



The Restructuring and Privatisation of the Peruvian Electricity Distribution Companies: A Social Cost-Benefit Analysis:

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- The market structure
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General information



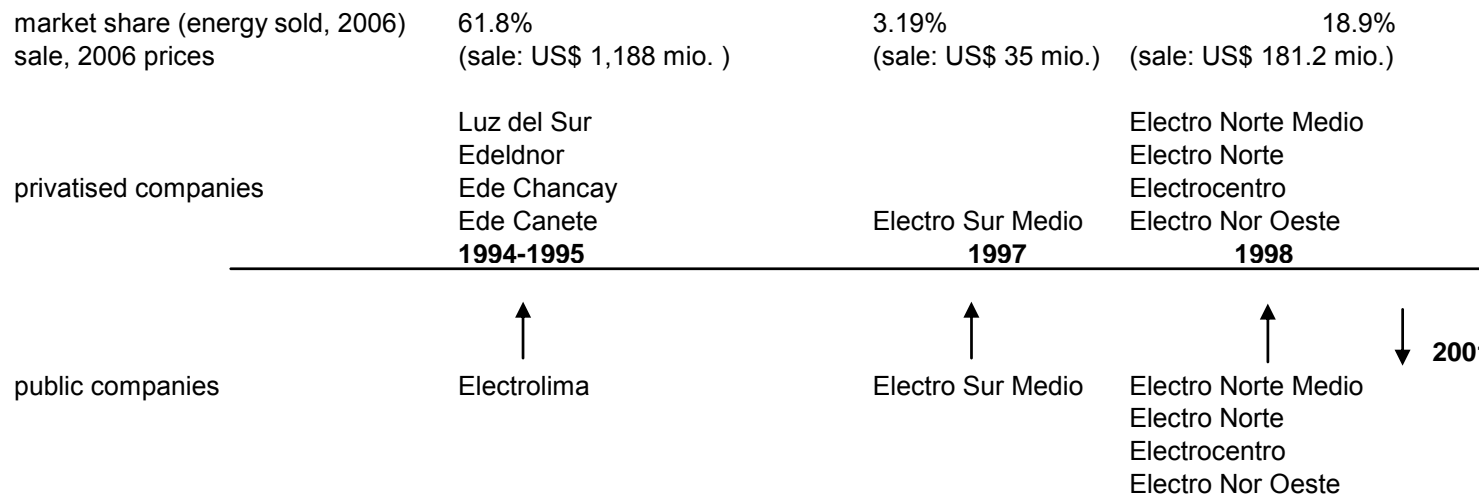
PERU	
Capital	Lima
Area	1'285,220 km ²
Population (2007)	28.7 mio.
GDP (PPP, 2007)	US\$ 207.985
Per capita	US\$ 7,410
HDI (2005)	0.773
Official language	Spanish
Currency	Nuevo sol



The sector reform (1)

- Regulatory framework: Electricity Concession Law (LCE), Antimonopoly Law, NTSC (quality of service)
 - Segmentation of generation, transmission and distribution activities
 - Vertical (5%) and horizontal concentration (15%)
 - Creation of two markets: regulated and free market (1 MWh)
 - Creation of COES: Economic Operation Commission (generators and transmission companies)

The sector reform (2)



Sector 2006 figures	Generation				Transmission				Distribution				Total	
	Energy production ^{1/} GWh	market share %	Energy billed US\$ (mio.)	market share %	Lines Km.	market share %	Energy billed US\$ (mio.)	market share %	Customers	market share %	Energy billed US\$ (mio.)	market share %	Energy billed US\$ (mio.)	market share %
Privatised	13,323.50	53.67%	770.55	53.51%	5,764.60	85.02%	108.68	89.55%	1,872,500	44.88%	848.01	65.00%	1,727.23	60.26%
Private	1,502.97	6.05%	116.97	8.12%	945.10	13.94%	12.69	10.45%	6,595	0.16%	4.83	0.37%	134.49	4.69%
Sub total	14,826.47	59.72%	887.52	61.63%	6,709.70	98.95%	121.37	100.00%	1879095	45.04%	852.83	65.37%	1,861.72	64.96%
Public ^{2/}	9,999.32	40.28%	552.53	38.37%	70.88	1.05%	n.a.	n.a.	2,292,689	54.96%	451.88	34.63%	1,004.41	35.04%
Total	24,825.79	100.00%	1,440.05	100.00%	6,780.58	100.00%	121.37	100.00%	4,171,784	100.00%	1,304.71	100.00%	2,866.13	100.00%

^{1/} "Others" category is not included. See Table No 5

^{2/} Includes customers of distribution companies managed by local/regional Governments

Source: CEPREL (1997), COPRI (2000), MINEM (2006), OSINERGMIN (2006), Proinversión

The market structure

Regulatory Authorities		Sub sectors	Electricity market structure	Price review
Ministry of Energy and Mines	Commission for free competition (INDECOPI)	a. Generation <i>Liberalised</i>	Companies: generation: 19 (97.3% of the national production) distribution: 11 (2.7% of the national production)	12 months
			Source of energy ^{1/} : hydraulic: 74.8% (19 125.8 GWh) thermal: 25.2% (6 432.9 GWh)	
	OSINERGMIN Tariff regulator division (GART)	b. Wholesale markets	Market: Regulated market: 54.6% energy sold (12 170.4 GWh) Free market: 45.4% energy sold (10 130 GWh)	
		c. System operations	Economic Operation Commission (COES). Members: generation and transmission companies representatives	
	OSINERGMIN Tariff regulator division (GART) and INDECOPI	d. Transmission <i>Monopoly/concession</i>	Companies: 7 National grid (SEIN) ^{2/} : 98.2% energy sold (21 888 GWh) Isolated systems: 1.8% energy sold (412 GWh)	12 months
OSINERGMIN Tariff regulator division (GART) and INDECOPI	e. Distribution <i>Natural monopoly</i>	Companies: 22 (accounts for 63% energy sold)	48 months	

1/ Includes production from electricity distribution companies

2/ The National grid (SEIN) is composed of the previous Central Northern Grid and the South Grid.

Source: OSINERGMIN (2003), OSINERGMIN 2006 Annual Report



Methodology (1)

Cost-benefit analysis by Jones et. al. (1990):

- $\Delta W = V_{sp} - V_{sg} + (\lambda_g - \lambda_p) * Z \dots\dots\dots(1)$

Where:

- V_{sp} : social value under private operation
- V_{sg} : social value under government operation (counterfactual scenario)
- λ_g : shadow multiplier on government revenue
- λ_p : shadow multiplier on private funds
- Z : actual price of the executed sale

- **Net efficiency gains/loss = ΔW – R&P**

R&P: restructuring and privatisation costs

- **Distributional impact:**

$$\Delta W = \lambda_c \Delta Con + \lambda_g \Delta Gov + \lambda_p \Delta Prod + (\lambda_g - \lambda_p) * Z \dots\dots\dots(2)$$

- **Notes:**

- Social value: net operating controllable costs = total operating costs – (generation costs+transmission costs+purchase of energy costs + depreciation+operating non-controllable costs)
- Net operating controllable costs (NOCC) under counterfactual scenario: average per unit (NOCC), 1991-1993 (Electrolima), 1994-1996 (Electro Sur Medio), use of different counterfactual cost fall (0% - 4%)

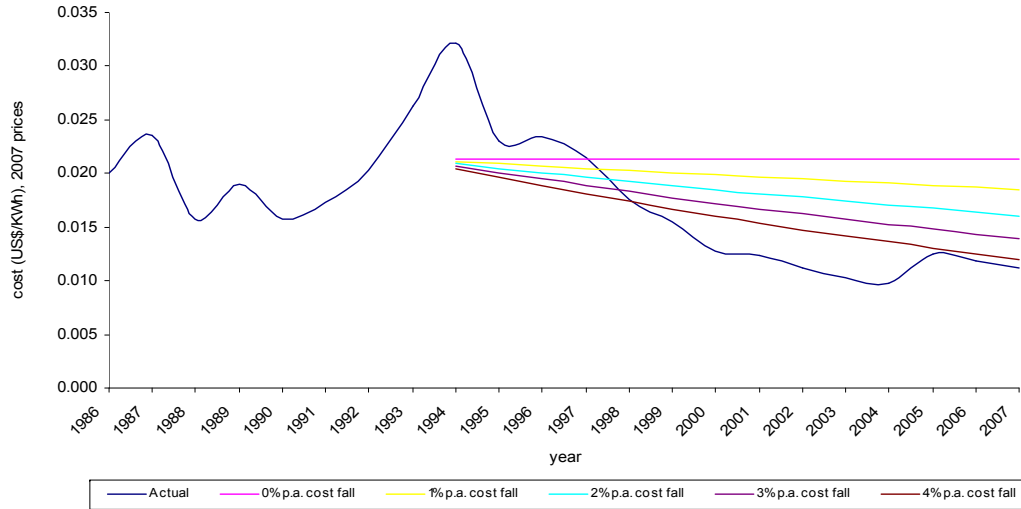


Methodology (2)

- Actual and counterfactual operating controllable cost: unit operating controllable costs (average 3 years before privatisation). Individual analysis.
- Efficiency Gains: Cost fall rate (0%-4%), discount rates (5% - 12%)
- Distributional impact: central-case scenario
 - Cost fall: 2.4 per cent (benchmark company: SEAL)
 - Discount rate: 7.3 per cent (reference interest rate – 1990's)
 - Shadow multipliers remain the same: $\lambda_g = \lambda_p = \lambda_c = 1$
- Total social welfare: central-case and more scenarios
 - Includes benefit of being connected (US\$ 30.5/month)
 - Different values of shadow multipliers

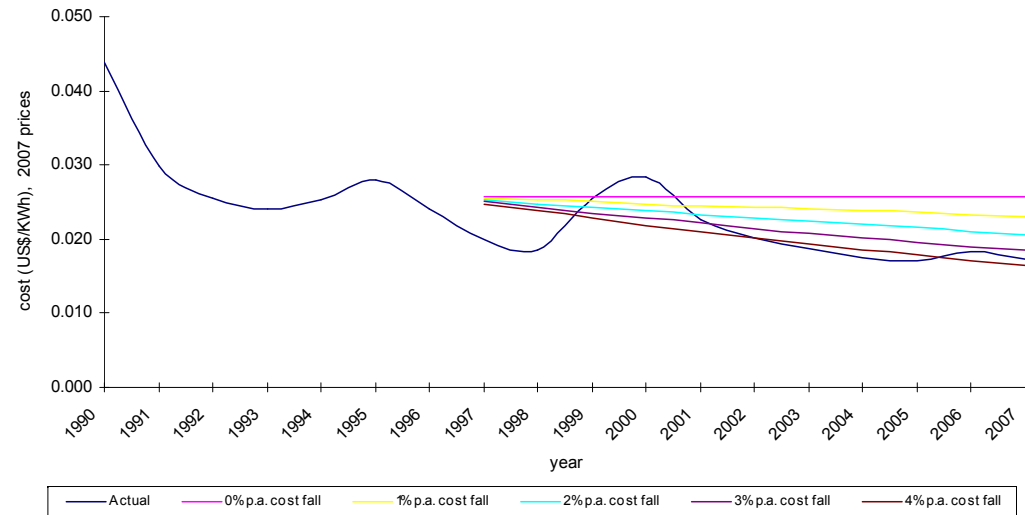
Results (1): Actual and counterfactual controllable cost

Actual and counterfactual controllable costs - Electrolima



Key Assumption:
Efficiency gains between private and public ownership will be closed in the following 15 years

Actual and counterfactual controllable costs - Electro Sur Medio



Results (2): Efficiency Gains (ΔW)

Counterfactual cost fall 2007 prices (US\$ million)		Discount rate				
		5%	6%	8%	10%	12%
Electrolima	0%	687.3	611.8	489.0	395.1	322.3
	1%	511.1	454.2	361.6	290.7	235.7
	2%	349.8	309.8	244.7	194.8	156.0
	3%	201.9	177.4	137.4	106.6	82.6
	4%	66.4	56.0	38.9	25.5	15.0
Electro Sur Medio	0%	33.4	30.0	24.5	20.2	17.0
	1%	23.7	21.3	17.5	14.5	12.2
	2%	14.7	13.3	10.9	9.2	7.8
	3%	6.2	5.7	4.8	4.1	3.6
	4%	-1.7	-1.4	-0.9	-0.6	-0.3
Efficiency gains	0%	720.7	641.8	513.5	415.3	339.3
	1%	534.9	475.6	379.1	305.2	248.0
	2%	364.5	323.1	255.6	203.9	163.8
	3%	208.1	183.1	142.2	110.7	86.2
	4%	64.7	54.7	38.0	24.9	14.7
Efficiency gains (% cost)	0%	25.4%	27.2%	29.0%	29.3%	28.7%
	1%	18.9%	20.1%	21.4%	21.5%	21.0%
	2%	12.9%	13.7%	14.4%	14.4%	13.9%
	3%	7.3%	7.7%	8.0%	7.8%	7.3%
	4%	2.3%	2.3%	2.1%	1.8%	1.2%
R&P		15.3	14.6	13.3	12.1	11.2

□ Counterfactual cost fall: 0-1%: Pro private scenario, 3-4%: Pro public scenario

Results (3): Efficiency Gains (ΔW) Central-case

Net Efficiency gains for central-case scenario

Central case scenario (2.4%) 2007 prices (US\$ million)	Discount rate											
	Up 2007						Up 2022					
	5%	6%	7.3%	8%	10%	12%	5%	6%	7.3%	8%	10%	12%
Electrolima	183.5	166.1	146.0	136.2	111.7	91.4	289.1	255.5	218.2	200.7	158.6	125.9
Electro Sur Medio	6.3	5.9	5.5	5.3	4.7	4.3	11.2	10.2	9.0	8.4	7.1	6.1
Efficiency gains	189.7	172.0	151.5	141.5	116.4	95.7	300.3	265.6	227.2	209.1	165.7	132.0
Efficiency gains (% cost)	6.7%	7.3%	7.8%	8.0%	8.2%	8.1%	10.6%	11.2%	11.7%	11.8%	11.7%	11.2%
Net efficiency gains	174.5	157.5	137.8	128.2	104.3	84.6	285.0	251.1	213.5	195.8	153.6	120.8

Results (4): Distributional impact

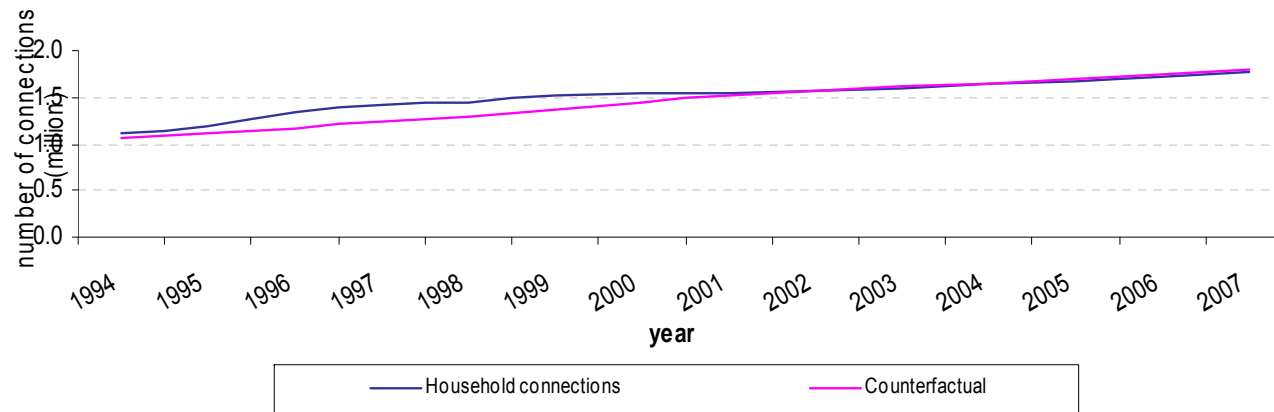
Distribution of the net efficiency gains from restructuring and privatisation Central-case scenario

Central-case scenario (2.4% cost fall) 2007 prices (US\$ million)	Discount rate					
	5%	6%	7.3%	8%	10%	12%
Net Distributional Gains						
1. Electrolima						
ΔGov	320.9	291.9	259.7	244.5	207.9	179.1
ΔCon	-482.6	-435.4	-384.3	-360.6	-304.9	-262.6
$\Delta Prod$	435.6	384.6	329.3	303.7	243.6	198.3
ΔW	274.0	241.1	204.7	187.6	146.6	114.9
2. Electro Sur Medio						
ΔGov	10.7	9.8	8.7	8.2	6.9	5.9
ΔCon	-8.1	-6.7	-5.3	-4.6	-3.0	-1.8
$\Delta Prod$	8.4	7.0	5.4	4.7	3.1	1.9
ΔW	11.0	10.0	8.8	8.3	7.0	6.0
Total net distributional gains						
ΔGov	331.7	301.7	268.3	252.6	214.8	185.0
ΔCon	-490.7	-442.2	-389.5	-365.2	-307.9	-264.4
$\Delta Prod$	444.0	391.6	334.7	308.4	246.7	200.2
ΔW	285.0	251.1	213.5	195.8	153.6	120.8

- Use of benchmarks companies to determine the counterfactual cost fall (SEAL company)
- Selection of discount rate based on annual average reference interest rate (1990's)
- Government and producers benefit the most, consumers the least – (increase in prices, 8.6% p.a.)

Results (5): Benefits of being connected

Number of household connections (actual and counterfactual)



- Social welfare of being connected based on value given by World Bank (US\$ 30.5/month)
- For counterfactual: use of 2 rates (1994-2001, 2002-2022), benchmark company: SEAL.
- Total social welfare net of connection costs
- Household connections increase: 6% p.a. (first 5 years after privatisation) and 3.3% p.a. (1994-2007)

Results (6): Total social welfare

Social welfare from restructuring and privatisation under different values of social weights
Consolidation of results

Central-case scenario (2.4% cost fall) 2007 prices (US\$ million)	Discount rate					
	5%	6%	7.3%	8%	10%	12%
Base Scenario ($\lambda_g = \lambda_c = \lambda_p = 1$)						
ΔGov	331.7	301.7	268.3	252.6	214.8	185.0
ΔCon	-490.7	-442.2	-389.5	-365.2	-307.9	-264.4
$\Delta Prod$	444.0	391.6	334.7	308.4	246.7	200.2
<i>Social welfare</i>	285.0	251.1	213.5	195.8	153.6	120.8
Including additional benefits						
ΔCon	-156.0	-109.7	-61.3	-39.8	8.1	40.7
<i>Social welfare</i>	619.6	583.5	541.7	521.3	469.5	426.0
Scenario 1 ($\lambda_g = 1, \lambda_c = \lambda_p = 0.5$)						
ΔGov	331.7	301.7	268.3	252.6	214.8	185.0
ΔCon	-245.3	-221.1	-194.8	-182.6	-153.9	-132.2
$\Delta Prod$	222.0	195.8	167.3	154.2	123.3	100.1
<i>Social welfare</i>	820.6	788.6	753.1	736.5	696.4	665.2
Including additional benefits						
ΔCon	89.3	111.4	133.5	142.8	162.0	172.9
<i>Social welfare</i>	1,155.2	1,121.1	1,081.4	1,061.9	1,012.3	970.3
Scenario 2 ($\lambda_g = 1, \lambda_c = 0.8, \lambda_p = 0.5$)						
ΔGov	331.7	301.7	268.3	252.6	214.8	185.0
ΔCon	-392.5	-353.7	-311.6	-292.1	-246.3	-211.5
$\Delta Prod$	222.0	195.8	167.3	154.2	123.3	100.1
<i>Social welfare</i>	673.4	655.9	636.3	626.9	604.0	585.8
Including additional benefits						
ΔCon	-57.9	-21.3	16.6	33.3	69.6	93.6
<i>Social welfare</i>	1,008.0	988.4	964.5	952.3	920.0	891.0
Social benefits from being connected	334.6	332.5	328.2	325.4	315.9	305.1

Social welfare includes the sales component (scenario 1 and 2)

- Notable increase in social welfare due to the use of different social weights
- Sales component important participation
- Consumers benefit only in scenario 1,2 and when additional benefits and costs are included
- Values of social weights based on literature review (developing countries)



Results (7)

- Some quality Indicators were also analysed
- Use of benchmark companies for making comparisons
- SAIFI and SAIDI indicators have improved notably especially those refer to the biggest companies (Luz del Sur y Edelnor)
- Distribution losses (private and public ownership) have reduced significantly in average



Conclusions

- The partial privatisation and restructuring of the electricity distribution market was worthwhile. The benefits of being connected contribute to these gains.
- From distributional impact, government and producers benefit the most and consumers benefit the least. Consumers start to gain with the introduction of the benefits of being connected.
- The actual average prices p.a. is higher than the counterfactual in 8.6 per cent, for the period 1994-2022. An increase in prices was expected (price calculation methodology: “price sincerity”)
- The increase of net revenues relate to the privatised companies during the first years after being privatised, is noticeable. Main reasons: price increase and the better collection of revenues (bills)
- Improvements in quality indicators such as number and time of interruptions are more noticeable in the biggest companies that operate in areas with high density. Sectors in which the electricity companies operate have a strong influence on these indicators, independently whether the companies are under private or public-ownership.
- Restructuring and privatisation has contributed notably to the reduction of distribution losses. Important improvements were also observed in state-owned companies.



Thank you!