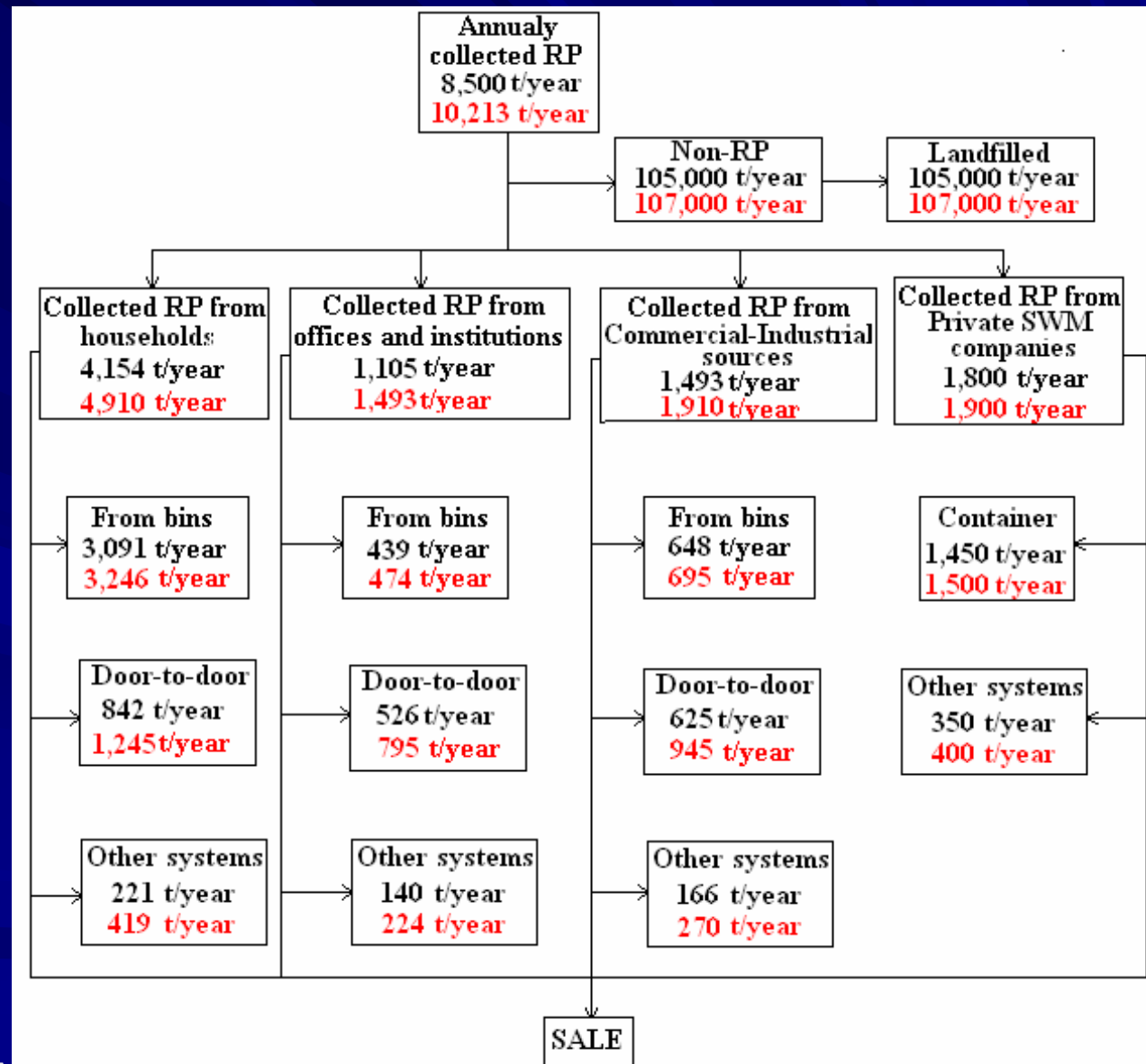
Current situation (2005)
(2007)

7.2 Paper Recycling Projects in Athens (HERRCO & ACMAR)



Current situation (2005)
(2007)

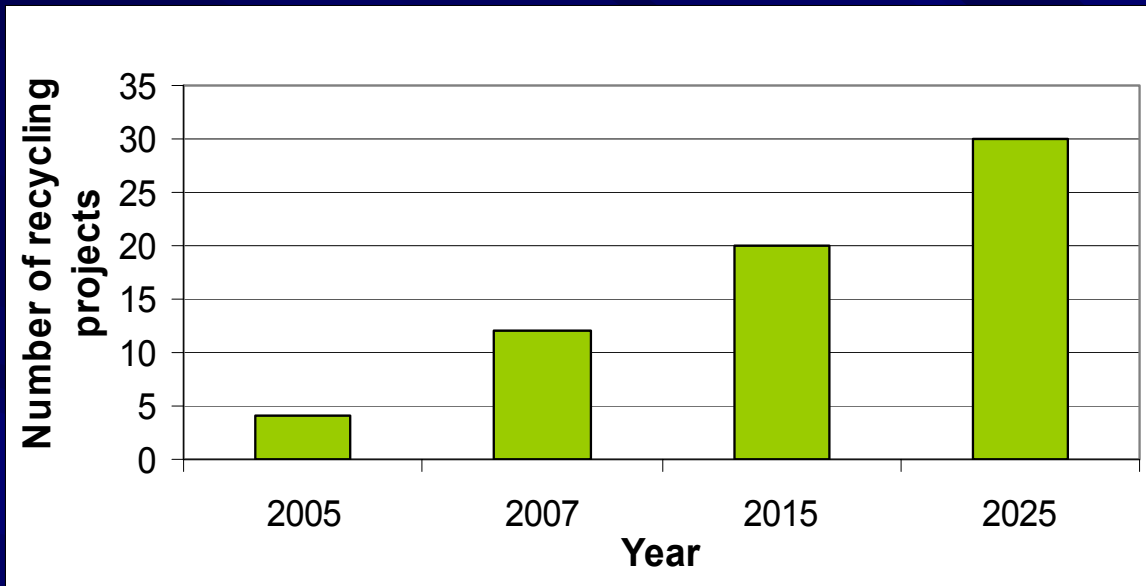
7.3 Paper Recycling Projects in Thessaloniki (HERRCO & ACMAR)



Παρούσα κατάσταση (2005)

Πρόβλεψη (2007)

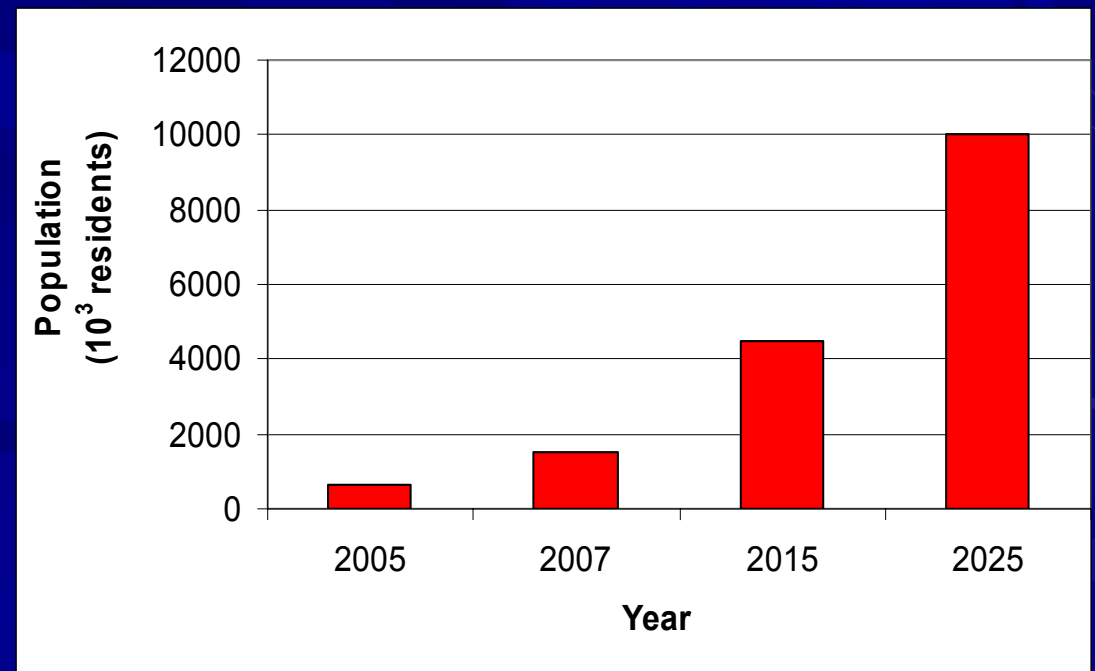
7.4 Future of Paper Recycling Projects (from HERRCO) in Greece



Future plans for recycling projects in Greece.

Future plans for population coverage from recycling projects in Greece.

It is estimated that after 2020, the annually collected RP from these projects, will be more than 400kt

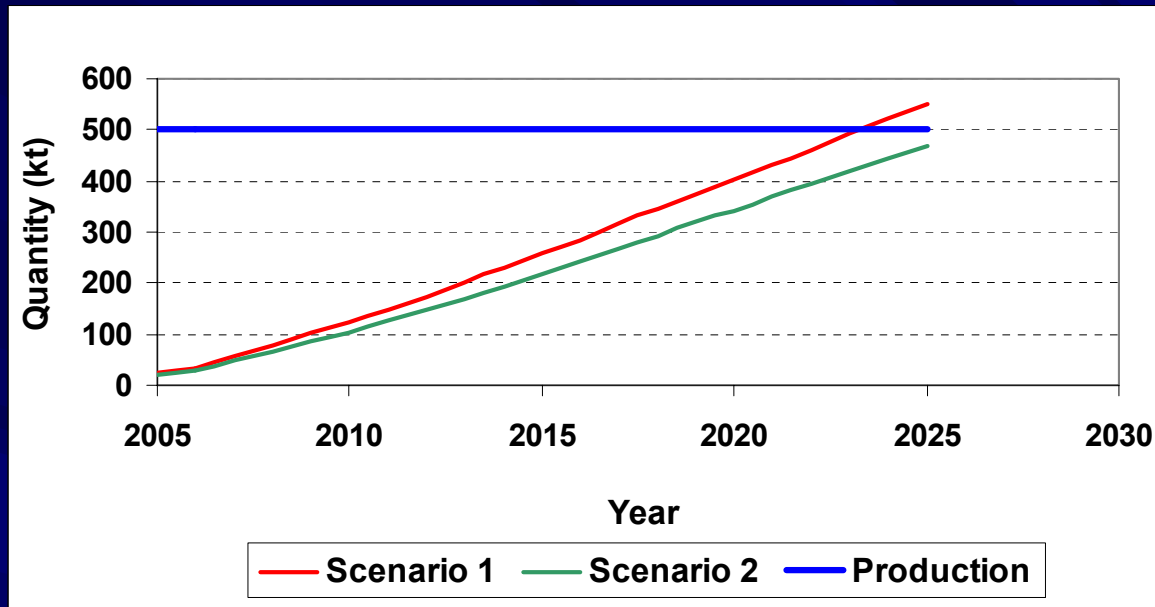


7.5 Future of the Hellenic paper industries

According to the Hellenic Association of Paper Industries:

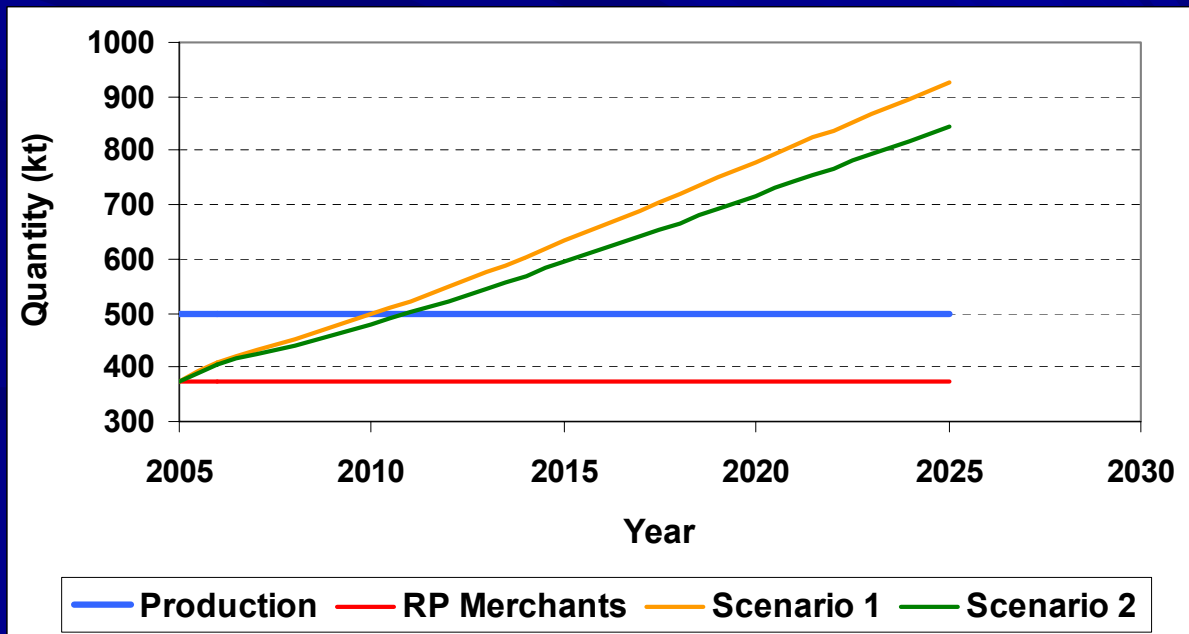
- The paper and board production is not expected to be dramatically increased.
 - The current situation (available equipment, lack of policy and lack of motives from the government) shows that it is difficult to invest in order to increase the collection of recovered paper to be used in paper production.
 - It is estimated that the collected recovered paper will be much more than the domestic demand, thus, the more collected recovered paper will be exported to other countries (Turkey, Bulgaria, Italy) or used in applications outside paper industries.

7.6 Future of Paper Recycling in Greece



A. Steady paper & board production and 2 scenarios on the increased collection of recovered paper from paper recycling projects in Greece (optimistic and less optimistic scenario of collection).

B. Steady paper & board production and 2 scenarios on the increased collection of recovered paper from paper recycling projects in Greece and steady collection from paper merchants (375kt, 2003).



8. Results – Europe

(1/2)

Paper & board market

- Production increased more than 1/3 during 1993-2003.
- It is estimated to reach 115 Mt in 2020 from 95 Mt in 2003.
- Europe is the bigger exporter worldwide.
- Europe exports recovered paper but imports significant amounts of chemical pulp.

Collection of recovered paper

Collection rate

1985: 34% (15 Mt).

2003: 57% (48 Mt).

2020: 66% (68 Mt).

- Differences on the extent of collection among the countries of Central and North Europe and those from South.

Utilization of recovered paper

Utilization rate

1985: 34% (16 Mt).

2003: 47% (44,6 Mt).

2020: 56% (64 Mt).

- Increasing collection, the utilization of recovered paper is also increased (and vice versa).

Paper recycling

- Recycling rate 53,2% to 2003.
- EU target for the recycling rate: 60%, 2008.
- EU targets: for packaging paper and board. No legislation in force for printing and graphic paper.

9. Results – Greece

(1/2)

Paper & board market

- Production

1998: 515 kt.

2003: 495 kt.

- Paper & board imports

1994: 690 kt.

2003: 783 kt.

- Greece exports recovered paper (62 kt in 2003).

Collection of recovered paper

The collected amounts of paper have been increased due to the Law 2939/01.

- Collection rate

1998: 22% (250 kt).

2003: 33,3% (407 kt).

- It is estimated that the collection rate will further be increased.

Utilization of recovered paper

Utilization rate

1998: 56% (290 kt).

2003: 69,7% (345 kt).

Paper recycling

▪ Recycling rate

1991: 19,3% (116 kt).

2003: 28,2% (345 kt).

- 85% of the collected paper (407 kt) was recycled in 2003
- According to the EU legislation for packaging waste, the target for paper and board is: 15% recycling up to 2006.
- No existing schemes for alternative uses of recovered paper (outside paper industries).

Thank you for your attention!