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Cogeneration Using Residual Forest Biomass- A Comparative Analysis of Costs of Production (II)

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D F I U
I F A R E

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Agenda

I. Power Production from Biomass

Combustion technologies and technologies under R&D

II. Short overview of small scale biomass CHP

CHP plants in Chile

III. Costs of supply of Biomass

IV. Analysis of a Case of Study in Chile

V. Concluding Remarks

I. Power Production from Biomass

Rankine cycle continues to be the main technology fro small scale CHP production.

i. Pile burners

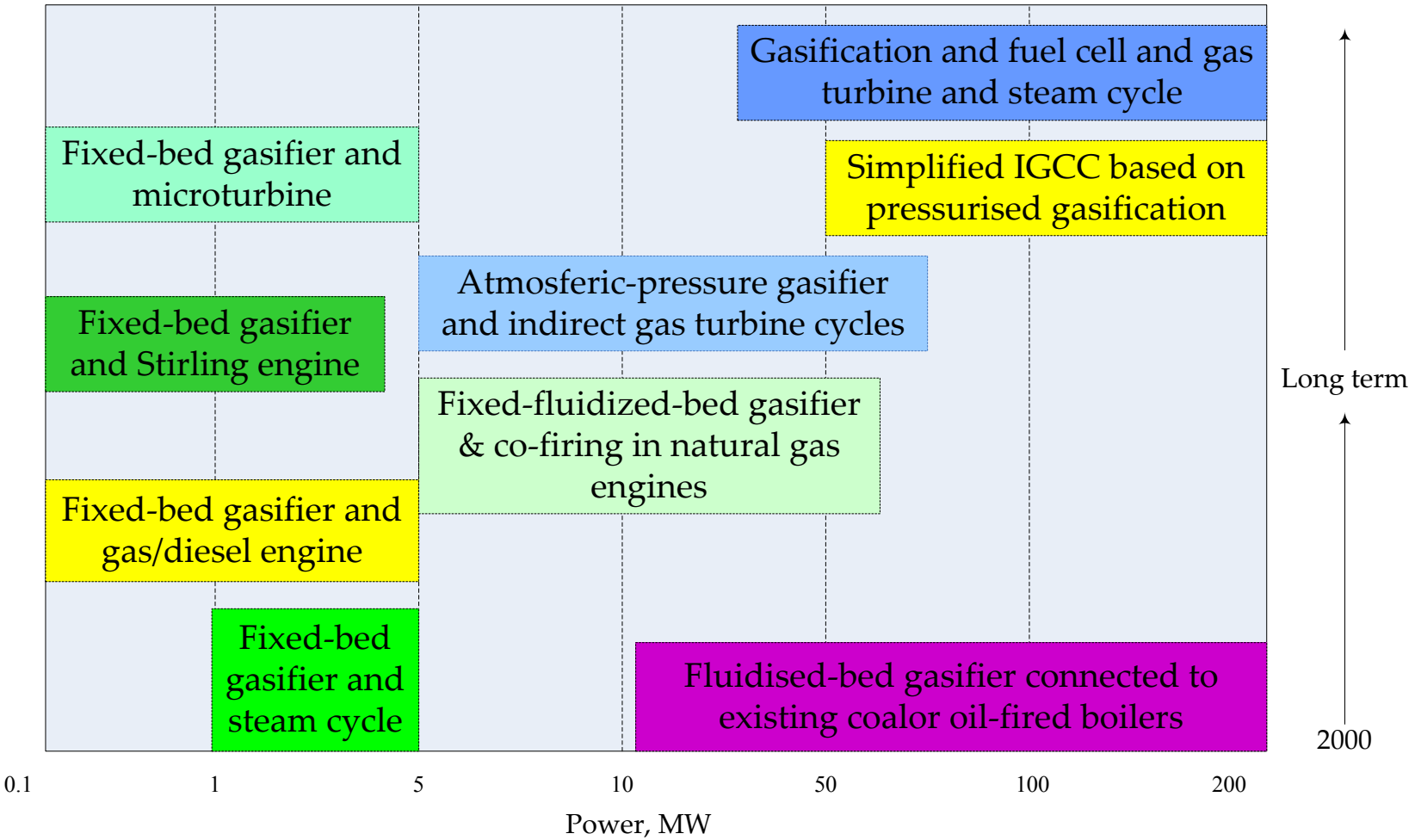
ii. Grate-fired boilers

iii. Suspension-fired boilers

iv. Fluidized-bed boilers

Gasification of biomass, organic rankine cicle (ORC), stirling engines are under R&D. Most of those has not reach commercial maturityn (Kirjavainen et al.; 2004).

Emerging Gasification Technologies for Different Power Plant Size.



Source: Adapted from *OPET Report 12*. European Commission. Directorate Energy and Transport. (2004).

i. Pile Burners

☺ *Fuel flexibility (humidity and size) and simple design.*

☹ *Low boiler efficiency, poor combustion control.*

ii. Grate-fired Boilers

Stationary sloping grate, travelling, and vibrating grate.

☺ *Lower maintenance requirements.*

☹ *Difficult control of the combustion, risk avalanching the fuel.*

iii. Suspension-fired Boilers

Fuel fired as small particle- it burns while is fed into the boiler

☺ *Fuel flexibility (humidity and size) and simple design.*

☹ *Low boiler efficiency, poor combustion control.*

II. CHP Under Operation in Chile

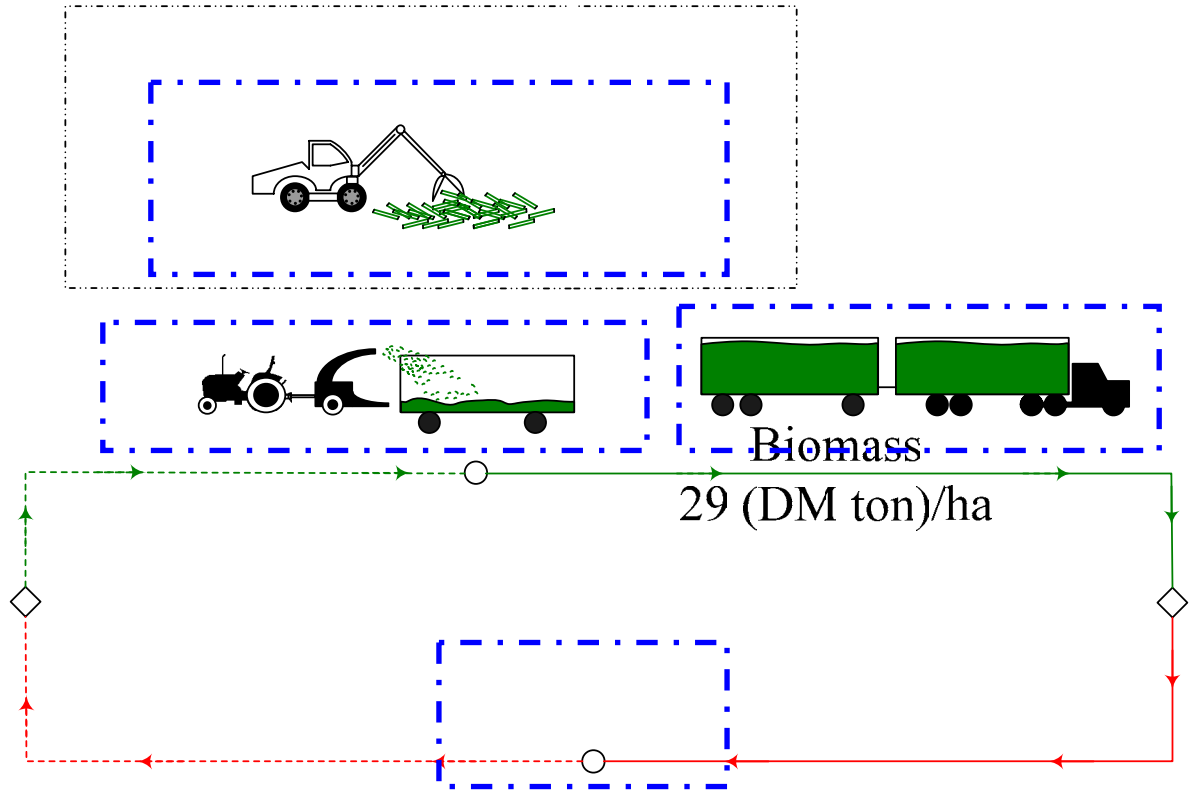
Base year 2007

Plant Name	Owner	Fuel	Power (MWe)
Arauco	Arauco Generación S.A.	Black licor (1)	33.0
Celco	Arauco Generación S.A.	Black licor (1)	20.0
Nueva Aldea III	Cenelca	Black licor (1)	20.0
Cholguán	Arauco Generación S.A.	Forest subproduct (1)	9.0
Valdivia	Arauco Generación S.A.	Forest subproduct (1)	61.0
Laja	Energía Verde S.A.	Forest subproduct (1)	8.7
Constitución	Energía Verde S.A.	Forest subproduct (1)	8.7
Licantén	Arauco Generación S.A.	Forest subproduct (1)	5.5
Nueva Aldea I	Arauco Generación S.A.	Forest subproduct (1)	13.0
CFI Arauco Horcones	Celulosa Arauco y Constitución S.	Forest subproduct (2)	31.0
FPC	Forestal y Papelera Concepción	Forest subproduct (1)	10.0
Masisa Cabrero	Masisa S.A.	Forest subproduct (2)	9.6
CBB	CBB Foprestal S.A.	Forest subproduct (2)	6.3
Total (MWe)			**236**

(1) *Energía Eléctrica*. Informe Annual 2007. INE; (2) Declaración de Impacto Ambiental (www.seia.cl)

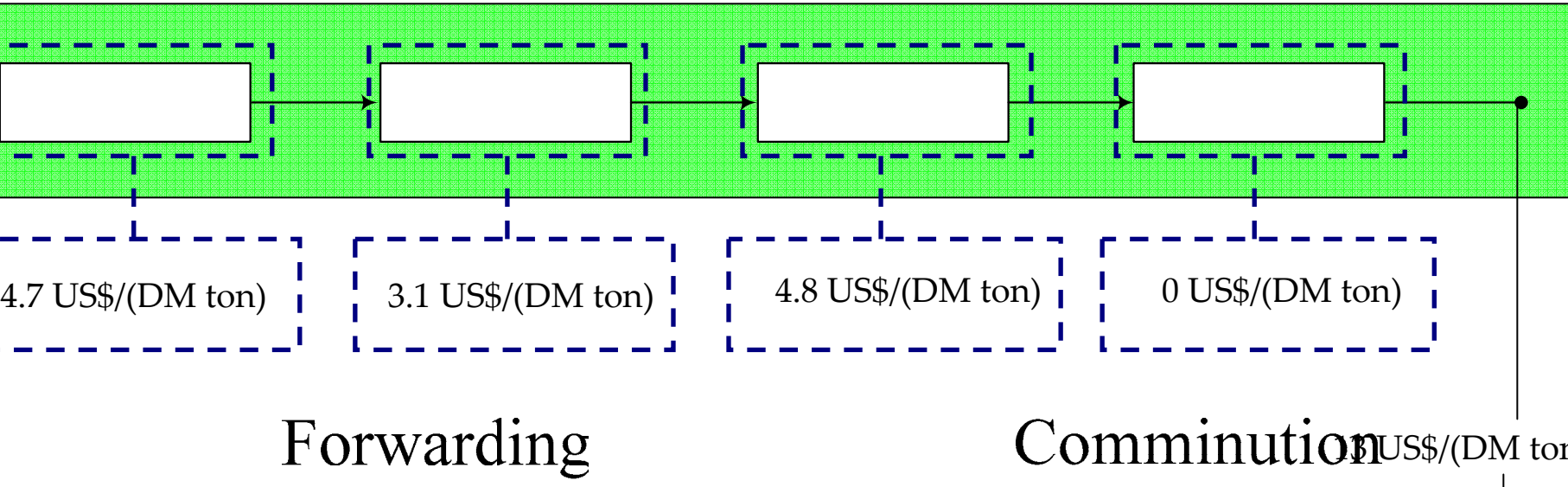
III. Costs of supply of Biomass

From Forest after Harvesting (Bidart and Berg, 2007)



Co

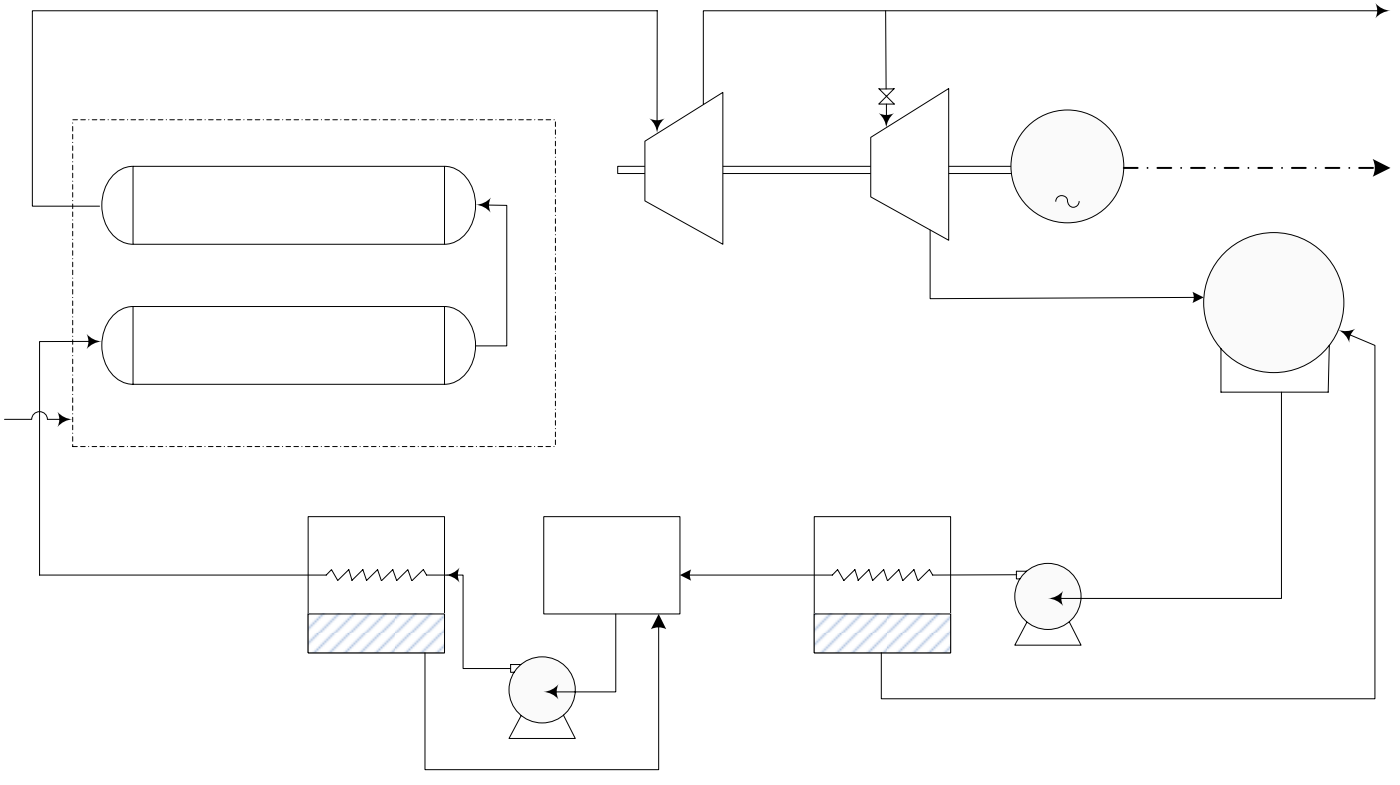
Comminution and Transportation of Forest Residues



Just costs !! – without tax, profitability or others

Metodology adapted from *Production Technology of Forest Chips in Finland*. Finland-VTT (2005)

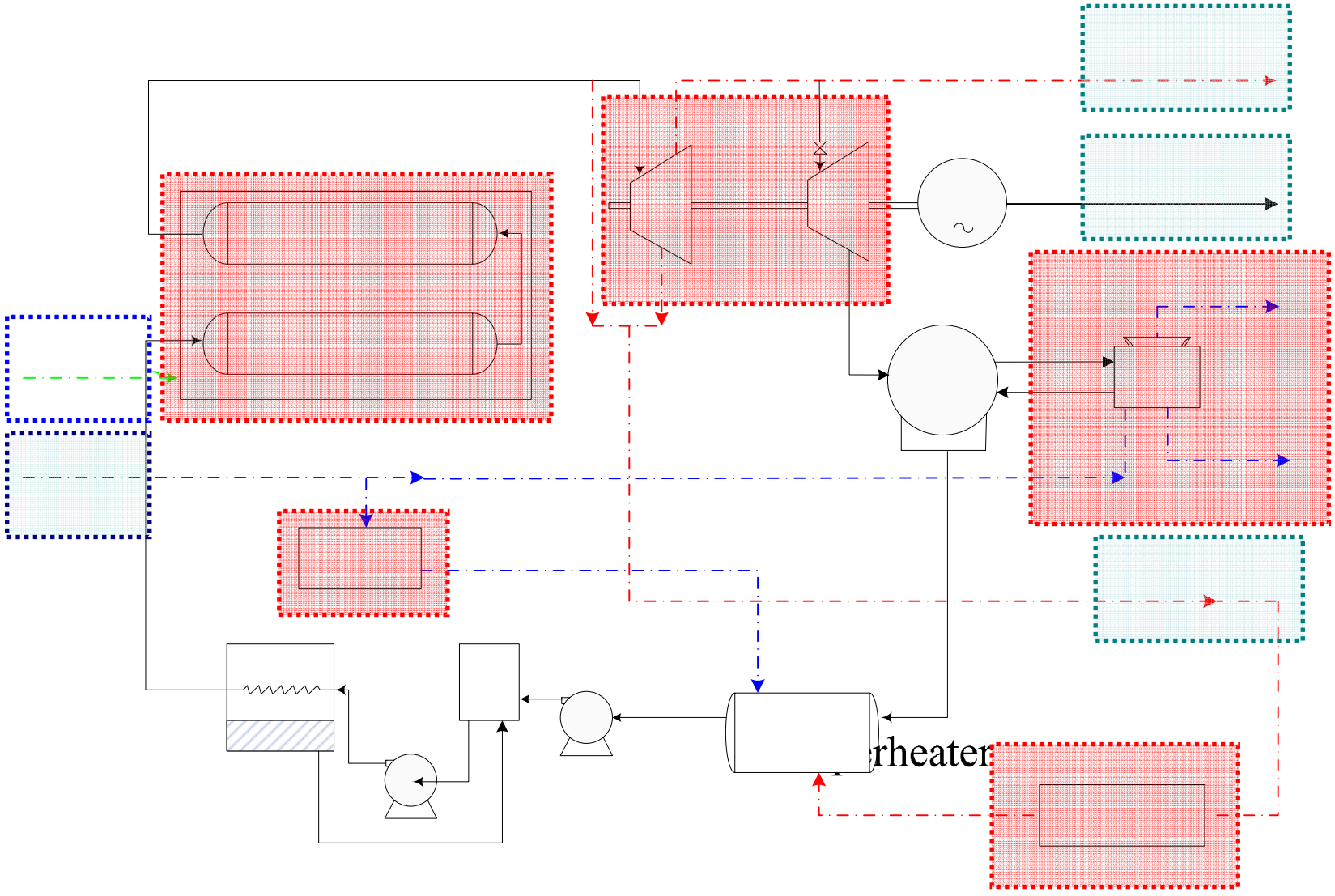
IV. Analysis of a Case of Study in Chile



Main components of a boiler-steam system.

Source: Adapted from *Combined heat and Power Partnership. EPA (2002).*

CHP Process for a Comparative Analysis



Key Aspects for the Assessment

Number of CHP plant : 4 with full M&E balance; 3 with general information

Working hours : 7,200 h/year.

Net electrical power : 4 – 15 MW_e

Steam to process : 9 – 80 ton/hr ; 5 – 25 bar and between 150 °C– 250°C

Labor Cost : four shift of personnel

Non-Fuel Costs : water supply for boiler 2.50– 3.50 US$/$m^3$

water supply for cooling 0.06-0.10 US$/$m^3$

ash disposal 8-10 US$/ton; Sand 10-15 US$/ton

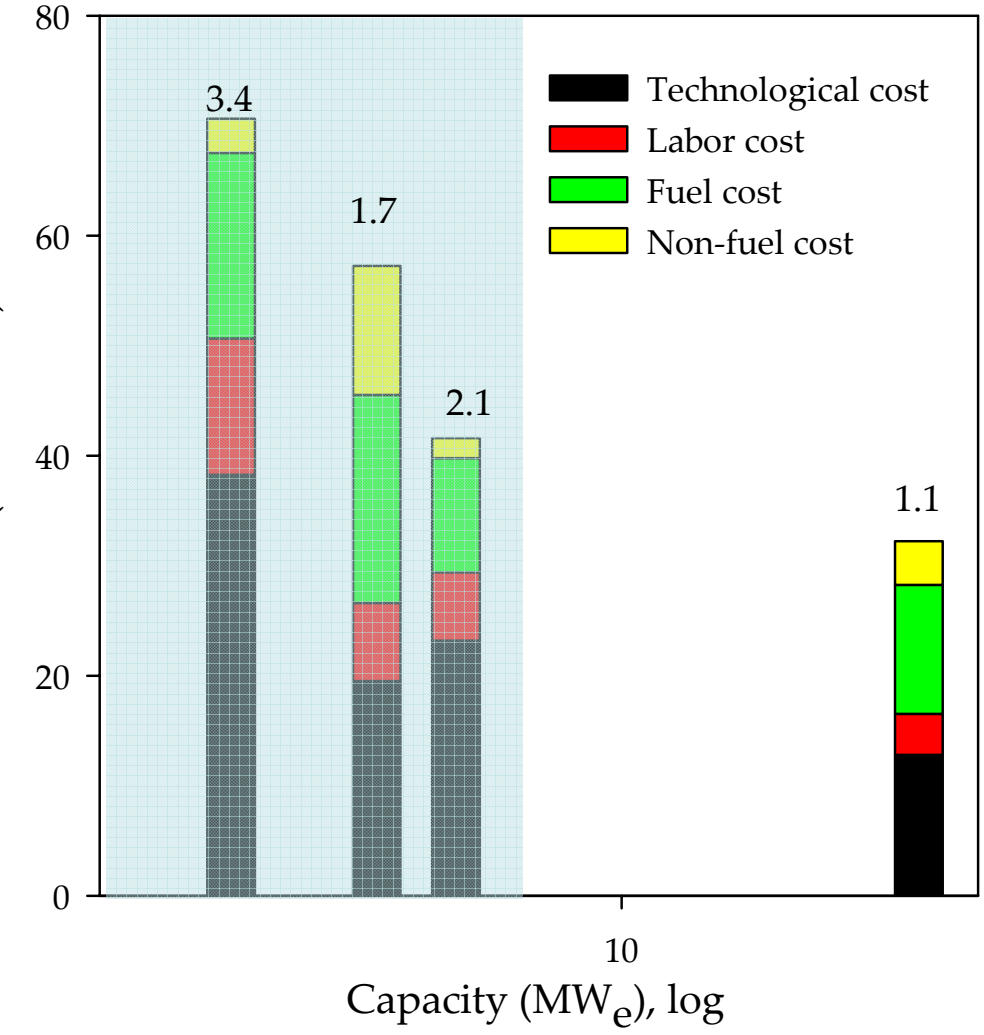
Fuel Costs : biomass with 13 US$/(DM ton)

Maintenance Costs : general maintenance as a percentage of investment

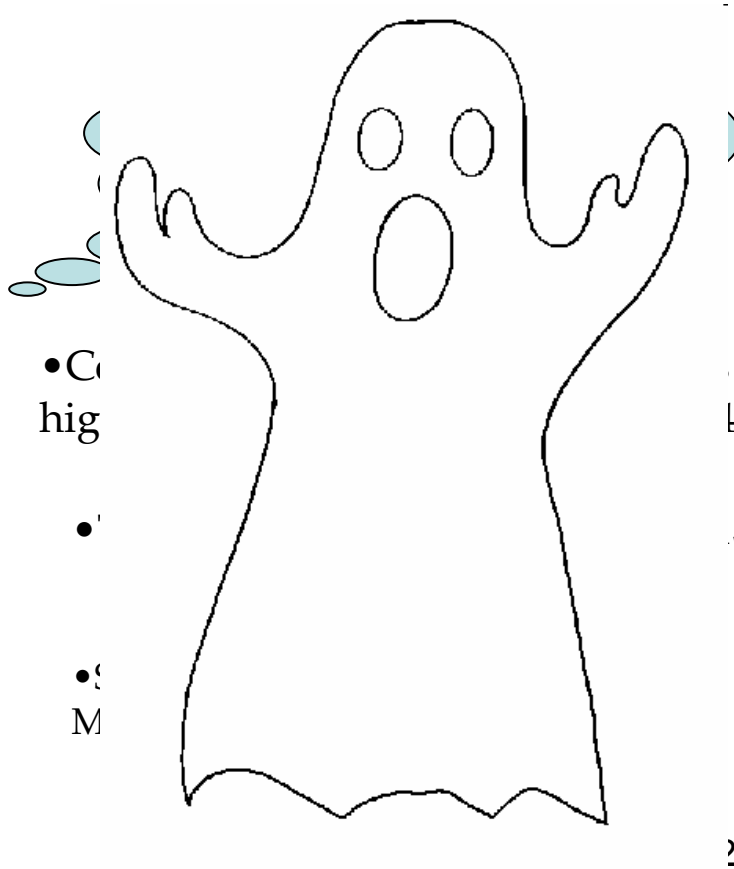
Others : insurance, permissions, e.g.

IV Analysis of a Case of Study in Chile

Economic Assessment of CHP Plants



- Effect of economy of scale is notorious



V. Main Conclusions

- The cost range of electricity production by CHP is from 30 to 80 US$/$MW_e$

(For the economic framework under study)

- Technological cost is the most significant, and it may represent almost 50 % of the unitary cost of production of electricity.

- Cost of residual biomass is still high in comparison with “residues “ commonly used to co-genenerate.

VI. Further Analysis

- What is the "break-point" with the most competitive analogous technology of cogeneration?

- What is the current situation concerning price market?

- Which is a reasonable strategy of commercialization of electric energy under this scenario?

Cogeneration Using Residual Forest Biomass- A Comparative Analysis of Prices (III)

Thanks very much for your attention

And to Conicyt and DAAD

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6 DE FEBRERO DE 2009

LA REDUCCIÓN SE OBTIENE AL COMPARAR CON EL MISMO MES DEL AÑO PASADO

Costo eléctrico de empresas cayó 53,2% durante enero

De acuerdo con un informe de Bice Inversiones, respecto del mes anterior la baja de los costos marginales en el Sistema Interconectado Central (SIC) fue de 9,8%.

La caída en los precios internacionales del petróleo y el aumento de la generación hidroeléctrica son los factores que explicaron la fuerte caída que anotaron los costos marginales del Sistema Interconectado Central (SIC) durante enero.

De acuerdo con un informe de Bice Inversiones, durante el primer mes de 2009, estos costos -a los que está indexado buena parte de los contratos de los grandes consumidores eléctricos- promediaron US$ 117,8 por MWh, lo que representa una baja de 53,2% respecto del mismo lapso de 2008, cuando la media fue de US$ 251,7 por MWh.

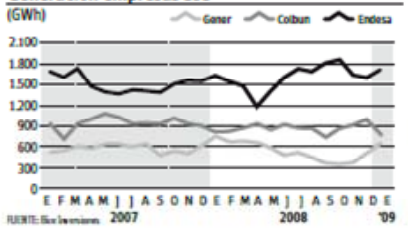
En tanto, si la comparación se realiza respecto del mes inmediatamente anterior, cuando en el SIC los costos marginales promediaron US$ 130,6 por MWh, la reducción corresponde a 9,8%.

Los analistas del Bice advirtieron que pese a que el descenso es importante, este factor sigue estando en un nivel "históricamente elevado".

En lo que respecta a la generación, el documento establece que Endesa fue responsable del 47,8% del total mensual, con 1.706 GWh, lo que representa un alza de 6,5% respecto de diciembre, mientras que AES Gener aportó el 18,2% de la generación del sistema con 649 MWh, un 27,5% más que en diciembre.

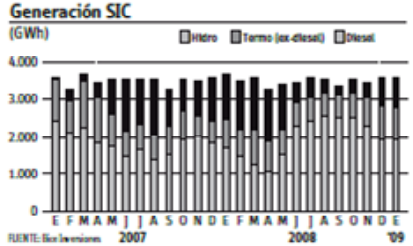
En el sentido contrario,

Generación empresas SIC



FUENTE: Bice Inversiones

Generación SIC



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