There are two ways to have a rough approximation of the 'costs' of the different scenarios. For a given set of technologies allowed (say without CCS and without nuclear), one could for a given year compute the average cost of carbon reduction in a given year. This corresponds to the area under the marginal abatement cost function for carbon. The second approach is to compute the change in consumer and producer surplus on the different user markets of energy (industry, tertiary, residential). The simplest case is illustrated in the following Figure 6.47 where the green area represents the 'cost' of the abatement constraint. (We hereby neglect other external effects, taxes, subsidies and monopolistic margins). As can be seen in this figure, the increase in user price corresponds in this example to a real cost increase (the green triangle).[171]

For the different consumers, higher prices correspond to higher costs though.

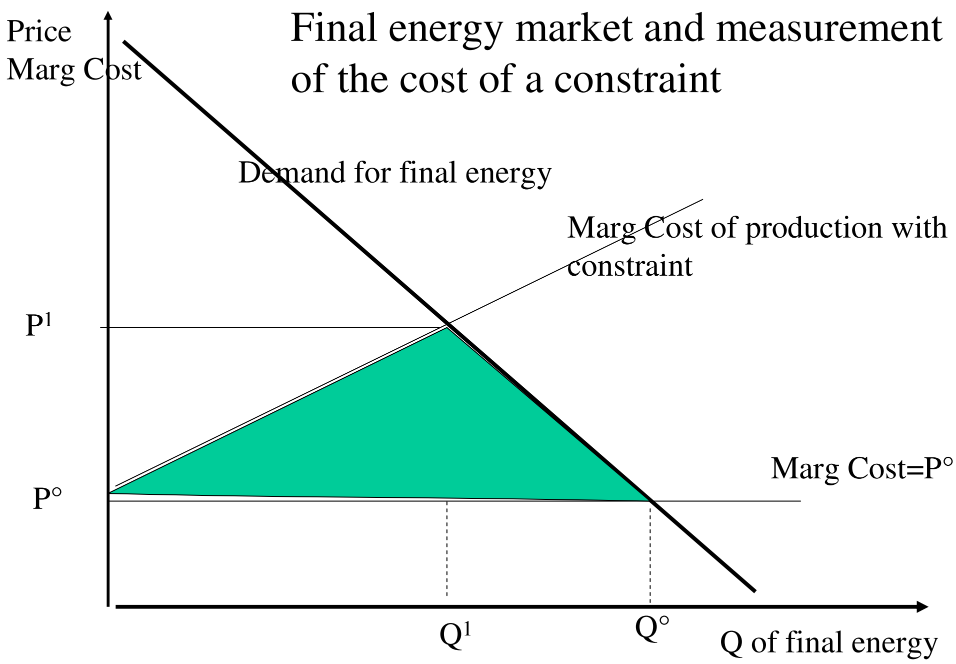

Figure 6.47. *Relationship between prices and costs. See text. [Ref. S. Proost]*

Tables 6.11 and 6.12 summarize the comparison of the energy-related prices in 2030 compared to the year 2000 and compared between the different scenarios. In these tables, four sectors are considered: the power sector (electricity and heat from CHP), industry, the residential and the tertiary sector. All these numbers are to be interpreted subject to the assumptions, constraints and the limitations behind and of the models (including the databases) and the scenarios.

[171] But the reader will easily understand that the same price increase (same height of the triangle) can correspond to different cost increases (areas of triangles can be very different if slope of demand and marginal cost curves are very different). Whenever there are important taxes, subsidies or other external effects than climate change (say conventional air pollution), price changes and cost changes do no longer have the same sign.

Values for 2030	Power sector	Industry		Tertiary		Residential	
	[€2000 per (MWh_e+ MWh_{th})]	[€2000/toe]	Energy price per added value [(*)]	[€2000/toe]	Energy price per added value [(*)]	[€2000/toe]	Energy price per household [(**)]
	In 2000: **37**	In 2000: **540**	In 2000: **0.16**	In 2000: **820**	In 2000: **0.021**	In 2000: **960**	In 2000: **2200**
Baseline	51 (36%)	660 (24%)	0.13 (-19%)	1100 (31%)	0.021 (1%)	1600 (63%)	3000 (39%)
Bpk15	73 (96%)	970 (81%)	0.17 (6%)	1500 (83%)	0.027 (27%)	2000 (110%)	3500 (62%)
Bpk15n	43 (17%)	730 (37%)	0.14 (-16%)	1100 (36%)	0.022 (3%)	1600 (71%)	3000 (40%)
Bpk15s	61 (64%)	1300 (150%)	0.20 (27%)	2100 (150%)	0.031 (48%)	2600 (170%)	3800 (78%)
Bpk15ns	42 (13%)	790 (47%)	0.14 (-12%)	1200 (43%)	0.022 (6%)	1700 (79%)	3100 (43%)

SOURCE: PRIMES SIMULATION RESULTS

Rounded figures; Between brackets (% change between 2000 and 2030)
[(*)] €2000 energy related prices / €2000 added value = dimensionless fraction
[(**)]energy related expenditures per household in €2000
1 toe = 41.868 GJ = 11.63 MWh

Bpk15 = post Kyoto -15%; no nuc; CCS allowed
Bpk15n = post Kyoto -15%; nuc allowed; CCS allowed
Bpk15s = post Kyoto -15%; no nuc; no CCS
Bpk15ns = post Kyoto -15%; nuc allowed; no CCS

***Table 6.11**. Comparison of the prices in 2030 compared to those of 2000 in the power sector, industry, the tertiary and residential sectors and this for all post-Kyoto -15% scenarios and the Baseline. The numbers between brackets represent the relative increase between 2000 and 2030; the difference with the baseline is obvious from the numbers. Attention should be paid to the units in each column. Adapted from [FPB, 2006 - Sept]*

The Baseline has been indicated with a yellow background, and the most stringent scenario, *'no nuc & no CCS'* has been highlighted in pink and red.

For the power sector, a price/cost indicator is constructed that is expressed per kWh, whereby the sum of electric and thermal energy has been taken.[172] As is clear from Table 6.11, the scenarios with nuclear power give a smaller price for the power sector than even the Baseline, which had no post-Kyoto limit but which implements the nuclear phase-out law. It is interesting to note that the scenario Bpk15 (with CCS allowed) has a higher power-sector price than Bpk15s (in which no CCS is allowed). The reason is that there are no 'cheap' reduction possibilities left in the *'no nuc & no CCS'* Bpk15s scenario in the power sector (since the assumed maximum potential for wind has been exhausted and PV is too expensive), shifting the burden of the reduction to the other sectors. This is evident from Table 6.11, when looking at the other sectors. As expected and as will be shown below, the overall price of the energy system is higher in the Bpk15s scenario than in the Bpk15 scenario.

For the -30% case, Table 6.12 applies. In this case, because of the very stringent conditions (and correspondingly large carbon values), the Bpk30s *'no nuc & no CCS'* scenario is the most expensive one in *all* sectors. The extra prices compared to the Baseline are substantial. These are unmistakable observations. Also here, the overall prices of energy provision are higher in the Bpk30s scenario than in all other scenarios.

[172] Although an extensive discussion can be set up on the appropriateness of the allocation of costs over the electric and the thermal side of a CHP [IEA, 2005a] , which reflects the difficulties of the 'allocation problem', here a simple approach has been taken. Therefore the reader should focus on the changes of this cost indicator, rather than absolute numbers.

Values for 2030	Power sector	Industry		Tertiary		Residential	
	[€2000 per (MWh_e+ MWh_{th})]	[€2000/toe]	Energy price per added value [(*)]	[€2000/toe]	Energy price per added value [(*)]	[€2000/toe]	Energy price per household [(**)]
	In 2000: **37**	In 2000: **540**	In 2000: **0.16**	In 2000: **820**	In 2000: **0.021**	In 2000: **960**	In 2000: **2200**
Baseline	51 (36%)	660 (24%)	0.13 (-19%)	1100 (31%)	0.021 (1%)	1600 (63%)	3000 (39%)
Bpk30	83 (120%)	1300 (130%)	0.20 (27%)	2000 (140%)	0.032 (53%)	2500 (160%)	4000 (89%)
Bpk30n	51 (38%)	930 (73%)	0.16 (-1%)	1400 (73%)	0.026 (22%)	2000 (100%)	3300 (56%)
Bpk30s	94 (150%)	2900 (440%)	0.40 (150%)	5000 (510%)	0.058 (180%)	5000 (420%)	6100 (180%)
Bpk30ns	46 (23%)	1200 (120%)	0.18 (15%)	1800 (120%)	0.029 (40%)	2400 (150%)	3600 (66%)

SOURCE: PRIMES SIMULATION RESULTS

Rounded figures; Between brackets (% change between 2000 and 2030)
[(*)] €2000 energy related prices / €2000 added value = dimensionless fraction
[(**)]energy related expenditures per household in €2000
1 toe = 41.868 GJ = 11.63 MWh

Bpk30 = post Kyoto -30%; no nuc; CCS allowed
Bpk30n = post Kyoto -30%; nuc allowed; CCS allowed
Bpk30s = post Kyoto -30%; no nuc; no CCS
Bpk30ns = post Kyoto -30%; nuc allowed; no CCS

***Table 6.12**. Comparison of the prices in 2030 compared to those of 2000 in the power sector, industry, the tertiary and residential sectors and this for all post-Kyoto -30% scenarios and the Baseline. The numbers between brackets represent the relative increase between 2000 and 2030; the difference with the baseline is obvious from the numbers. Attention should be paid to the units in each column. Adapted from [FPB, 2006 - Sept]*

As will be recalled, the Baseline considered here has the nuclear phase out incorporated. It would be interesting to see what the prices of the post-Kyoto scenarios would be regardless of the nuclear issue. This is shown in Table 6.13, where the difference in price for the power sector between an adjusted baseline (identical to the Baseline but with nuclear power unconstrained) and the post-Kyoto scenarios is shown.

Bpk15n	Bpk15ns	Bpk30n	Bpk30ns
8.6%	5.0%	28%	15%

***Table 6.13**. Comparison of the prices/costs in the power sector, between the scenarios indicated and an adapted baseline, in which nuclear power would have been allowed. Adapted from [FPB, 2006 - Sept]*

These numbers show that post-Kyoto constraints are posing a burden on the energy system in terms of cost and prices, but Tables 6.11 and 6.12 also show that nuclear power acts as a relief to mitigate these prices.

The numbers for the transport sector have been collected together in Table 6.14, in a somewhat different structure. The -15% and -30% cases are shown in vertical columns, whereas the scenarios Bpkαβ, Bpkαβn, Bpkαβs and Bpkαβns are shown in the horizontal rows, with αβ being 15 or 30. Results for passenger transport and for freight transport are shown.