Primary Energy Analysis:

A New Approach beyond Extant Growth Theories

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Material "Production" under the Law of Mass Conservation

Coke (C)
Air(O_2)

Iron Ore (Fe_2O_3)

Blast Furnace

Iron (Fe)

Input

Waste (CO_2)

Σ Inputs = Σ Outputs
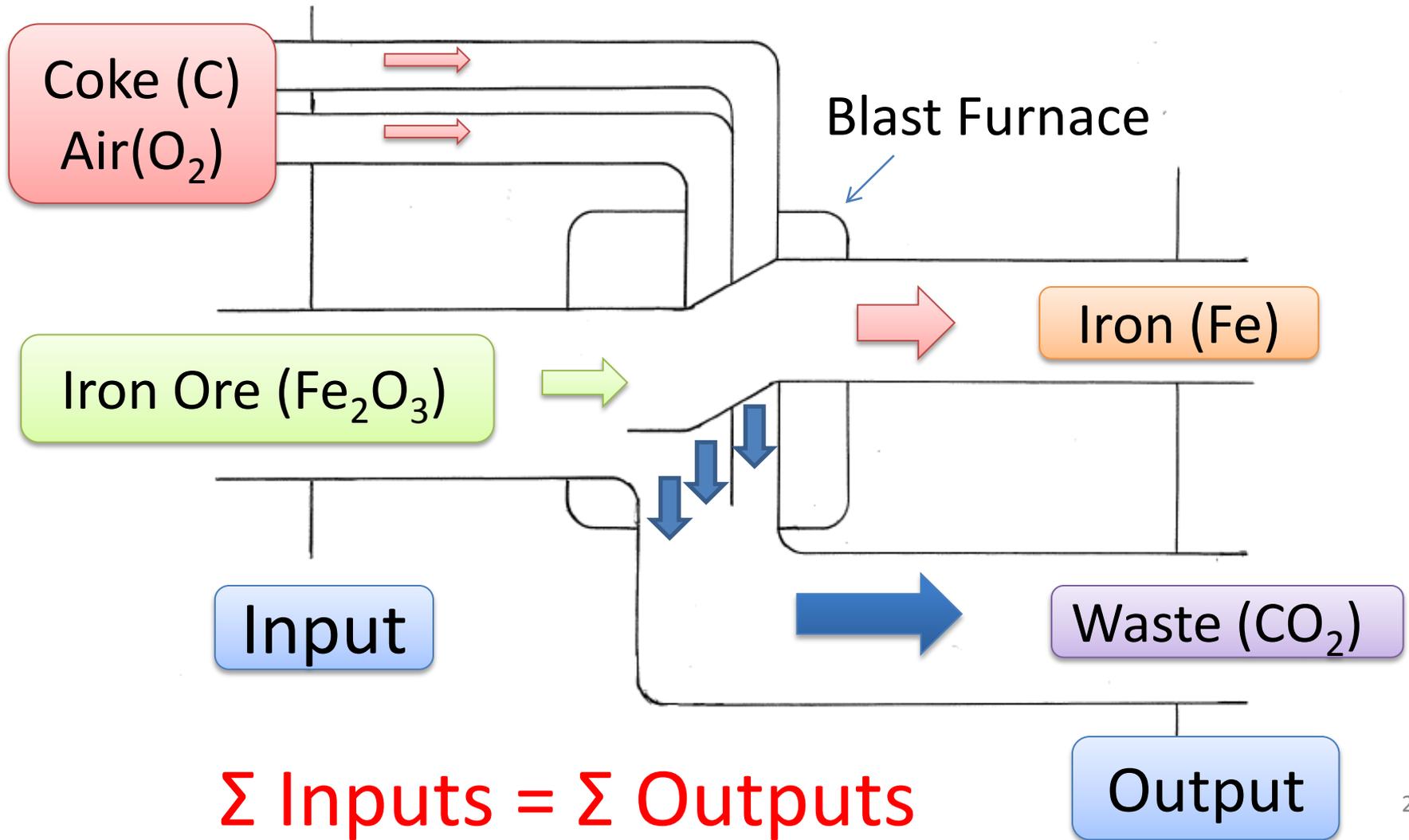
Output

Energy "Production" under the Law of Energy Conservation

The diggings

Energy Invest.

Natural Resources

Energy Return

Available Energy

Waste Heat

Waste Heat

Input
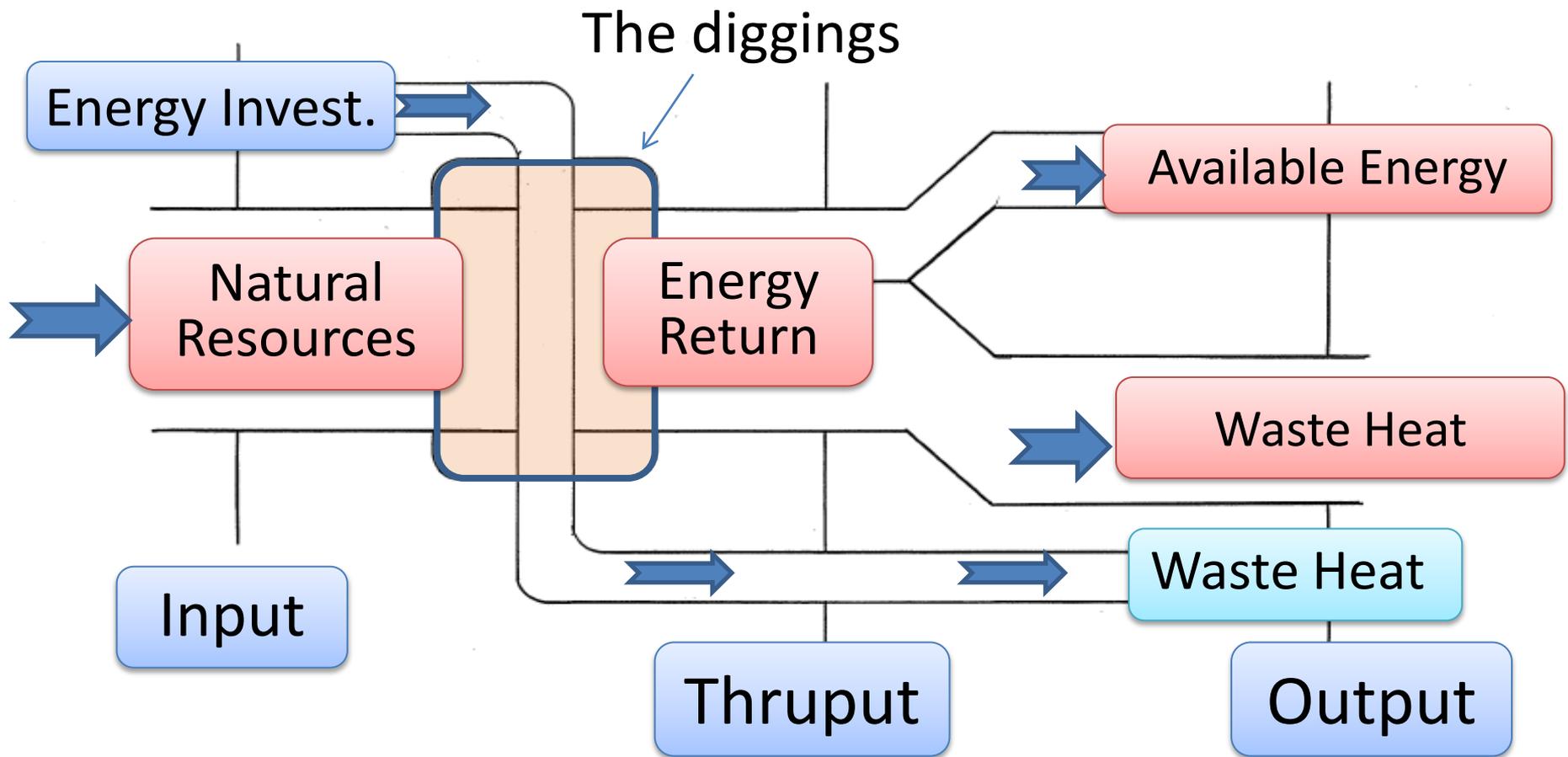
Thruput

Output

Σ Inputs = Σ Thruputs = Σ Outputs

$$\text{ERoEI} = \text{Energy Return} / \text{Energy Invest.}$$

The diggings

Energy Invest.

Natural Resources

Energy Return

Available Energy

Waste Heat

Waste Heat

Input
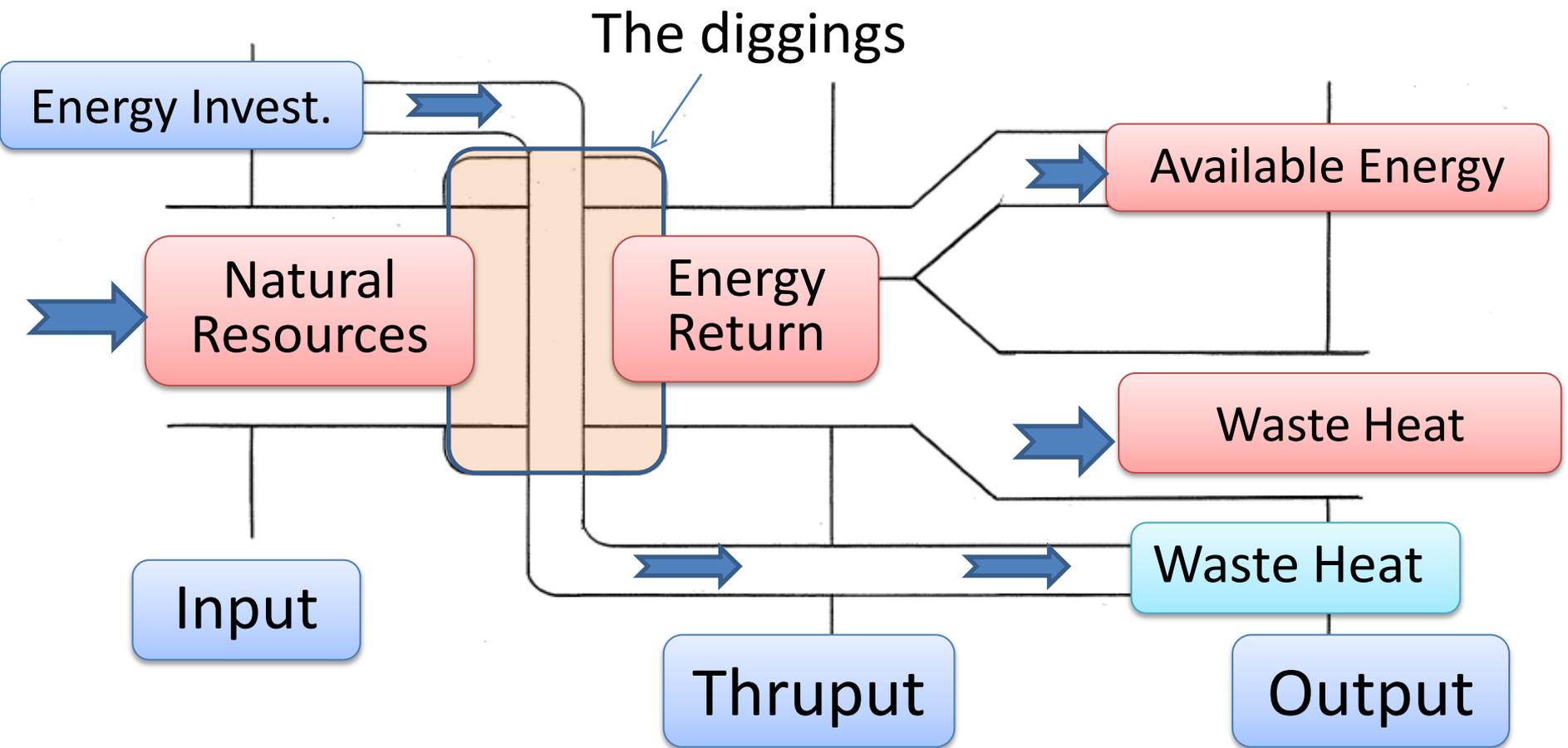
Thruput

Output

Σ Inputs = Σ Thruputs = Σ Outputs

Physical Substance vs
Monetary Expression

Unit Energy Contents

1 toe

The diggings

3 toe

10 toe

10 toe

7 toe

Input 11 toe

1 toe

Thruput 11 toe

Output 11 toe

Face Values on Trial

10K Euro

The diggings

130K Euro

100K Euro

120K Euro

0 Euro

Input 110K

0 Euro

Thruput 120K

Output 130k

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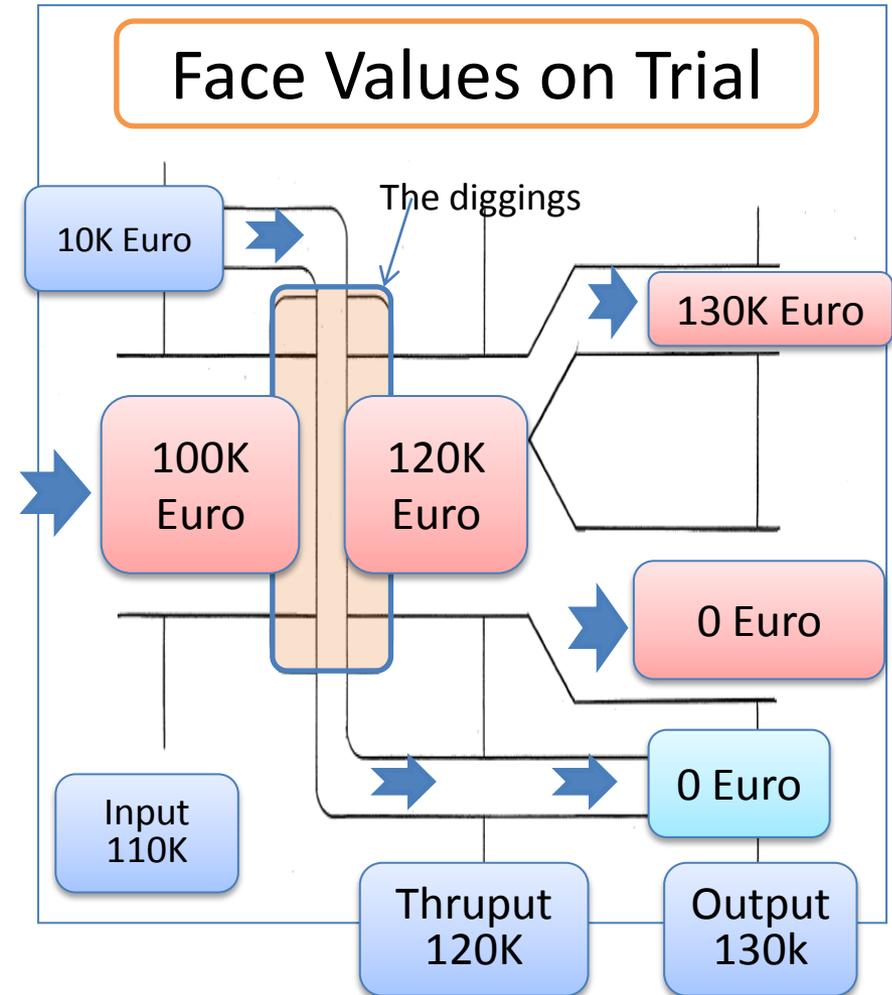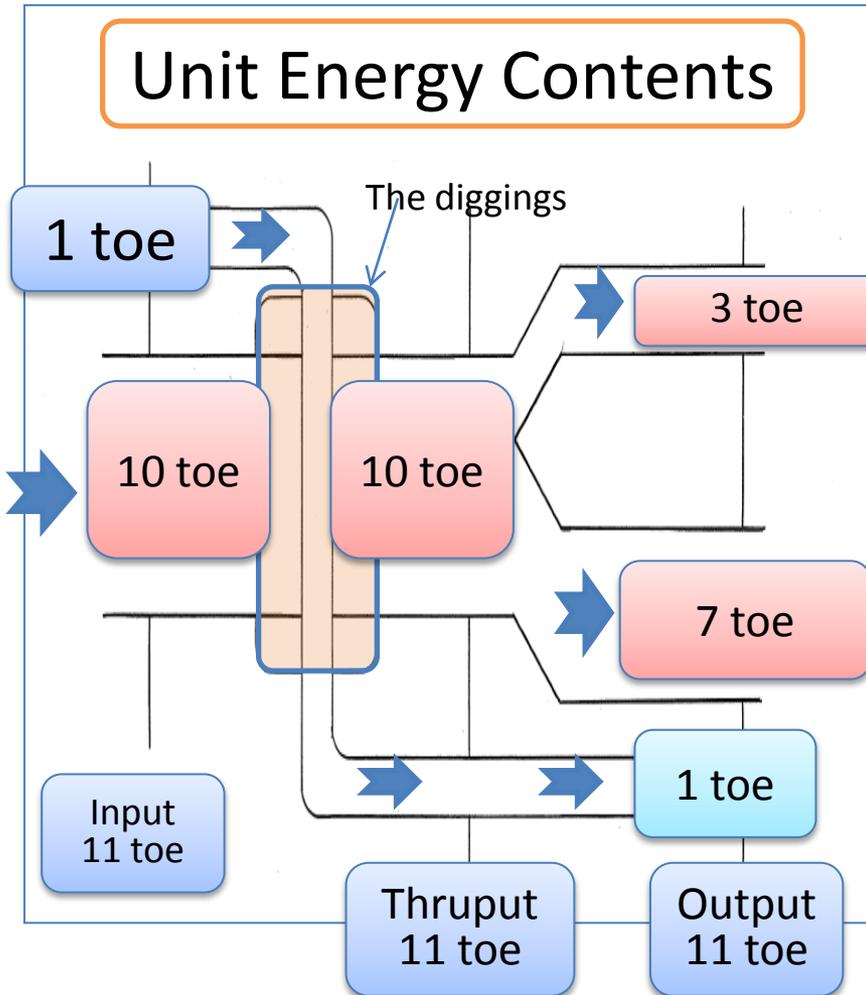
Energy Flows in Japan (2010)

20.8 EJ **(497 Mtoe)**

Power Generation

Nuclear	3.14 **(75 Mtoe)**
Hydro	0.30 **(7 Mtoe)**
Wind	0.01 **(0.2 Mtoe)**
Solar	0.03 **(0.7 Mtoe)**
Waste fuel	0.07 **(1.7 Mtoe)**
Geothermal	0.10 **(2.4 Mtoe)**
Wood	0.23 **(5.5 Mtoe)**
Coal	4.81 **(115 Mtoe)**
Gas	3.60 **(86 Mtoe)**
Oil	8.50 **(203 Mtoe)**

5.52 (132 Mtoe)

3.80 **(91 Mtoe)**

9.34 **(223 Mtoe)**

House hold 2.08 **(50 Mtoe)**

Industrial 3.92 **(94 Mtoe)**

Heat Supply 0.03 **(0.7 Mtoe)**

Business 2.69 **(64 Mtoe)**

Transport 3.22 **(77 Mtoe)**

Captive Consumption 1.52 **(36 Mtoe)**

Waste Energy 12.3 **(294 Mtoe)**

Available Energy 6.65 **(159 Mtoe)**

Organic Materials 1.67 **(40 Mtoe)**

Staristical error 0.18 **(4 Mtoe)**

$1 \text{ EJ} = 1 \times 10^{18} \text{ J}$

Reference: IEA, Energy Balances of OECD Countries 2012. IEA, Renewable Information 2012.
Kondo, Energy and exergy utilization efficiencies in the Japanese residential/commercial sectors, 2009. etc.

Feb. 19, 2013 Y.Takita @Nakata lab.
*Based on IEA statistics

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What GDP shares in the Whole Economy

Contents of Price		Contents of SNA	
Materials cost	→	Intermediate Input/Output	
Labor cost	→	Wages	⎫
Profit	→	Profit	G D P
Depreciation cost	→	Consumption of Fixed Capital	⎭

Aggregation
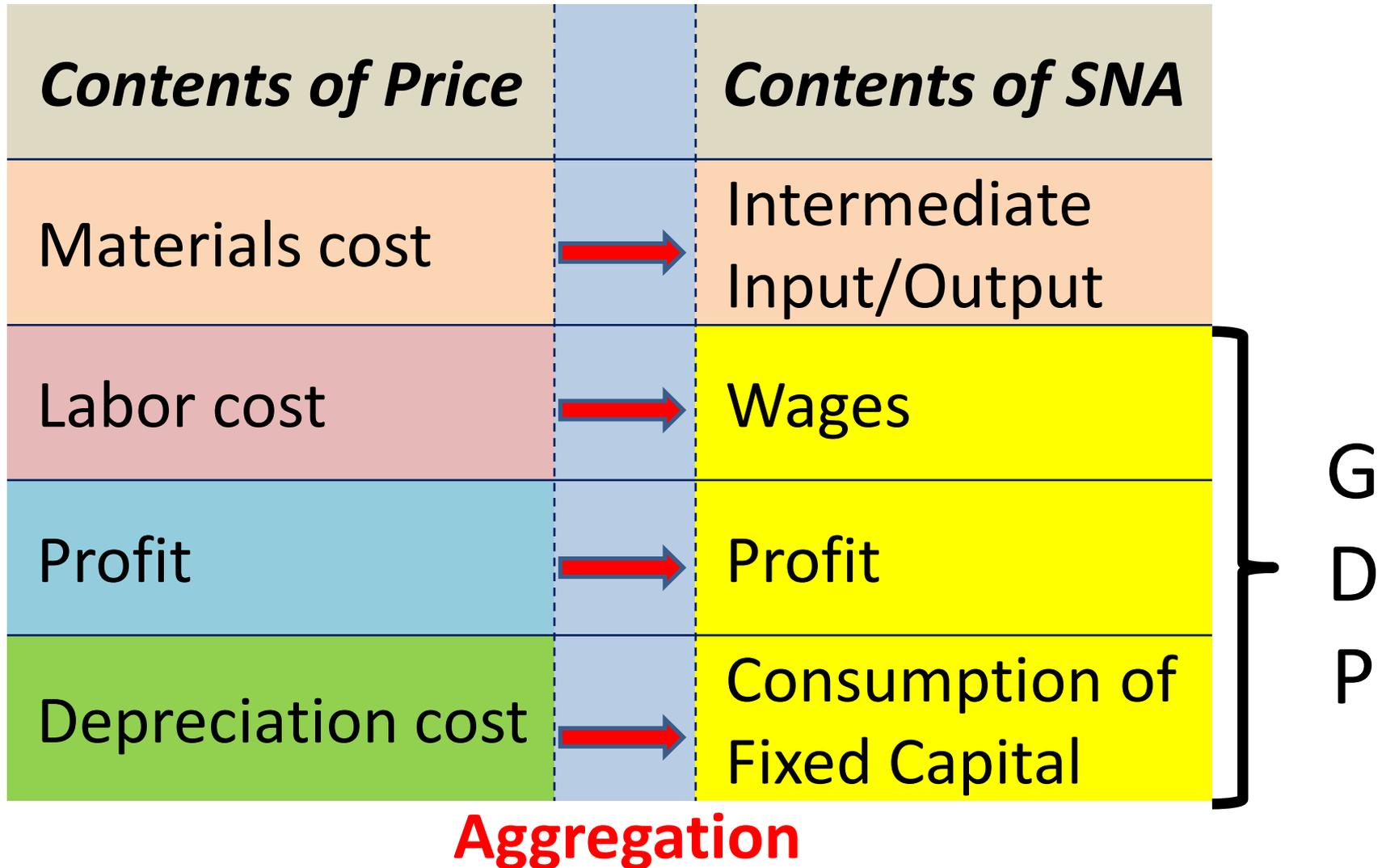
The Structure of the Input/Output Table

Corresponding to Primary Energy Supply

| (A) Intermediate Input/output (449 Trillion Yen)	(B) Final Demands			(C) Import (75 Tr. Yen)	(D) Total Output (A＋B－C) (914 Tr. Yen)
	consumption (370 Tr. Yen)	Capital Formation (96 Tr. Yen)	Export (74 Tr. Yen)		
(E) Added Value — Wages (296 Tr. Yen)	① (D)=(A)+(B)-(C)=449+540-75=914				
Profits (81 Tr. Yen)	② (F)=(A)+(E) =449+465 =914				
Consumption of Fixed Capital (88 Tr. Yen)	③ (D)=(F)				
	④ (A)+(B)-(C)=(A)+(E) ←Total Output				
(F) Total Value (A＋E) (914 Tr. Yen)	⑤ (A)+(B)=(A)+(E)+(C)=449+540=989				

Whole Industrial Production

Correspondence between Monetary Value and E Content Value

ITEM	Monetary Value	Conversion Rate	Energy Content Value
Intermediate Input/output	449 Tr. Yen		226 M toe
consumption	370 Tr. Yen		186 M toe
Capital Formation	96 Tr. Yen	(WIP) 989 Tr. Yen / (PES) 497 M toe = 199 M Yen/toe	48 M toe
Export	74 Tr. Yen		37 M toe
Import	75 Tr. Yen		38 M toe
Wages	296 Tr. Yen		149 M toe
Profits	81 Tr. Yen		41 M toe
Consumption of Fixed Capital	88 Tr. Yen		44 M toe

Japan's PES, WIP and GDP
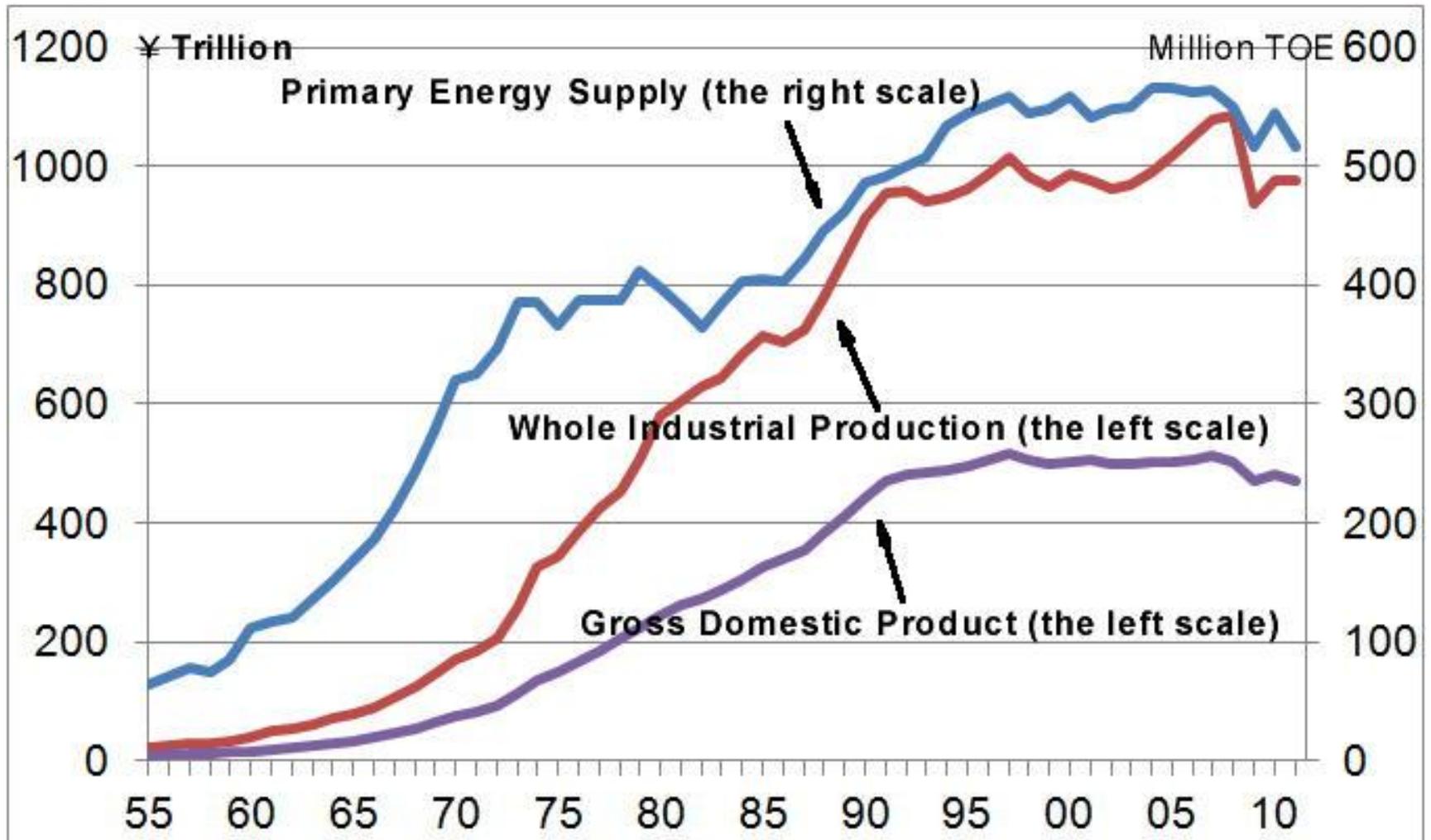
Concluding Remarks

- 1990-91 saw Japan's Bubble Burst: this was the most advanced phenomena against all the other OECD countries.

- 1990s was the age of Massive Spending Policy as an only countermeasure effective (supposedly) to overcome the Bubble Burst recession: but this ended utterly in vain.

- 2000s was the age of record-breaking financial relaxation with virtually zero interest rate and abundant money supply.

- Whatever growth policy the government may take, Japan's economy persisted in a deep slump, as has been notorious.

- This demise from the growth path is considered to be an inevitable result of Japan's industrial history.