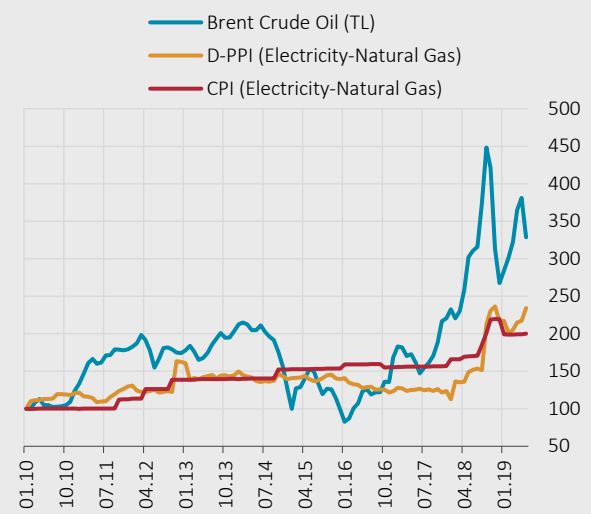
Box 3.1

Indirect Effects of Electricity and Natural Gas Price Increases on Consumer Prices

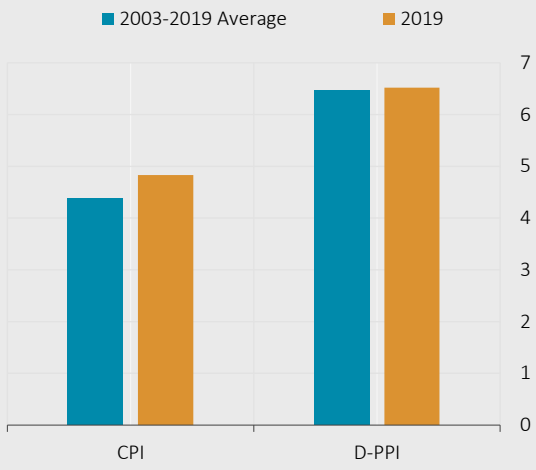
As Turkey is a net energy importer, energy prices determined in international markets are considerable cost factors for domestic energy prices. Moreover, fluctuations in foreign exchange rates put additional pressure on the pass-through of these costs to domestic prices (Chart 1). Furthermore, energy prices have a significant share both in household expenditures and in the costs of the manufacturing industry and services sector firms (Chart 2).[1] In this respect, pricing of energy items differs from that of other goods and services to some extent. Looking at the general energy pricing policies in many countries we see that either the prices are directly determined - partly or fully- by the state or the state has an active role through tax policy in a fully-privatized energy market. In Turkey, for example, although fuel prices are determined in the free market, tax adjustments on final sales prices have a significant weight on fuel prices, or electricity prices are determined with the approval of the Energy Market Regulatory Authority (EPDK).

Chart 1: Oil, CPI and D-PPI Electricity–Natural Gas Prices (January 2010=100)



Source: Bloomberg, CBRT, TURKSTAT.

Chart 2: Share of Electricity and Natural Gas in the Price Index (%)



Source: TURKSTAT.

Price adjustments in energy have direct effects on inflation that are proportional to the share of these products in the price index. In addition, the indirect effects of adjustments in administered energy prices on inflation can be observed through production and operating costs or relative prices channels. In this context, the indirect effects of adjustments in electricity and natural gas prices under the producer and consumer price index on consumer inflation are examined in this box. From the producer's point of view, the first thing worth noting is the pass-through between the energy items. A considerable portion of electricity production in Turkey is made through the use of natural gas. Therefore, increases in natural gas producer prices affect electricity producer prices.[2]

[1] In terms of the costs of firms, Yüncüler and Öğünç (2015) calculated the share of electricity expenses in the manufacturing and service sectors as 2.3 and 1.9 percent, respectively. Additionally, according to the results of another unpublished CBRT study, the average share of electricity expenditures in costs in the 2010-2015 period is estimated as 2.2 and 1.9 percent in the manufacturing and service sectors, respectively.

[2] According to the Ministry of Energy and Natural Resources, 29.8% of our electricity production was obtained from natural gas in 2018.

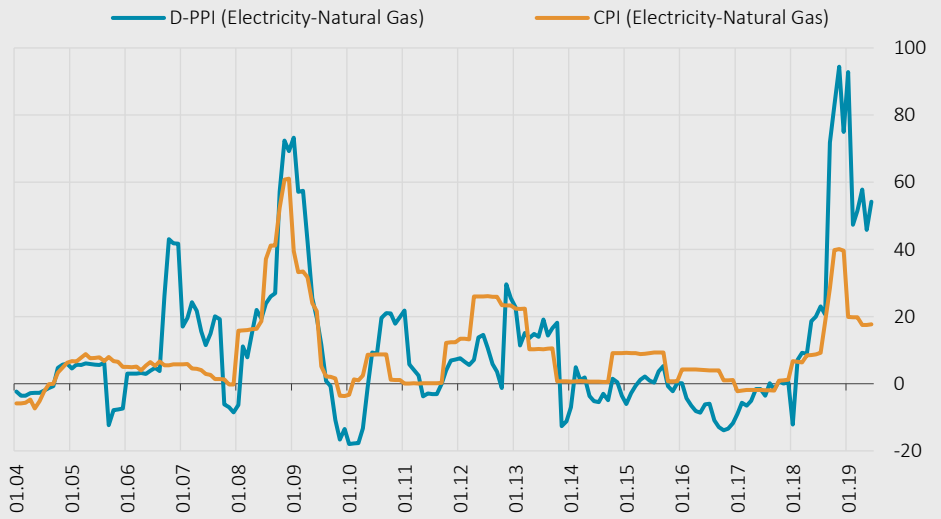
On the other hand, increases in electricity prices in industry affect manufacturing industry prices through the production costs channel, which in turn translates into consumer prices indirectly.

Secondly, increases in electricity and natural gas prices in the CPI may also have indirect effects on consumer prices. Even though the CPI includes only electricity and natural gas prices used in housing, for example, similar to price adjustments in housing, adjustments in energy prices in commercial establishments can be seen. Through this channel, indirect reverberations on the prices of groups such as services, core goods or processed food can be observed.

In this box, various Vector Autoregression (VAR) models are used to estimate the indirect effects of electricity and natural gas prices on consumer inflation. Indirect effects of the adjustments in energy prices on inflation are examined via the impulse response functions generated from these models. To estimate the indirect effects through the producer prices channel, a VAR model including TL-denominated crude oil prices, gas production prices, electricity production prices, output gap and manufacturing sector prices of the domestic producer index (D-PPI) respectively, is estimated. For an accurate identification of the effects, changes in the US dollar / Turkish lira exchange rate (with lagged values) are added to the model as exogenous variables. This model is expanded to include the prices of a different core consumer subgroup (processed food, core goods and services) each time, so that indirect effects of producer price adjustments on the main sub-groups of consumer prices can be calculated.

With the aim of estimating the indirect effects of changes in consumer prices of electricity and natural gas on the main groups of CPI excluding energy group, price indices including electricity and natural gas items are constructed for producers and consumers.[3] In general, electricity and natural gas price adjustments for the industry and the consumers coincide (Chart 3). Therefore, it would be preferable to control producer prices while looking into the indirect effects of energy price adjustments for consumers.

Chart 3: CPI and D-PPI Electricity – Natural Gas Price Indices (Annual % Change)



Source: CBRT, TURKSTAT.

[3] The use of aggregate indices was preferred both to keep the number of variables in VAR reasonable and to eliminate possible pass- through between these items. This implies that the size of indirect effects relative to direct effects is identical for these two items. Additional analysis indicates that this assumption is reasonable. In the calculation of the indirect effects of electricity and natural gas, the relative shares of these items in the aggregated index are taken into account.

To this end, we estimate VAR models which include crude oil prices in TL, producer electricity-natural gas prices, consumer electricity-natural gas prices, output gap and a sub-group of headline consumer index (processed food, core goods and services) at each time.[4] The change in the US dollar/Turkish lira exchange rate again stays as an exogenous variable. Accordingly, indirect effects on consumer prices are obtained considering the main groups and the effects are then aggregated.

Indirect effects of producer and consumer price increases in electricity and natural gas on processed food, core goods and services are calculated by using the impulse responses from the models and are reported in Table 1.

Table 1: Impact of Electricity and Natural Gas Price Adjustments on Consumer Inflation (% Points)

Response to a 10% Price Increase		
Price increase in:	Direct Impact on CPI	Indirect Impact on CPI*
D-PPI Natural Gas	--	0.12 *(0.10-0.13)*
D-PPI Natural Electricity	--	0.15 *(0.12-0.16)*
CPI Natural Gas	0.18	0.12 *(0.09-0.18)*
CPI Natural Electricity	0.30	0.20 *(0.15-0.29)*

* Indirect effect shows the cumulative response at the end of one year. Values in parenthesis can be evaluated as lower and upper bands reflecting estimation and model uncertainty.

Accordingly, while the direct effects of a 10% increase in electricity and natural gas prices in CPI are 0.30 and 0.18 percentage points, respectively; the indirect effects of these increases on consumer prices are calculated as 0.20 and 0.12 points on average, respectively. However, based on estimation and model uncertainty, the indirect effect of adjustments in electricity prices could be between 0.15 and 0.29 points; adjustments in natural gas prices may also be in the range of 0.09 and 0.18 points.[5] Meanwhile, the indirect effect a 10% increase in electricity and natural gas prices in D-PPI on consumer prices, through the production costs channel, is estimated to be in the range of 0.10-0.13 and 0.12-0.16, respectively. In sum, it is assessed that the indirect effect of electricity and natural gas price adjustments in CPI can amount to at least half of their direct effect.

References

Yüncüler, H.B. G. & Öğünç, F. (2015). "Firma Maliyet Yapısı ve Maliyet Kaynaklı Enflasyon Baskıları (Firm Cost Structure and Cost-Push Factors of Inflation)", CBRT Working Paper, No. 15/03.

[4] In some VAR models, the changes in producer electricity-natural gas prices are included as exogenous variables. All the models are estimated for the post-2010 period and models include stationary forms of the variables.

[5] When estimating the indirect effects of electricity-natural gas increases in CPI, inferences regarding model and estimation uncertainty were made by introducing changes in producer prices in VAR models in different ways. In this box, core goods, services and processed food sub-groups, which fall within the scope of a core indicator -index B-, are taken into consideration to examine the indirect effects on consumer prices. However, indirect effects of electric-natural gas on other energy items such as water and solid fuels; or on unprocessed food may also be observed. Considering such concerns as well as the model and estimation uncertainty, it may be argued that as an upper limit, the indirect effects of electricity and natural gas price increases on consumer inflation can be as strong as the direct effects.