

中技社 物質流研討會

物質流分析工具及資料庫需求

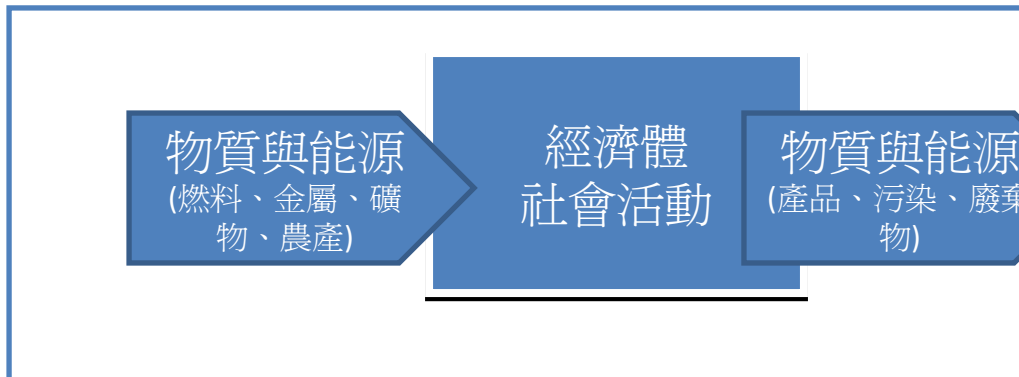
馬鴻文

台大環境工程學研究所

物質流簡介

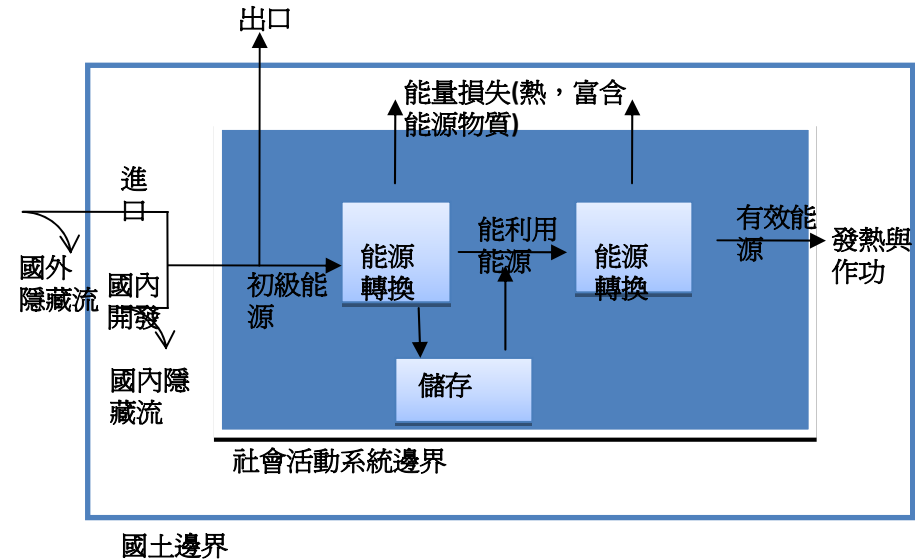
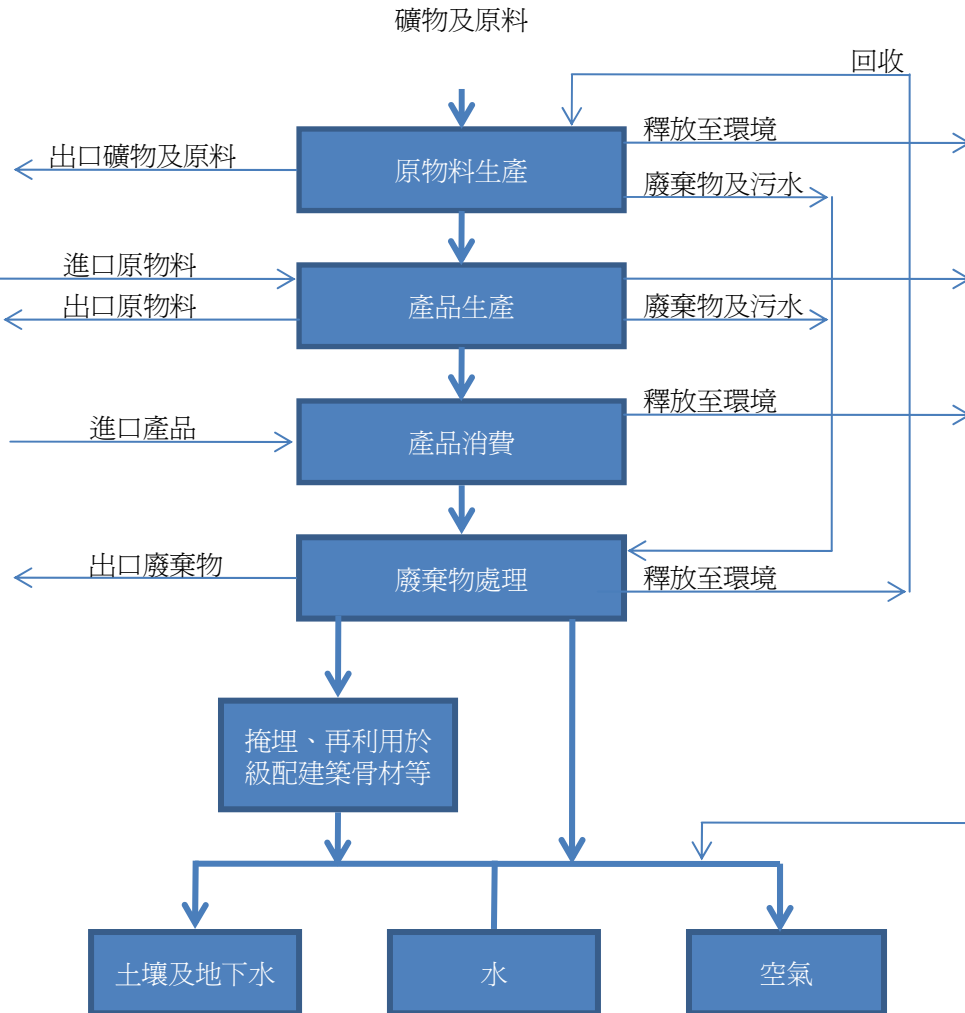
物質流分析

- 資源使用導致：
 - 資源匱乏
 - 物質及能量擾動所帶來之環境惡化
- 永續或循環型社會
 - 物質和能量的管理以提升資源利用與環境維護效率
- 評量經濟體內物質及能源的流布轉換



物質流簡介

物質流與能量流的系統



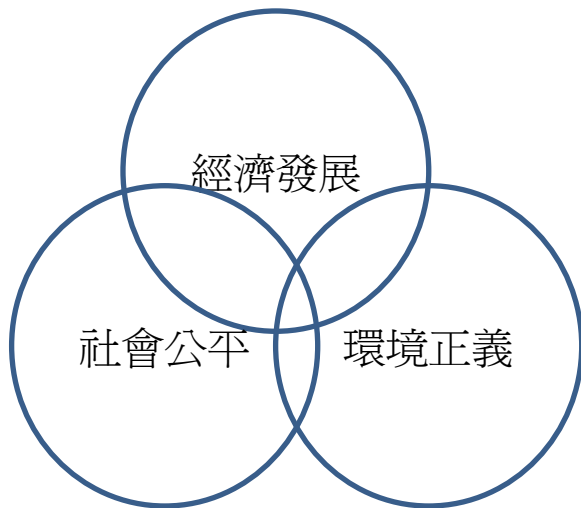
物質流簡介

物質流的尺度

尺度	例子	資料特性	策略規劃	探討物質舉例
區域	台灣	總體物質資訊	區域物質整合管理； 產業結構調整； 永續消費	砂石；石化產品； 金屬；再生能源； 廢棄物
產業	鋼鐵產業	相關資訊之整合	供應鏈管理； 生態工業園區； 技術標竿	廢棄物；水；工業 排放物質
製程	化學工廠	細部資訊	製程最適化； 清潔生產； 技術及能源效率	原料；燃料；電力

物質流應用

物質流與環境



環境問題	牽涉物質
氣候變遷	碳
臭氧層破壞	NO _x 、CFCs
優養化	氮鹽、糧食生產
酸雨	硫、氮
毒性物質	重金屬、有機物、燃料
資源耗竭	資源物質
土地破壞	化石燃料、金屬礦、土石資源
廢棄物質管理	廢棄物
世代環境公平	總物質消費
區域的環境正義	總物質消費

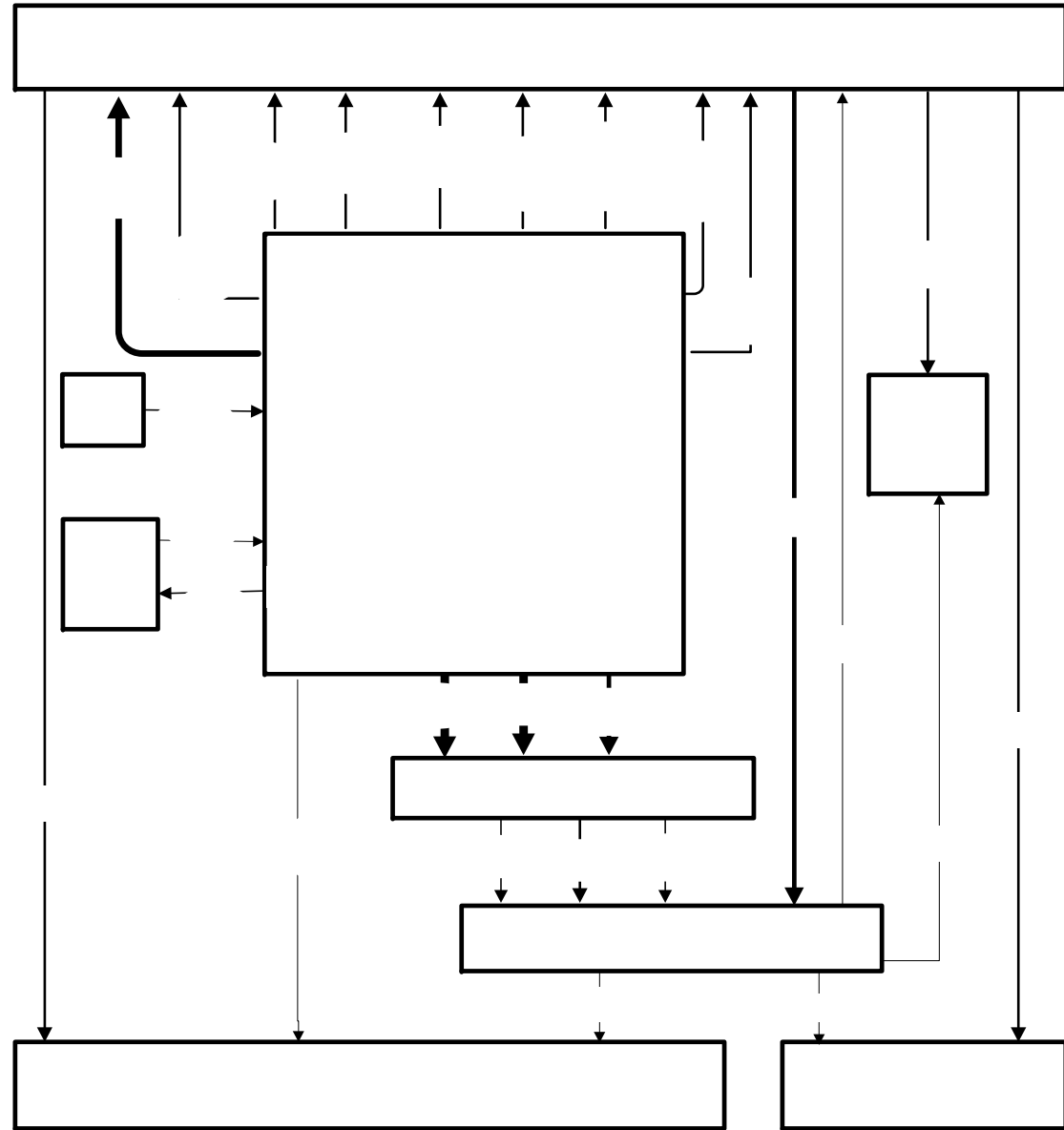
物質流應用

各國的物質流分析

國家	物質流分析經驗
奧地利	纖維、肥料、塑膠、PCB、Zn、Ag、Pb、N及有機碳等
丹麥	偶氮染料、溴化耐燃劑、石蠟、戴奧辛、氟化烴類、含氯有機溶劑、CFCs、Al、As、Cd、Cr、Co、Cu、Pb、Hg、Ni及Sn等
德國	環境荷爾蒙、Pb、Cu、Cd、Al、N、P、Na、Cl及PVC等
荷蘭	重金屬、營養鹽、含氮化合物及PVC等
挪威	Cr、As、Cu、Pb、Ni、Zn、含氯溶劑、戴奧辛、溴化耐燃劑，含氯石蠟，全氟磺酸鹽、壬基酚等
瑞典	Cd、Cr、Cu、Pb、Hg、Ni、Zn、Sb、PBDE、PAHs、及新興污染物APA、DEHP、PFOS等
瑞士	Cd、鹵化有機溶劑、戴奧辛、呋喃、溴化耐燃劑、含氯石蠟、廢電子電機產品內的金屬與非金屬元素
我國	鋼鐵、砂石、石化、水資源、農業資源、鉻、鎘、戴奧辛、PET、紙、

物質流應用

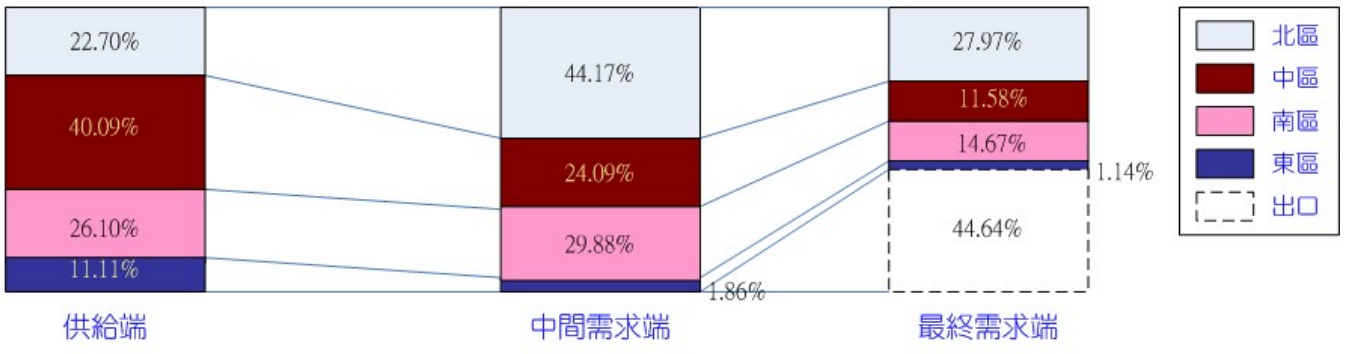
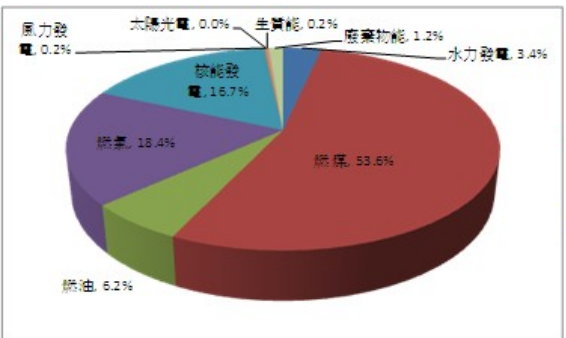
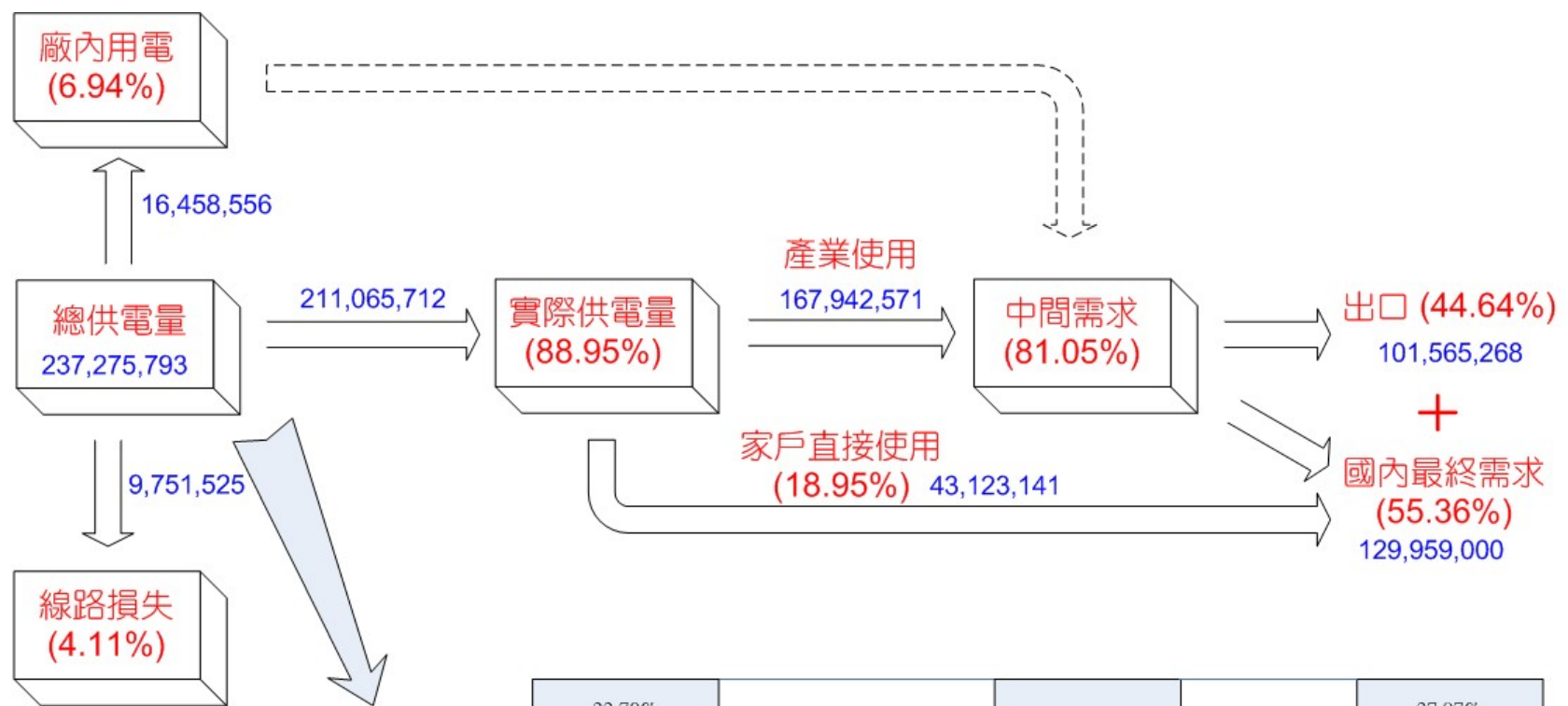
國內應用案例- Dioxins



台灣戴奧辛流佈現況(平均量) (g I-TEQ/yr)

物質流應用

國內應用案例-電力流



物質流資料庫

Hot material and substance

Category	Material (substance)
總體資源	生質, 化石燃料, 砂石, 鋼鐵, 水
元素資源	氮, 磷, 鋁, 銅, 貴重金屬, 碳
毒性物質	重金屬, 戴奧辛, 持久性有機物, 揮發性有機物, 環境荷爾蒙, 農藥, 其他合成化學物質
總體物質	廢棄物, 電子電機產品, 微粒, 塑膠, 紙



資料庫舉例

Theme database	Relevant government agency	Query term
Energy flow	Bureau of Energy(能源局)	Import, type, usage
Electrical appliance	Ministry of economic affair(經濟部)	Eco profile, RoHS restricted substance content, composition
Wood and paper	Council of agriculture(農委會)	import ,production,
Biomass	Council of agriculture(農委會)	Water content, heat value, carbon content
Metals	Bureau of mine礦物局	Import, export, domestic, recycle
Construction aggregate	Bureau of mine礦物局	Import, export, domestic, reuse
Hazardous substance	EPA(環保署)	Mass, waste constituent, industry, facilities, treatment, destination, hazard
Emission factor	EPA(環保署)	Emission per unit production, consumption of raw material, fuel burned, pretax income. Control tech.

進出口, 生產量, 產品成分, 物質型態, 再利用, 回收等



TRI Explorer

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You are here: EPA Home » TRI » TRI Explorer(ver 4.7) » Reports

Bookmark

Toxics Release Inventory

Maps

Hints for First-time users Assumptions used in the analysis
 This site uses pop-up windows, click here for help on allowing pop-ups from this site [Go To New Report](#)

Reports:

- Chemical
- Facility
- Federal Facility
- Trends
- Geography
- Industry

Maps:

- Dynamic

Year of Data 2006

Geographic Location U.S. by State

Chemical Released Use selected chemical(s)

Industry All Industries

Data Set

The default is the current data update (as of June 11 2008)

Select 2006 PDR data set (frozen on October 12, 2007 and released to the public on February 21, 2008)

Releases

Total On-site Disposal or Other Releases
 Total Off-site Disposal or Other Releases
 Total On-and Off-site Disposal or Other Releases

http://www.epa.gov/cgi-bin/tri.getcounties?report=maps&scriptname=maps&state=c_tabrpt=1&c_chk0=false&c_chk1=false&

EPA TRI Explorer | US EPA - Mozilla Firefox

http://www.epa.gov/triexplorer/chemist.htm

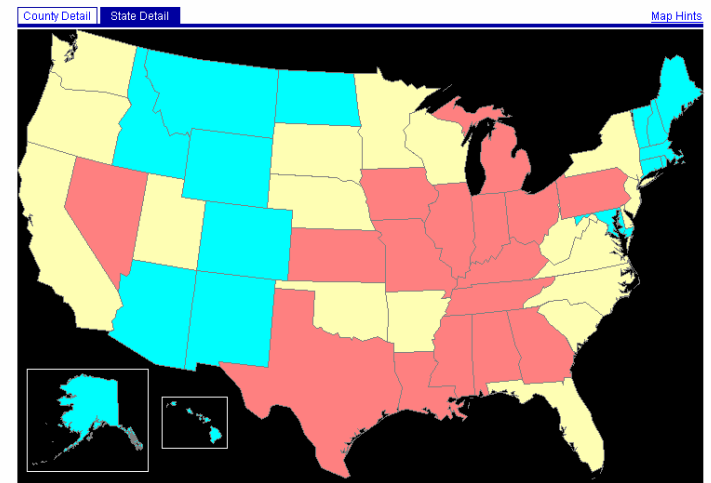
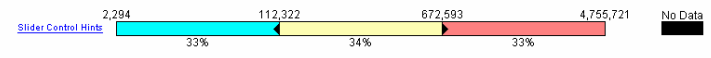
Select one or more chemicals

Click a chemical to select

- Mecoprop (listed 1995)
- Melamine (delisted 1988)*
- Mercury
- Mercury Compounds
- Morphos (listed 1995)
- Methacrylonitrile (listed 1994)

Click a chemical to deselect

Mercury

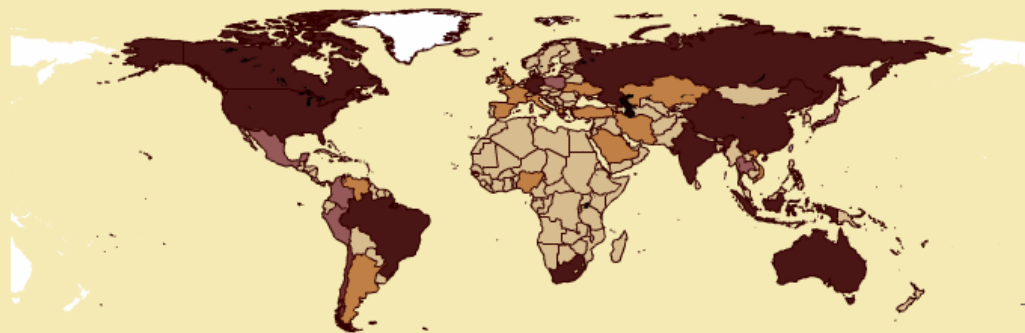


Sustainable Europe Research Institute

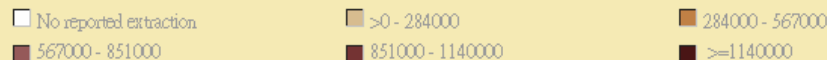
Visualising Global Resource Extraction

Domestic Extraction:
 Reference Parameter:
 Resource Group:
 Resource Sub-Group:
 Year:

Used extraction in 2005 (in kt)



© Sustainable Europe Research Institute 2008



::Download Area::

You have selected used extraction

Last update: 31/07/2008

Additional download specifications:

Year: from until
 Time Period: Country Group:
 Country:

(.xls format)

Eurostat



View Table Select Data Demo Tour



Material flow accounts

Interactive extraction size limit: 30000

Current extraction size: 360

Selected Update

GEO MA MFC TIME UNIT

Show all Search

<input type="checkbox"/>	Code	Label
<input checked="" type="checkbox"/>	MA_0	Total
<input type="checkbox"/>	MA_1	Biomass
<input type="checkbox"/>	MA_2	Minerals
<input type="checkbox"/>	MA_3	Fossil fuels

UNIT: 1000T - Thousands of tons

MA: MA_0 - Total

MFC: DE - Domestic Extraction

time	1993A00	1994A00	1995A00	1996A00	1997A00	1998A00	1999A00	2000A0
geo								
EU15	4713803.30	4877486.64	4842995.98	4821997.56	4838575.23	4841399.22	4924358.93	4934518.
BE	115279.54	123940.24	120083.51	119821.55	118546.18	114279.49	118239.00	115075.
DK	94440.68	98244.03	104244.26	108729.23	117288.35	112170.21	130077.50	124121.
DE	1307125.46	1375592.73	1335468.74	1306020.55	1286092.96	1250588.34	1284086.67	1243620.
IE	61043.38	63507.65	69262.53	71593.18	68131.22	68634.38	71727.33	72908.
GR	154916.41	156412.82	154395.86	159950.13	160633.54	173217.82	176823.72	181465.
ES	395604.07	395993.66	406903.86	432284.60	437800.19	468455.16	468839.47	500120.
FR	752993.62	762301.17	758427.68	729139.27	744927.30	751481.60	757620.27	779978.
IT	461462.80	462591.15	458194.39	460333.91	457838.97	461090.31	464092.99	470366.
NL	176316.11	183902.63	173284.59	197359.84	188627.13	184998.30	177110.25	162900.
AT	123217.24	130347.92	124780.10	123631.80	130823.56	121175.02	123480.89	119168.
PT	83017.07	85591.75	86970.54	99694.30	105976.33	106858.93	106527.04	119294.
FI	139409.42	154485.49	153737.63	143682.88	154856.06	154624.84	167767.44	171989.
SE	180249.16	179449.05	193629.33	173136.76	169747.25	179704.89	175754.89	192936.
UK	668728.33	705126.35	703612.94	696619.57	697286.20	694119.93	702211.46	680571.

No footnotes available

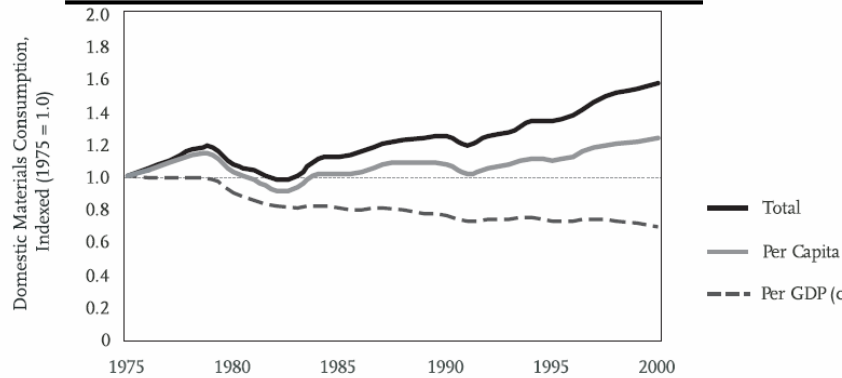
物質流工具的尺度與物質組合

Level of analysis	Substances	Material groups		All material groups and monetary flow
Products/ Firm	SFA	<i>Micro-MFA</i> LCA, MIPS		
Sectors	SFA/EIO	<i>Meso-MFA</i> MFA of selected sectors or activity fields		<i>Integrated economic and environmental accounting</i>
		PIOT	EIO-LCA	NAMEA
Region/Nation	<i>Partial Macro-MFA</i> SFA	<i>Macro-MFA</i> Economy wide MFA		SEEA

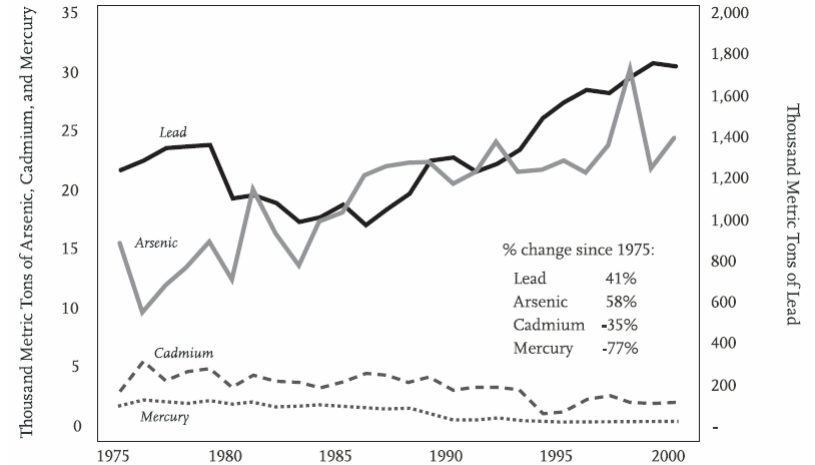
物質流工具

物質流時間序列

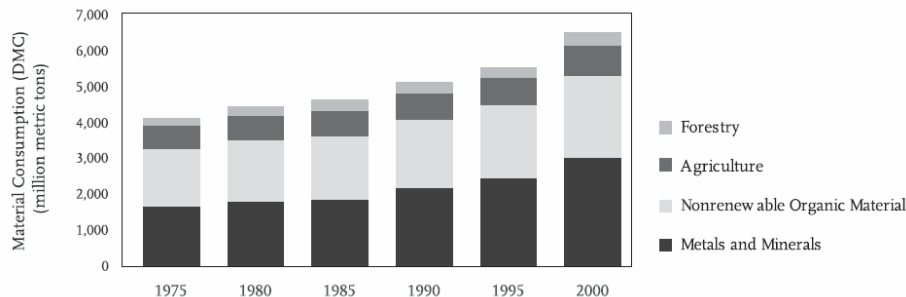
人均與單位產值的流量比較



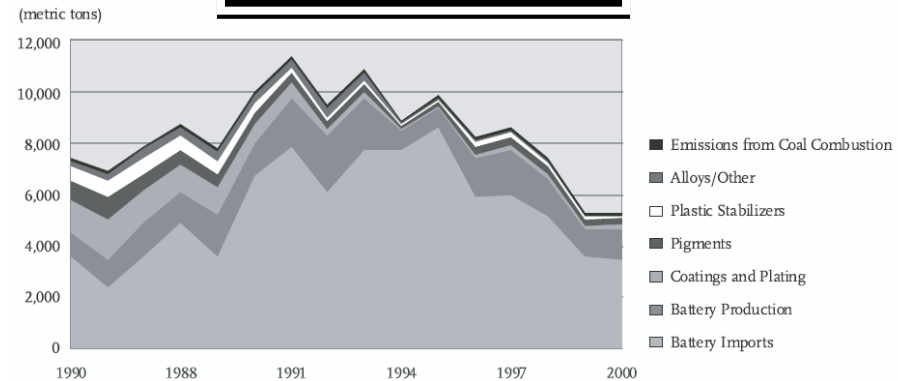
多項物質的比較



產業需求的比較



各種應用的比較



資料來源:
World Resource Institute

物質流工具

物質流指標

指標類別	物質流指標		計算公式
	縮寫	全名	
輸入	DMI TMR HF	Direct Material Input Total Material Requirement Hidden flows	DMI=Domestic raw materials+Imports TMR =DMI+HF HF=hidden flows domestic + hidden flows from imports
輸出	DPO DMO TDO TMO	Domestic Processed Output Domestic Material Output Total Domestic Output Total Material Output	DPO=Emissions +Waste DMO=DPO +Exports TDO=DPO +hidden flows domestic TMO=TDO +Exports
消費	DMC TMC	Domestic Material Consumption Total Material Consumption	DMC=DMI-Exports TMC=TMR-Exports-hidden flows exported
收支平衡	NAS PTB	Net Addition to Stock Physical Trade Balance	NAS=DMI-DPO-Exports PTB=Imports-Exports

*In addition, balancing items have to be included:

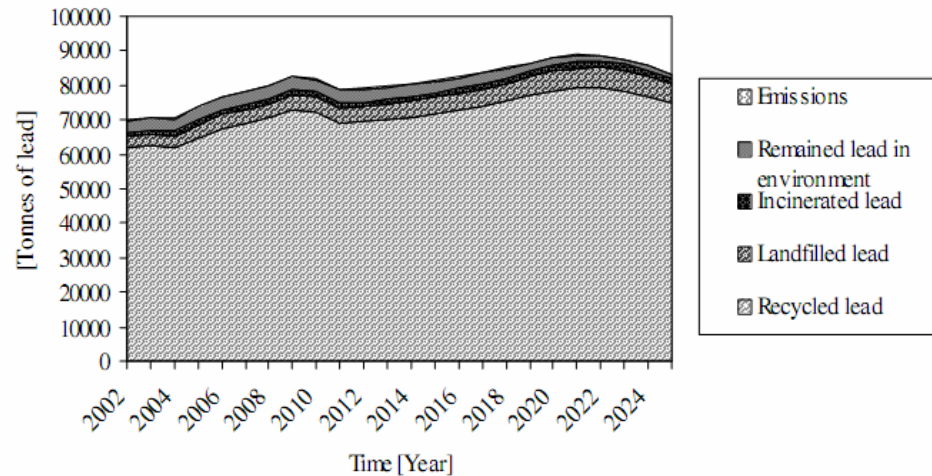
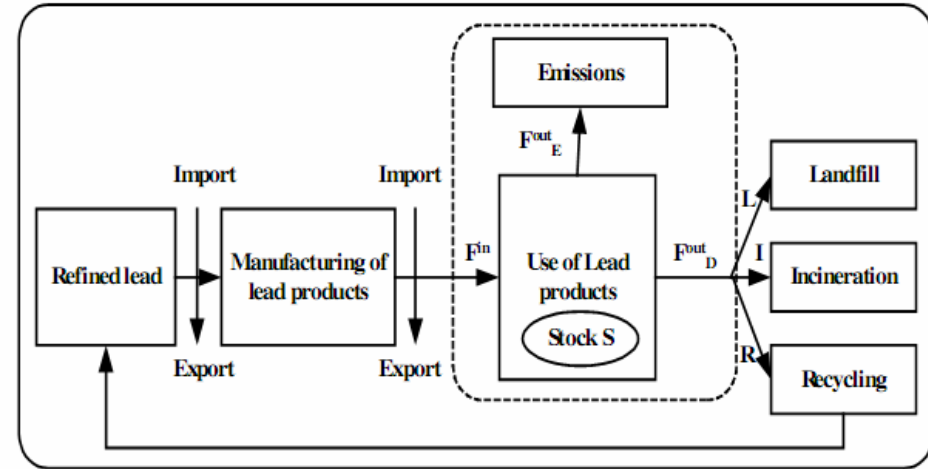
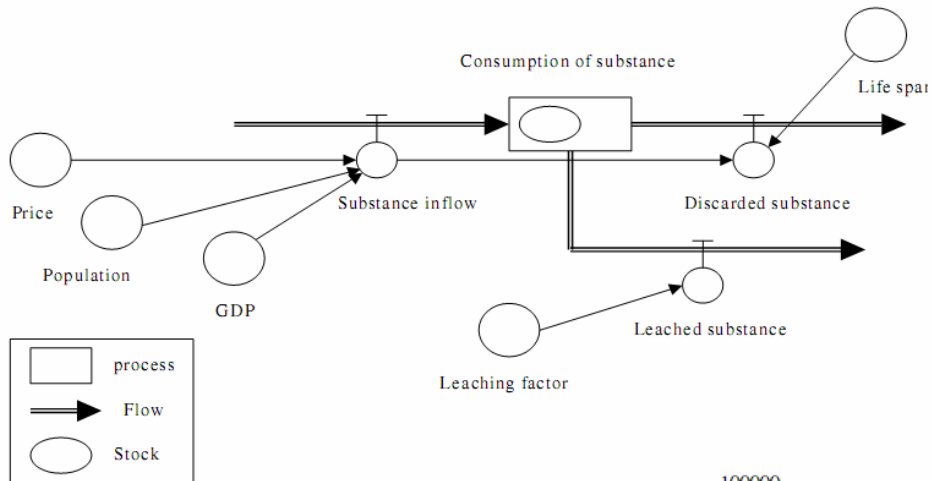
On the input side – oxygen for the combustion of fuels and for the respiration of humans and livestock

On the output side – water vapour from the combustion of fuels and water vapour and CO₂ from the respiration of humans and livestock

(EUROSTAT, 2001)

物質流工具

動態物質流分析



資料來源：Elshkaki(2007)

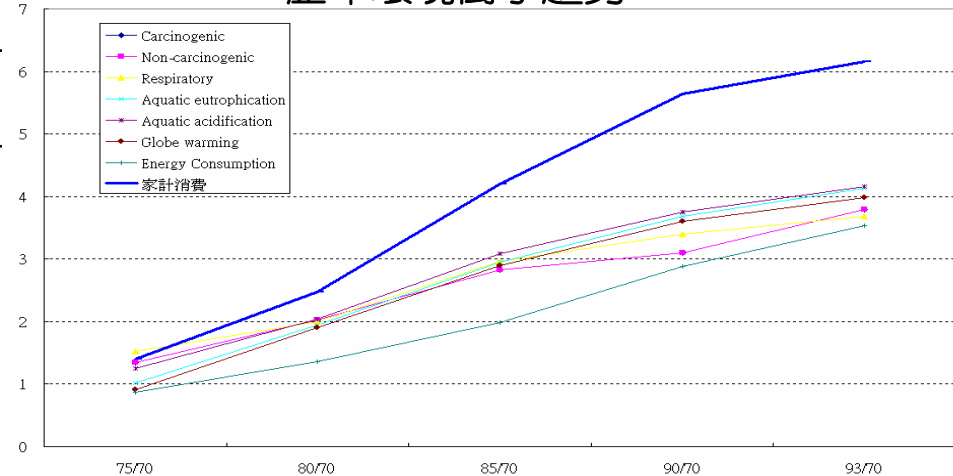
物質流工具

Monetary Input-output analysis & PIOT

	農業	工業	服務業	...		中間需求	最終需求
農業	Z_{11}	Z_{12}	Z_{13}	Z_{1j}			Y_1
工業	Z_{21}	Z_{23}	Z_{23}	Z_{2j}			Y_2
服務業	Z_{31}	Z_{32}	Z_{33}	Z_{3j}			Y_3
...	Z_{i1}	Z_{i2}	Z_{i3}	Z_{ij}			Y_j
原始投入							
最終投入							

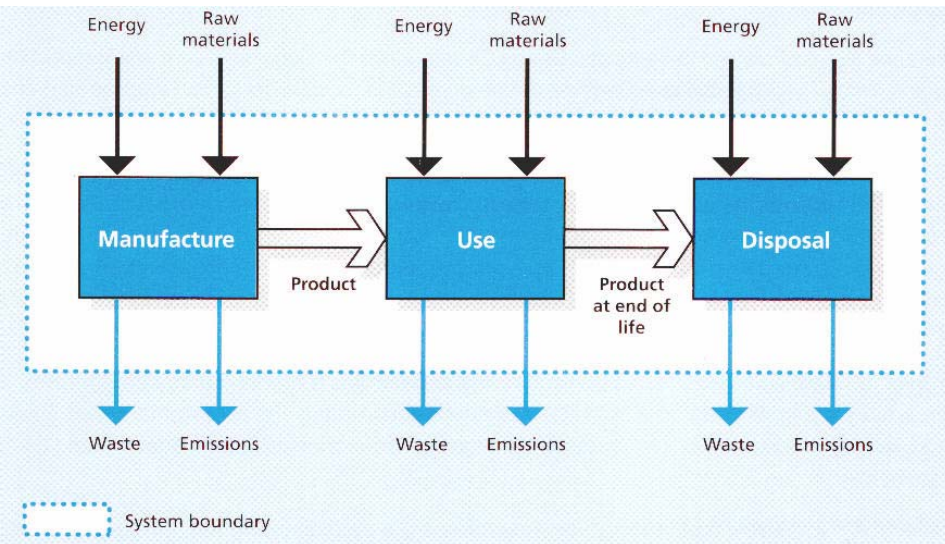
- 計算環境指標與衝擊
- 預測經濟結構與環境品質的連動性
- 產業關聯性分析

歷年環境衝擊趨勢



物質流工具

Life Cycle Assessment



範疇界定

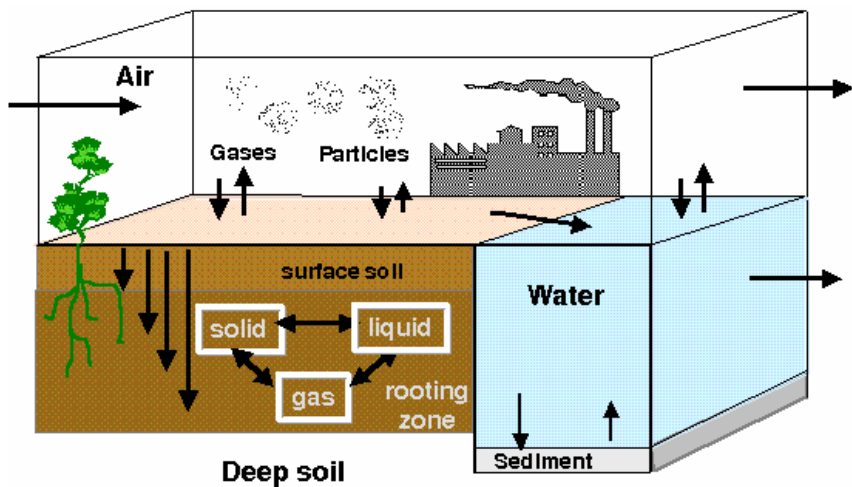
生命週期盤查

生命週期衝擊評估

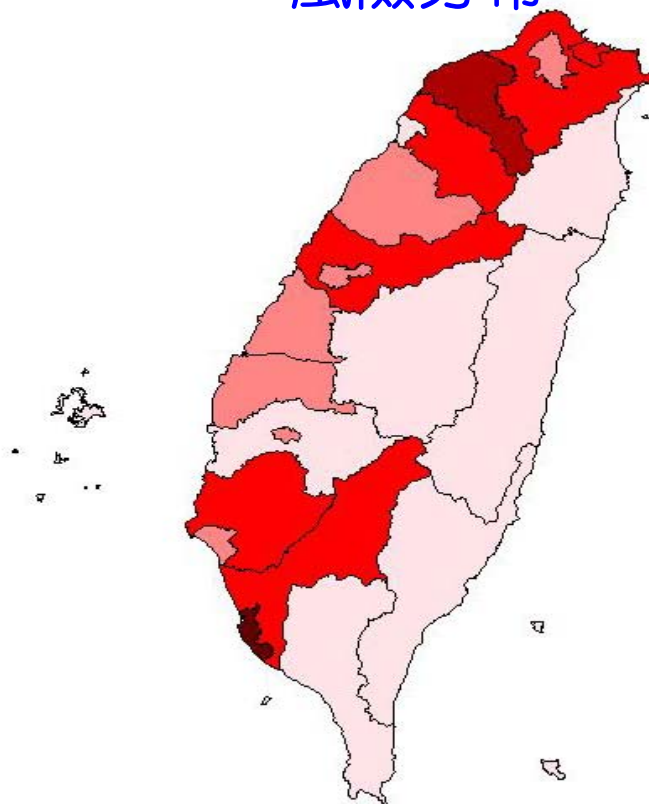
結果闡釋

Environmental Risk Assessment

環境介質間的物質流



風險分布



摘自 CalTOX

策略規劃與建議

產官學界之合作

主管機關

指導產業結構

工業生態園區

物質流導向的資料庫及申報系統

物質管理及政策

研究單位

估算我國物質流指標

整合環境系統分析工具

規劃物質流資料庫

決策支援系統

工商事業單位

建立物質能量平衡數據

依物質流建立環境管理系統

供應鏈管理

清潔生產

Thanks for Your Attention