

Appendix A: Key Process and Country Parameters

Table A.1 Key parameters for pellet plants

	Medium-scale pellet production	Large-scale pellet production
Annual pellet production	40,000 t/a	120,000 t/a
Pellet production rate	5 t/a	15 t/a
Annual operating hours	8,000 h	8,000 h
Total investment costs	3,743,300 €	9,176,200 € (11,286,726 € when suitable for wood chips)
Interest rate	6 %	6 %
Average service life of the pellets production facility	17.5	17.5
Raw material storage	Paved outdoor storage	Paved outdoor storage
Storage capacity^a	1.92	1.92
Kind of storage for wet raw material	Silo	Silo
Storage capacity	0.41 %	0.41 %
Drying	Belt dryer	Belt dryer (or rotary drum dryer)
Heat demand	1,200 kWh/t _{ev,w} .	1,200 kWh/t _{ev,w} . (belt dryer) 1,000 kWh/t _{ev,w} . (rotary drum dryer)
Required electric power	140 kW	420 kW
Grinding/ sieving	Hammermill (additional coarse grinding unit if wood chips are considered for particle size >7 mm)	
Required electric power	110 kW	330 kW
Pellet mill	Ring die technology incl. driving motor for feeding of raw material and mixing screw for hot water conditioning	Ring die technology incl. driving motor for feeding of raw material and mixing screw for hot water conditioning
Required electric power	300 kW	900 kW
Cooling	Counterflow cooler	3 Counterflow coolers

(continued)

Table A.1 (continued)

Required electric power	12 kW	36 kW
Pellet storage	Silo	Silo
Storage capacity	2.3 %	2.3 %
Peripheral equipment	Conveying systems, steel construction	Conveying systems, steel construction
Required electric power	108 kW	216 kW
Simultaneity factor for electric consumptions	0.85	0.85
Total electricity consumption	4.56 GWh/a	12.93 GWh/a (15.2 GWh/a if coarse grinding for wood chip is needed)
Efficiency of used fuel (biomass and natural gas, external boiler and related investment not considered)	90 %	90 %
Shiftwork/ Personnel		
Shifts per day	3	3
Working days per week	7	7
Persons per shift (incl. deputyship)	1.25	1.25
Personnel for marketing and administration	2 full time employees	2 full time employees

Sources Adapted from Oberberger and Thek (2010), Urbanowski (2005)

*Based on annual demand, annual production capacity respectively

Table A.2 Key parameter for a new coal power plant with steam turbine

Parameter	
Average nominal capacity	800 MW _{el}
Investment sum	1,040 million €
Net efficiency (without own electricity consumption)	46 %
Average operating hours	5,000 h/a
CO ₂ emissions	768 g/kWh _{el} (according to EC 2007)
Deprecation time	25 a
Interest rate	6 %
Specific investment costs	1,300 €/kW
Operating costs	2 % of investment costs/a
Additional investment costs for direct co-firing of wood pellets	300 €/kW _{el} for separate feeding and grinding unit for the preparation and co-firing of pellets
Additional operation costs during co-firing of wood pellets	3 €/kW _{el, due} to increased pre-treatment efforts

Source BMU (2010), Maciejewska et al. (2006), ECN (2011)

Table A.3 Key parameters for each export country

	Canada	Australia	Russia	Sources
Hourly rate of technical staff	26.82 €/h	30.53 €/h	12.96 €/h	Berlin (2006), Raitila et al. (2009), BLS (2011)
Electricity costs	44.4 €/MWh	51.06 €/MWh	50 €/MWh	Gerasimov (2012), BC Hydro (2011), World Nuclear Association (2012)
Natural gas costs	18.26 €/MWh	18.65 €/MWh	7.33 €/MWh	Engineroom (2009), Energysshop (2012)
Biomass price (ex pellet plant)	24.73 €/tw.b. for sawdust/shavings with 36 % mc, externally purchased and transported 100 km by truck	9.06 €/t w.b. with 50 % mc, (internally) purchased by co-located saw mill, incl. handling	17.42 €/tw.b. with 55 % mc, externally purchased and transported 30 km on average	Bradley (2010), Sikkema et al. (2010), Urbanowski (2005), May (2012), Cocchi et al. (2011)

Appendix B: National and Specific Price Indices

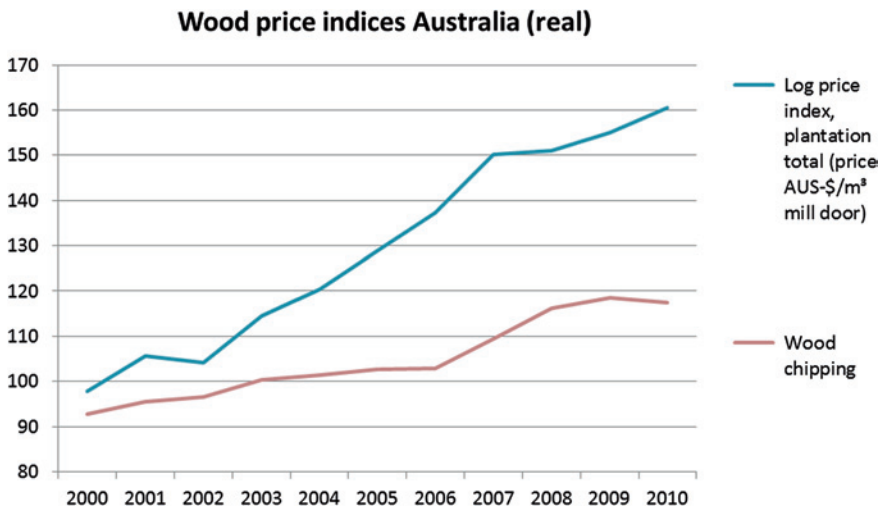


Fig. B.1 Plantation log price index and wood chip index (basis: 1989–1990 = 100). *Source* ABARES (2011)

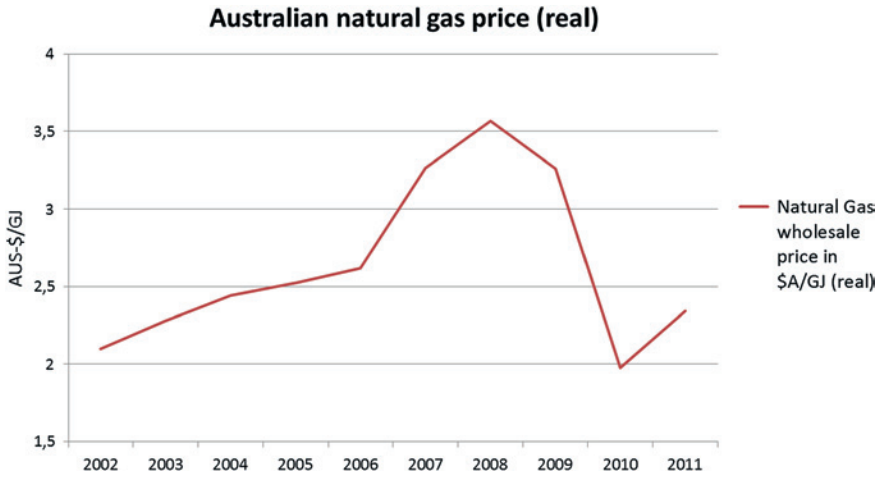


Fig. B.2 Development of natural gas wholesale prices in Australia 2002–2011. *Source* BREE (2012)

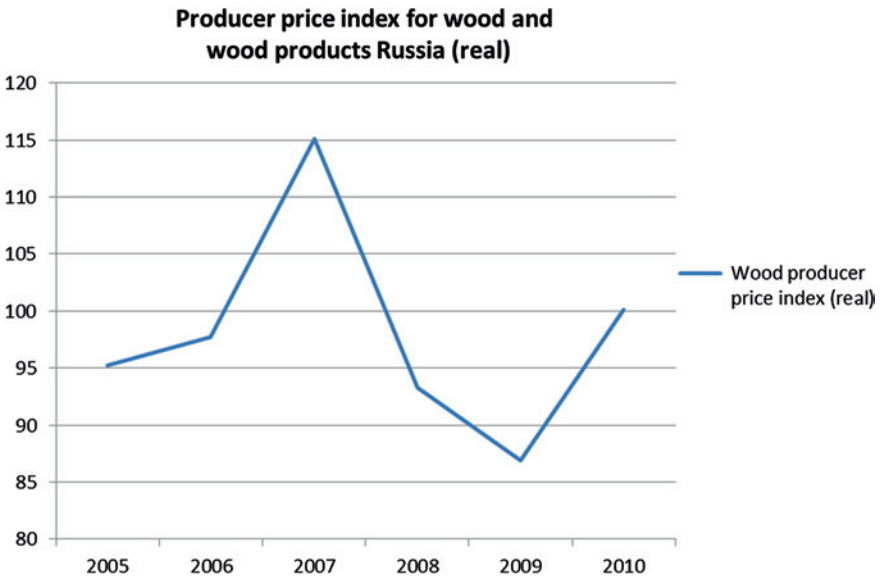


Fig. B.3 Russian wood and wood products producer price index 2005–2010. Basis: end of year percentage to end of previous year. *Source* FSSS (2012a)

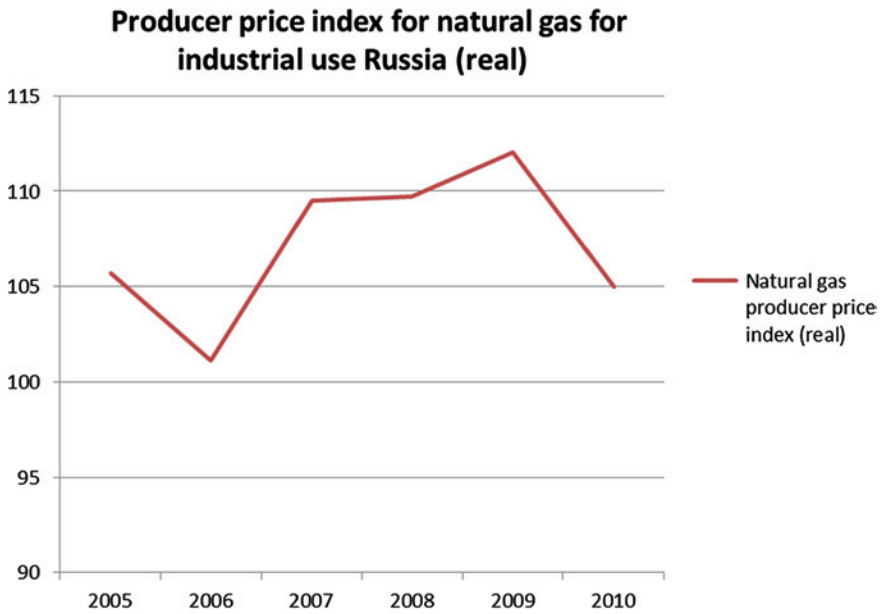


Fig. B.4 Russian producer price index for natural gas for industrial use. Basis: end of year percentage to end of previous year. *Source* FSSS (2012b)



Fig. B.5 Canadian raw material price index, logs and bolts, basis: 2002 average = 100. *Source* STATCAN (2012a)

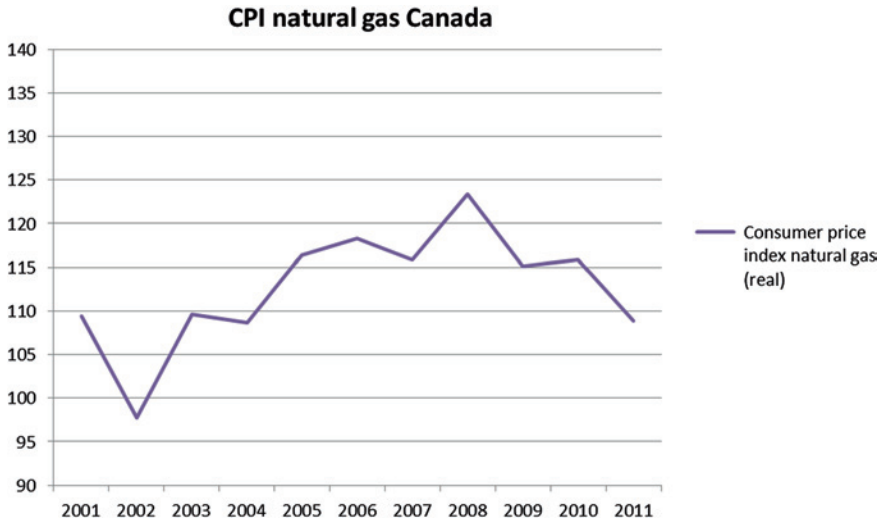


Fig. B.6 Canadian Consumer Price Index natural gas 2001–2011. Basis: 2002 = 100 (real). Source STATCAN (2012b)

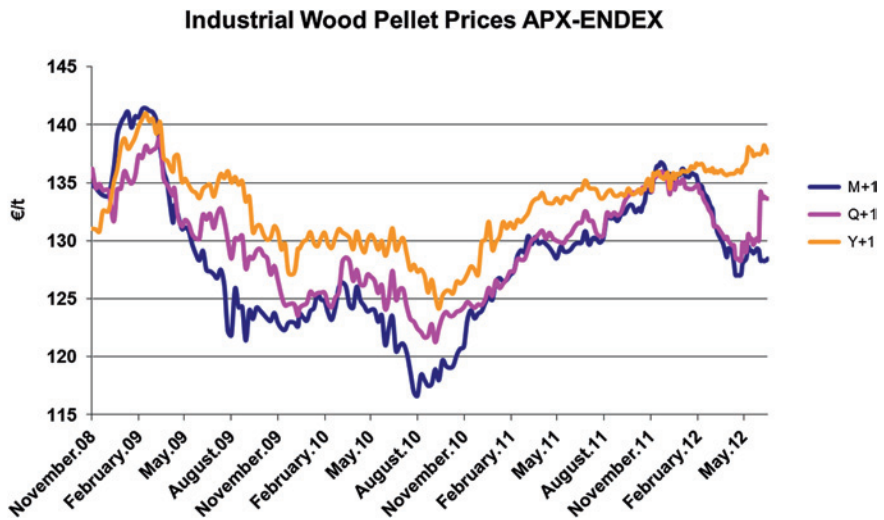


Fig. B.7 Industrial pellet prices at exchange APX-ENDEX in €/t for sales 1 month (M+1), 1 quarter (Q+1) and one year (Y+1) ahead. Source APX (2012)

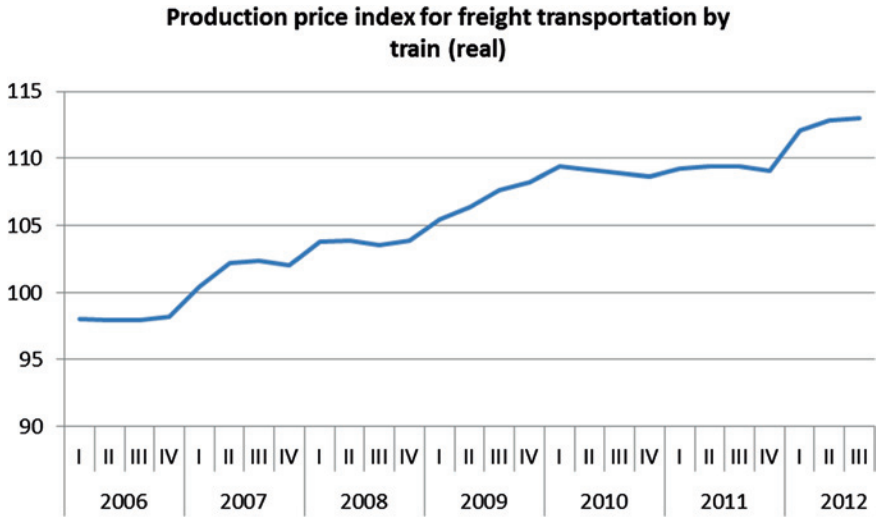


Fig. B.8 German producer price index for freight transportation by train (real). I 2006 = 100 (nominal). *Source* DESTATIS (2012)

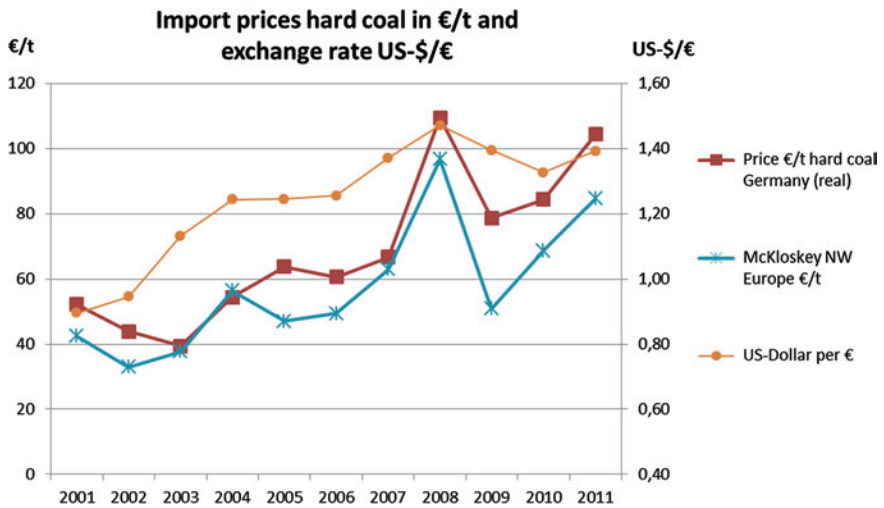


Fig. B.9 Import prices hard coal Germany and McKloskey for Northwest Europe in €/t and US-\$/€. *Sources* BAFA (2012), BP (2012), Eurostat (2012a)