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# Ukraine's energy policy and prospects for the gas sector

This Insight<sup>1</sup> outlines the principal energy policy issues facing Ukraine during the 2020s, and identifies: the factors that influence policy; the possible courses of action by the government and energy companies; and the impacts of their decisions on the gas sector.

Ukraine has one of the world's most energy-intensive economies. While it relies mostly on nuclear and coal for electricity generation, it is heavily dependent on gas – including imported gas – for heat supply, and residential and industrial uses. Dependence on imported gas has been a major obstacle to Ukraine's economic development during the post-Soviet period. In the last ten years, gas imports have fallen sharply, and direct imports from Russia have stopped altogether, but the long-declared aim of self sufficiency in gas has proved elusive. The reasons for this include (i) the slow progress of reform of the gas and heat sectors, and (ii) the stagnation at around 20 bcm/year of Ukraine's domestic gas production. A further set of problems surrounds the transit of Russian gas via Ukraine to Europe – but, whichever way the latest manifestations of these problems are resolved, this business is now in decline.

The paper will argue that the most significant energy policy issues are the development of an energy strategy that aligns with Ukraine's closer economic relationship with Europe, with the market reform principles to which it is committed by the Energy Charter Treaty, and with the ambitions for decarbonisation implicit in its ratification of the 2015 Paris climate agreement.

In practice, policies will be decided by a combination of, and possibly clashes between, different influences. In electricity generation, there will be international and European pressure to speed up the phase-out of coal; some political support in Ukraine for expanding nuclear; and possibly a greater role for gas. Market reforms in the gas sector itself are incomplete. Further progress is likely to cut demand e.g. from unauthorised withdrawals from the gas network; reforming the heat sector is a bigger challenge, but could also reduce demand during the 2020s. Price reform has been stalled, as it has elsewhere in eastern Europe, by government wariness of social discontent at the rising cost of municipal services.

The imperatives of Ukraine's relationship with Europe could have negative, as well as positive, impacts. A key example is hydrogen: the EU-supported aspiration to export-oriented hydrogen production could cut across Ukraine's domestic decarbonisation requirements.

Gas transit remains a subject of policy debate. The paper argues that, after the current contract expires, further reduction of transit volumes is likely, possibly to zero. The policy issues arising from this are to manage the decline in transit revenue, and to manage the adaptation of, and, where necessary, the

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decommissioning of pipeline infrastructure, while developing the reverse flow, short-haul transit and storage businesses.

On gas production, the paper shows that, due to the natural decline of the largest fields, maintaining output at 19-20 bcm/year will itself be challenging in the near term. The potential for inward investment will depend partly on international market factors beyond Ukraine's control.

The paper will (Section 1) briefly review the changes in energy policy and the gas market since 2010; (Section 2) consider the energy policy issues; and (Section 3) look at the effects of these energy policies on the electricity and heat sectors; on the possible future development of hydrogen; and on the gas market. Then it considers (Section 4) the transit business and (Section 5) the upstream, and (Section 6) offers some indicative projections of the gas balance for 2025 and 2030, and suggests some conclusions.

## 1. What has changed in the last ten years?

During the 2010s, Ukrainian governments' energy policy was transformed, from a post-Soviet administrative approach, to a market-oriented approach influenced by the European Union. The biggest changes were in the gas sector. At the beginning of the decade, most gas consumed was imported from Russia; the negotiations over prices and terms reflected the rising tension between the two countries; and the difficulty of covering the gap between high import prices and low consumer prices loomed large. A long-term decline in gas consumption was underway, caused by a series of economic recessions (1990-96, 1998-2000, 2009 and 2014-15), and by some switching to coal and some efficiency measures.<sup>2</sup> By 2016, consumption stabilised at around 30 bcm/year, of which two-thirds was supplied from domestic production and a third via "reverse flow" (i.e. mostly Russian gas, exported to central Europe and back to Ukraine). Direct imports from Russia had ceased. By the end of the decade, the transport business had been separated from production and supply, in keeping with the requirements of Ukraine's Energy Community membership, and market reforms were underway. Policy discussions had begun to take account of the energy transition.

There were three distinct phases of energy and gas sector policy: 2010-13, i.e. up to the removal of the Yanukovich government; 2014-19, when military conflict and the breakdown of political relations with Russia became a major factor; and 2020-21, after the signing of the new transit agreement with Russia and increased European influence took effect.

### 2010–13

Ukraine's economy was one of the world's most energy-intensive in 2010 and, although it has improved significantly, it remains relatively energy-intensive today. (See Figure 1.) As measured by the World Bank, the energy intensity of the Ukrainian economy in 2010 had fallen from its 1996 high of 425 koe/GDP (kg oil equivalent/\$1,000 GDP), to 245 koe/GDP, but was still significantly higher than Russia's (201 koe/GDP), more than twice Poland's (110 koe/GDP), and almost three times the European Union's (88 koe/GDP). The fall in energy intensity during the 2000s was largely due to the gradual economic recovery that followed the 1990s slump, and the decline in heavy industry's share of economic output. But structural problems remained, including industry's dependence on coal and gas, and the heating and residential sector's dependence on gas.

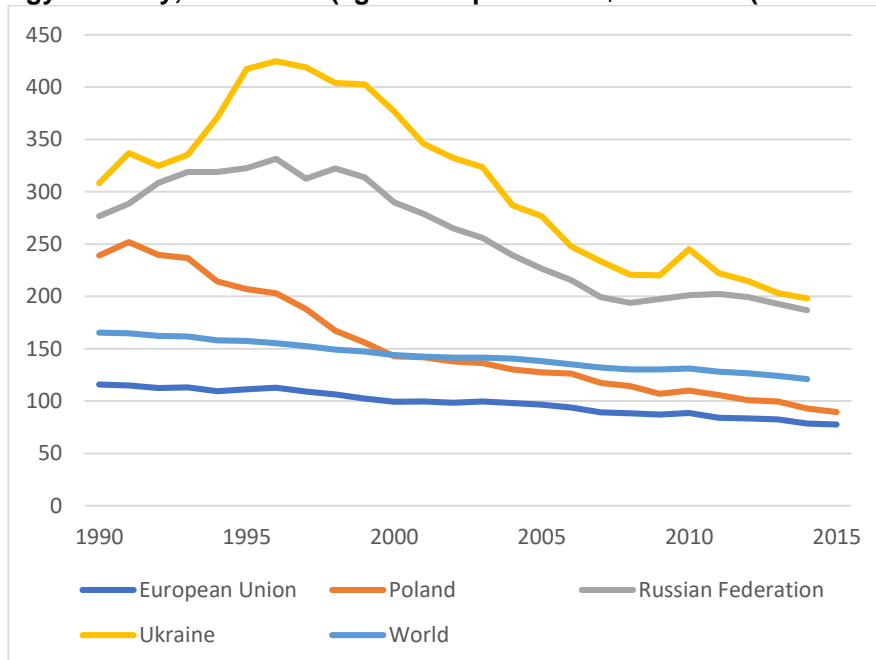
The government had in 2006 adopted an *Energy Strategy for the Period until 2030*, which set out ambitious plans on the supply side that could not be funded, and said little about demand-side measures. It envisaged reducing dependence on imported gas by doubling domestic gas output, doubling coal production and more than doubling electricity generation from nuclear. The IEA centred a critique of the strategy on its lack of attention to energy efficiency, to achieving cost-reflective pricing,

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<sup>2</sup> World Bank statistics, GDP (current US\$), Ukraine

and to transparency.<sup>3</sup> The supply-side focus of the Energy Strategy was plainly inadequate to the task of tackling the energy intensity that was, and is, such a burden on the Ukrainian economy, and, in the event, the government took some steps towards market reform despite the *Energy Strategy* rather than because of it. A gas market law, adopted in 2010, provided for third-party access to pipeline capacity, separation-out of Naftogaz’s production, transportation and marketing functions, establishment of regulatory bodies and gradual reform of price regulation. In 2011, Ukraine joined the Energy Community Treaty, committing to gradual convergence with EU energy market rules.<sup>4</sup>

**Figure 1: Energy Intensity, 1990–2015 (kg of oil equivalent / \$1000 GDP (current US dollars))**



Note: Energy use refers to use of primary energy before transformation to other end-use fuels, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport.

Source: World Bank statistics

Both these measures were significant in the longer term. But under Viktor Yanukovich’s presidency (2010-14), reforms were willy-nilly pushed to the background by the urgent problem of managing gas imports and transit. In 2010-12, gas demand was 54-62 bcm/year, of which 34-41 bcm/year was imported; in 2013, demand fell to 50 bcm and imports to 28 bcm. The problem of paying for these volumes was at the forefront of Ukrainian politics. In January 2009, after the most serious of the “gas wars” between Russia and Ukraine – during which imports ceased, and transit to Europe was suspended, for two weeks – parallel 10-year import and transit contracts had been signed between Gazprom of Russia and Naftogaz Ukrainy. Under the import contract, volumes were fixed at 52 bcm/year; imports were priced with an oil-linked formula, at around 10% higher than a netback from European border prices; and strict payment terms imposed by the Russian side, following a cycle of disputes in the 2000s and unauthorised off-take of Russian gas volumes in Ukraine.<sup>5</sup>

<sup>3</sup> Government of Ukraine, *Energy Strategy of Ukraine for the period until 2030* (Kyiv, April 2006); IEA, *Ukraine Energy Policy Review* (Paris: OECD/IEA, 2006), p. 17; S. Pirani, *Ukraine’s Gas Sector* (OIES Working Paper, 2007), pp. 11-16

<sup>4</sup> Pirani and Yafimava, “CIS Gas Markets and Transit”, in Henderson and Pirani (eds.), *The Russian Gas Matrix: how markets are driving change*, pp. 194-195

<sup>5</sup> Import volumes were fixed at 40 bcm for 2009 and 52 bcm/year for 2010-19, with an 80% take or pay provision – a level that it soon became clear was far too high. This was one of the many enduring problems with the contract. See: S. Pirani, J. Stern

Hopes that these contracts had, at least, separated commercial gas issues from politics soon proved misplaced. In 2010, the Ukrainian government negotiated a significant amendment to the contract with its Russian counterpart, taking a \$100/mcm discount on import prices – that had hit an annual average of \$257/mcm in 2010 and would peak at \$424/mcm in 2012 – in return for an extension of the lease on Russia’s Black Sea naval base in Crimea by 25 years. No-one foresaw that that particular concession would be moot within four years, due to the Russian annexation of Crimea. But as the Ukrainian economy went back into recession after the 2008-09 economic crisis, not only the high, oil-linked prices, but also the high guaranteed volumes in the 2009 contract proved unsustainable.

Ukraine now sought to counter the effect of Russian pricing policy with the “reverse flow” trade – the purchase of gas on Ukraine’s western border, at European market prices. Although Naftogaz’s import monopoly had been removed, at this stage only companies owned by politically-connected insiders were able to join the import business. Nevertheless, physical infrastructure limitations were quickly overcome. All capacity in the east-west pipelines was booked by Gazprom, meaning that “virtual reverse flow” was not yet possible. (With “virtual reverse flow”, implemented only in 2020, volumes imported into Ukraine are netted off against volumes delivered in an east-to-west direction, and only the balance physically flows across the border.) But in 2010-11, new physical west-east connections were built or refurbished. This gave Ukraine access to gas at European market prices. “Reverse flow” imports rose rapidly from 4.8 bcm in 2011 (11% of total imports) to 15 bcm (54% of total imports) in 2013.

This Ukrainian challenge to Russian pricing policy, which was to stick to oil-linked prices that were at a widening premium to European market prices, ran in parallel to challenges from Gazprom’s major European counterparties, who took legal action to revise contracts.<sup>6</sup> Table 1 provides an overview of the changing profile of imports, consumption and transit.

**Table 1: Ukraine's gas consumption, imports and transit by volume (bcm), 2006–2020**

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Volume imported (bcm)</b>	<b>57</b>	<b>50.59</b>	<b>54.6</b>	<b>26.95</b>	<b>36.47</b>	<b>44.8</b>	<b>32.94</b>	<b>27.9</b>	<b>19.6</b>	<b>16.4</b>	<b>11.1</b>	<b>14.1</b>	<b>10.6</b>	<b>14.2</b>	<b>15.8</b>
<i>incl:</i>															
<i>Direct imports from Russia</i>	57	50.59	54.6	26.95	36.47	40	24.89	12.9	14.5	6.1	0	0	0	0	0
<i>"Reverse flow"</i>	0	0	0	0	0	4.8	8.05	15	5.1	10.3	11.1	14.1	10.6	14.2	15.8
<b>Consumption</b>	<b>75.3</b>	<b>71.1</b>	<b>67.5</b>	<b>53.1</b>	<b>59</b>	<b>61.9</b>	<b>54.8</b>	<b>50.3</b>	<b>42.2</b>	<b>33.4</b>	<b>33.2</b>	<b>31.9</b>	<b>32.2</b>	<b>29.9</b>	<b>31.2</b>
<b>Volumes transited</b>	<b>128.5</b>	<b>115.2</b>	<b>119.6</b>	<b>95.8</b>	<b>98.6</b>	<b>104.2</b>	<b>84.3</b>	<b>86.1</b>	<b>62.2</b>	<b>67.1</b>	<b>82.2</b>	<b>93.4</b>	<b>86.8</b>	<b>89.6</b>	<b>55.8</b>
<i>incl:</i>															
<i>Europe and Turkey</i>	113.8	112.1	116.9	92.8	95.4	101.1	81.2	83.7	62.2	67.1	82.2	93.4	86.8	89.6	55.8
<i>CIS countries</i>	14.7	3.1	2.7	3	3.2	3.1	3.1	2.4	0	0	0	0	0	0	0

Source: Energobiznes/energy ministry/ Naftogaz Ukrainy

## 2014–19

The collapse of the Yanukovich government in February 2014 was followed by military conflict in eastern Ukraine, the annexation of Crimea by Russia and the establishment of the Russian-supported “republics” in Donetsk and Lugansk. This human tragedy resulted in 13,000 deaths, 1.5 million people internally displaced in Ukraine and a similar number seeking refuge in Russia. Economic recovery was cut short, Ukraine returned to recession, and it lost industrial capacity based in the occupied areas. These events, paradoxically, reinforced the long-term decline in gas consumption, and lifted the burden of large-volume gas imports from Russia. Annual gas demand fell from 50.2 bcm in 2013 to 42.2 bcm in 2014 and 33.4 bcm in 2015, and settled at 30-32 bcm/year in 2016-21. Consequently, import demand

and K. Yafimava, *The Russo-Ukrainian gas crisis of January 2009: a comprehensive assessment* (OIES, 2009) and *The April 2010 Russo-Ukrainian gas agreement and the implications for Europe* (OIES, 2010)

<sup>6</sup> S. Pirani and K. Yafimava, “CIS Gas Markets and Transit”, pp. 181-215, and Jonathan Stern, “Russia’s responses to commercial change in European gas markets”, pp. 50-81, both in J. Henderson and S. Pirani (eds.), *The Russian Gas Matrix: How Markets are Driving Change* (Oxford: OUP, 2014)



fell, too, from 32.9 bcm in 2012 to 27.9 bcm in 2013, 19.6 bcm in 2014 and 16.4 bcm in 2015, settling at 11-15 bcm/year thereafter.

From 2016, Ukraine ceased all direct gas imports from Russia. (The contractual agreements between Naftogaz and Gazprom essentially broke down, leading to one of the largest ever commercial arbitration cases.<sup>7</sup>) Gas was imported entirely via “reverse flow”, from Slovakia, Poland and Hungary; European and Ukrainian traders joined Naftogaz as importers. Increasing domestic gas production was declared a priority, and although about 1.5 bcm/year lost from Crimean assets has been regained elsewhere, Ukraine’s gas output was stuck in a range of 19-21 bcm/year. The start made in 2012-13 in attracting international oil companies to the upstream – when a production sharing agreement was signed with Shell and preliminary negotiations completed with Exxon, RWE and Chevron on other projects – was reversed. As military conflict flared, the IOCs left.

In 2014-19, significant changes were made at Naftogaz Ukrainy. The new government of president Petro Poroshenko appointed a new management, headed by Andriy Kobolev and dominated by executives who had had little or no part in the pre-2014 management team, for which relations with Gazprom had been so crucial. On the advice of European and international organisations, a supervisory board was appointed with a majority of independent (and international) directors. The company’s finances were made more transparent. Previously, Naftogaz had soaked up not only all the revenue from gas transit, but also significant subsidies from the budget, to ensure the supply of subsidised gas to households and district heating companies. The IMF, which provided Ukraine with a series of loan programmes from 2009, made reduction of these subsidies a condition for lending. One result was that the state subsidy to Naftogaz was reduced to zero.<sup>8</sup> See Table 2.

**Table 2: Naftogaz balance in the context of the general government balance, 2014–18**

billions of US \$	2014	2015	2016	2017	2018
Fiscal expenditures	46.3	47.1	43.9	43.8	43.4
Overall (general gov’t) balance	-4.6	-4.2	-3.7	-3.1	-2.6
<b>Naftogaz balance</b>	<b>-5.7</b>	<b>-3.1</b>	<b>-0.3</b>	<b>0</b>	<b>0</b>
Combined balance (general gov’t + Naftogaz)	-10.3	-7.4	-3.9	-3.1	-2.6
Combined primary balance (general gov’t + Naftogaz)	-6.9	-2	1.2	1.6	1.6

Note: Combined primary balance is net of interest payments on debt, and is important for determining governments’ short-term sustainability.

Source: projections by government, compiled by IMF in negotiations on Extended Fund Facility request. IMF, Ukraine: ex-post evaluation of exceptional access under the 2015 extended arrangement, June 2020 (report no. 20/204), page 20.

The 2014 events also triggered broader changes in energy policy. Whereas previous Ukrainian governments had sought in their economic policy to balance Russian and European interests, Russia’s influence was now sharply curtailed. Russian trade with Ukraine fell sharply; Russian businesses pulled out of Ukraine. Ukraine drew closer to Europe. In 2014, the government concluded an Association

<sup>7</sup> Naftogaz brought an arbitration claim against Gazprom, grounded in the latter’s refusal to renegotiate the volumes and prices in the 2009 contract; Gazprom brought counter-claims related to take-or-pay provisions; a tribunal at the Stockholm chamber of commerce made a \$2.56 billion award against Gazprom. See S. Pirani, *After the Gazprom-Naftogaz arbitration: commerce still entangled in politics* (Oxford Energy Insight, March 2018)

<sup>8</sup> Researchers at the OECD found that Naftogaz received no direct budgetary support after the 2016 gas pricing reform. In 2016 it took a \$500 million loan from the World Bank that was repaid in 2019. Between 2016 and 2019 Naftogaz reduced the value of its state-guaranteed debt from 1,132 million to 96 million. See OECD, *Fossil Fuel Subsidies in the EU’s Eastern Partner Countries* (Paris: OECD, 2021), p. 33

Agreement with the EU, and Yanukovich's hesitation about signing that agreement was the trigger for the disturbances that overthrew him. In 2015, Ukraine agreed with international partners on economic and energy targets linked to the UN Development goals, and in 2016 ratified the Paris climate agreement. In 2017, the *Energy Strategy to 2035* was adopted, clearly influenced by the European "Green Deal". (See Section 2 below).

## 2020–21

On 31 December 2019, as the 2019 Gazprom-Naftogaz contract came to an end, a new five-year transit agreement was signed, accompanied by a memorandum signed by both corporate executives and political leaders of Russia, Ukraine and the European Union.<sup>9</sup> For much of 2019, it had seemed unlikely that agreement would be reached; and European gas storage had been filled, in readiness for a dispute that could have resulted in the interruption of supplies from Russia. But as a result of talks between president Putin and president Zelensky, and diplomatic efforts by the European Commission, an agreement was reached that provided for 65 bcm of Russian gas to transit Ukraine in 2020, and 40 bcm/year in 2021-24. Under EU pressure, Ukraine unbundled its gas transportation assets into a new company, Gas Transmission System Operator of Ukraine (GTSOU). Under the new agreement, Naftogaz, which sells gas transportation services to Gazprom, essentially buys them in from GTSOU.<sup>10</sup>

In early 2020, the implementation of Interconnection Agreements with its counterparts in Poland, Slovakia, and Hungary enabled GTSOU to facilitate substantial volumes of "backhaul" ("virtual reverse") imports. This substantially increased Ukraine's import capacity, and in 2020, 45 per cent of its 15.9 bcm of imports from Europe were made under the backhaul regime.<sup>11</sup> In August 2020, Ukraine received its first physical import of LNG from Romania, via the Trans-Balkan pipeline, in the form of a "test cargo" from Greece via Bulgaria and Romania. That experiment demonstrated that, in principle at least, Ukraine could import LNG via Greece, although the profitability of doing so compared to imports from other European sources remains unproven.<sup>12</sup>

The new transit agreement with Gazprom opened a new chapter for Ukrainian gas policy. Although government and Naftogaz managers continued an international political campaign against the Nord Stream 2 project (see below), domestically, more attention could be, and was, paid to market and corporate reform. (See Section 3 below.)

## 2. Energy policy

The *Energy Strategy of Ukraine to 2035*, adopted by the government in 2017, envisages a small increase in primary energy supply over the next 15 years, with substantial increases in the share of biofuels, other renewables and nuclear, and reductions in the shares of coal and oil products. A small increase in the share of gas, and in gas consumption in absolute terms, is forecast. The actual energy supply for 2010 and 2015, the government's estimates for 2019, and the Energy Strategy forecast for 2035, are displayed in Figure 2, and presented in numerical form in Table 3.<sup>13</sup>

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<sup>9</sup> *Protokol vstrechi predstavitelei Evropeiskogo soiuza, Ukrainy i RF, a takzhe kompanii etikh stran* (GTSOU, Naftogaz Ukrainy, Gazprom, 19-20 December 2019. Published on the government of Ukraine's web site <https://www.kmu.gov.ua/storage/app/sites/1/17-presentation-2019/12.2019/protokol.pdf>

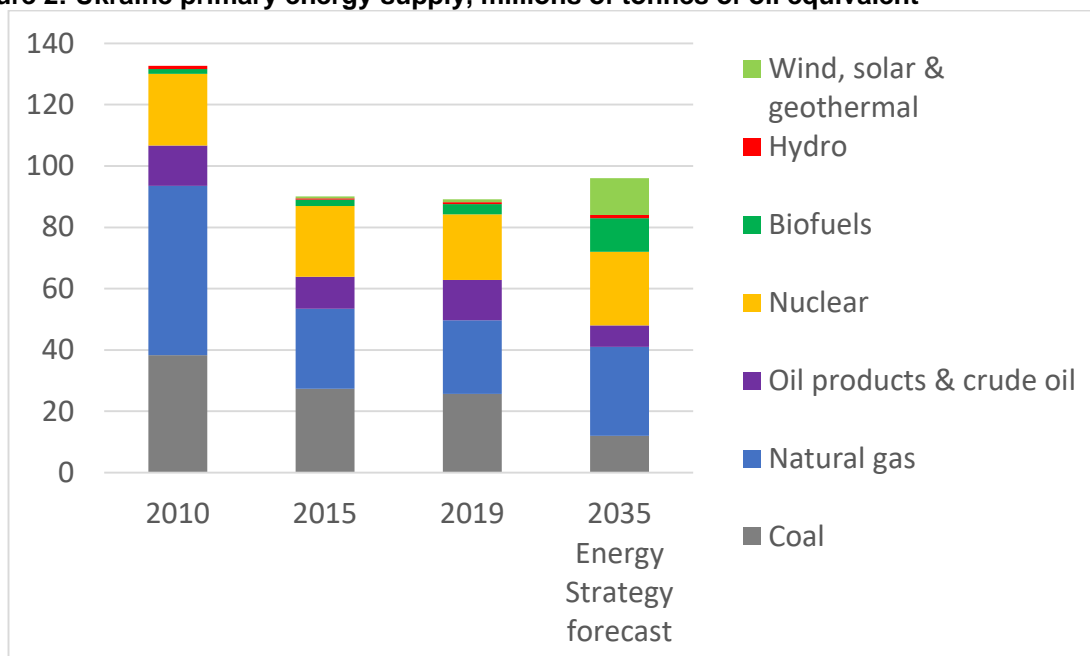
<sup>10</sup> S. Pirani and J. Sharples, *The Russia-Ukraine gas transit deal: opening a new chapter* (OIES, 2020)

<sup>11</sup> GTSOU, 2021. In 2020, the transit of gas to Europe by the Ukrainian GTS amounted to 55.8 billion cubic meters, gas transportation from Europe to Ukraine amounted to 15.9 billion cubic meters. *Press Release*, 4 January. <https://tsoua.com/en/news/in-2020-the-transit-of-gas-to-europe-by-the-ukrainian-gts-amounted-to-55-8-billion-cubic-meters-gas-transportation-from-europe-to-ukraine-amounted-to-15-9-billion-cubic-meters/>

<sup>12</sup> GTSOU, 2020. Ukraine imported about 567 million cubic meters of gas from EU in August. *Press Release*, 8 September. <https://tsoua.com/en/news/ukraine-imported-about-567-million-cubic-meters-of-gas-from-eu-in-august/>

<sup>13</sup> *Energetichna Strategiya Ukrainy na period do 2035 roku "Bezpeka, energoefektivnist', konkurentospromozhnist"* (Kyiv: Cabinet of Ministers, 2017), approved by resolution 605-r of 18 September 2017

**Figure 2: Ukraine primary energy supply, millions of tonnes of oil equivalent**



Source: Energy Strategy to 2035 (2017), appendix 2

**Table 3: Ukraine primary energy supply, 2010-2019 and 2035 forecast, millions of tonnes of oil equivalent**

	2010	2015	2019	2035 Energy Strategy forecast
Coal	38.3	27.3	25.7	12
Natural gas	55.2	26.1	24	29
Oil products & crude oil	13.2	10.5	13.1	7
Nuclear	23.4	23	21.4	24
Biofuels	1.5	2.1	3.4	11
Hydro	1.1	0.5	0.6	1
Wind, solar & geothermal	0	0.6	0.9	12

Source: Energy Strategy to 2035 (2017), appendix 2

The unrealistic assumptions about expansion of primary energy supply made in the 2006 *Energy Strategy* have been abandoned. But the new Strategy remained vague on key issues, including the relationship between energy policy and economic policy, how decarbonisation targets will be achieved, and the pace of the coal phase-out. A monitoring report by the OECD drew attention to a lack of allocation of responsibilities for implementation, and a lack of coordination between the Strategy and the EU-Ukraine Association agreement, which requires market reform and energy efficiency measures that align with the EU's.<sup>14</sup> The OECD has also drawn attention to Ukraine's high level of energy subsidies: it calculated these at 2.3% of GDP in 2018, i.e. greater than the 1.9% budget deficit. Most

<sup>14</sup> *OECD Monitoring of the Energy Strategy of Ukraine Until 2035* (Paris: OECD, February 2020), p. 9; S. Pirani, *The market takes shape: the Ukraine gas sector to 2030* (OIES, 2020), pp. 2-5

producer subsidies are targeted at coal; the second significant subsidy is to households for utility bills. This subsidy peaked at \$2.7 billion in 2017 and was partly monetised in 2019.<sup>15</sup> In 2021 a new effective subsidy of gas payments via Naftogaz was applied, in response to the spike in gas prices (see below, Section 3.d).

In August 2021, Ukraine submitted an updated Nationally Determined Contribution (NDC) under the UN Framework Convention on Climate Change, which commits to reduce net domestic greenhouse gas emissions by 2030 to 35% of the level of 1990. Calculated including land use, land use change and forestry (LULUCF), Ukraine's emissions were 882.9 million tonnes of CO<sub>2</sub> equivalent (MtCO<sub>2</sub>e) in 1990, and had fallen to 332.2 MtCO<sub>2</sub>e by 2019. The NDC implies a further reduction to 309 MtCO<sub>2</sub>e by 2030, i.e. about 7% lower than the 2019 level.<sup>16</sup> The updated NDC is substantially more ambitious than the NDC submitted in 2016, which committed to reduce emissions to 60% of the 1990 level by 2030, leaving room for a substantial increase from current levels. The updated NDC includes an estimate that €102 billion will be required for associated capital investments.

As with all overarching political plans, the *Energy Strategy to 2035* will be adapted in its implementation by a range of competing pressures and interests. These include Ukraine's interactions with the EU, the US and the international financial organisations, all of which have made offers, mostly conditional, of finance for energy sector investments.

Ukraine's obligations arising from the EU-Ukraine Association Agreement and its membership of the Energy Community Treaty are significant, in particular the National Emissions Reduction Plan (NERP) that provides for implementation in Ukraine of the EU's Industrial Emissions Directive, by retrofitting or phasing out of coal-fired power stations.<sup>17</sup> A recent report by Low Carbon Ukraine, a research group funded by the German environment ministry, showed that Ukraine is on course to exceed the aggregated emissions ceiling agreed with the EU (which already provides for several years of additional delay in implementation) and proposes that Ukraine should focus on decommissioning coal-fired power, rather than retrofitting.<sup>18</sup> (See below Section 3.a.) Energy Community membership also requires continuing integration of energy markets. This not only affects gas market development (see Section 3.d below), but also implies integrating electricity markets, and in the long term of technically synchronising electricity grids.<sup>19</sup>

In addition to "just transition" in Ukraine's coal producing regions, the energy transition measures that the EU may support include: green transition financing including through an Energy Efficiency Fund and green bond market development; development of hydrogen technologies; and forests strategy. These were discussed at a meeting in February 2021 between Frans Timmerman, vice president of the European Commission, and Denis Shmyhal, prime minister of Ukraine. At a follow-up meeting in October 2021 between EU and Ukrainian officials, the EU offered to use blending and guarantee mechanisms, in cooperation with international financial institutions,<sup>20</sup> to support energy transition measures. Such activity is also supported by the EU4Environment and EU4Energy programmes.<sup>21</sup> The

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<sup>15</sup> OECD, *Fossil Fuel Subsidies in the EU's Eastern Partner Countries* (Paris: OECD, 2021), pp. 13-15, 37-38 and 70-72

<sup>16</sup> Government of Ukraine, *Updated Nationally Determined Contribution of Ukraine to the Paris Agreement* (Kyiv, 2021); UNDP Ukraine, "In bold commitment to Paris Agreement, Ukraine pledges further reduction", 3 August 2021

<sup>17</sup> Cabinet of Ministers, *Natsional'nyi plan skorochennia vikidyv vyd velikikh spaliuval'nikh ustanovok*, November 2017, and Order no. 796-r/2017 <<https://zakon.rada.gov.ua/laws/show/796-2017-%D1%80#Text>>

<sup>18</sup> David Saha et al, *Implementing the National Emissions Reduction Plan: how should Ukraine's power plant park look like in 2033?* (Berlin: Low Carbon Ukraine, September 2021)

<sup>19</sup> On electricity, see: Lukas Feldhaus et al, *Connecting Ukraine to Europe's Electricity Grid* (Berlin: SWP Comment no. 57, November 2021)

<sup>20</sup> Blending and guarantee mechanisms are financial products offered by international financial institutions, designed to encourage private investment in developing countries

<sup>21</sup> European External Action Service, "Vydbulosia druze zasydannya robochoi grupi Dyalogu visokogo ryvnia", 23 September 2021; EU4Environment, *Towards a Green Economy in Ukraine: work in progress 2019-20*; on EU4Energy, see IEA web site <https://www.iea.org/programmes/eu4energy>



UK government, which has not previously been actively engaged with Ukrainian energy policy, is also seeking to join these discussions, and has commissioned KPMG to draft an energy strategy to 2050.<sup>22</sup>

Separately, in July 2021 the US and German governments agreed to provide financial support to energy transition in Ukraine, in the context of their agreement not to impose further sanctions on the Nord Stream 2 pipeline. The US and Germany, in a joint statement, said they would “endeavour to promote and support investments of at least \$1 billion in the Green Fund for Ukraine”, including an initial \$175 million from Germany and more from the private sector. The fund will “promote the use of renewable energy; facilitate the development of hydrogen; increase energy efficiency; accelerate the transition from coal; and foster carbon neutrality”. The statement further indicated support for: a Ukraine Resilience Package to ensure access to non-Russian energy supplies; a separate package of bilateral German-Ukraine projects on coal phase-out and renewables, overseen by a special envoy; and the Three Seas Initiative to improve network connectivity in south-eastern Europe.<sup>23</sup>

In September 2021, president Zelensky met US president Joe Biden in Washington. Parliamentary deputy Oleksiy Honcharenko, a member of Zelensky’s team, presented a list of \$25 billion worth of decarbonisation projects to US officials. These included the replacement of obsolete coal-fired power with small modular nuclear reactors and gas-fired power, and hydrogen and biomass projects. It was reported that Biden, in response, urged Ukraine to focus in the first instance on energy sector corporate governance and market-based pricing.<sup>24</sup>

These overlapping, but in some respects contradictory, commitments by Ukraine and its partners will shape energy policy in the coming years. Some near-term consequences for specific energy sectors are discussed in Section 3.

### 3. The effects of energy policy

#### (a) Electricity generation

The key long term policy questions for Ukraine’s electricity sector are the pace at which coal-fired electricity generation will be phased out, and the combination of other sources that will replace it. At the COP 26 talks, the government announced a 2035 target for ending coal-fired generation, while DTEK, the largest generator, opted for 2040.<sup>25</sup> These announcements raised hopes that the institutional obstructions to implementation of the NERP would start to be removed. Progress on implementation has essentially stalled since 2018, at least in part due to political nervousness about the social impact of closing coal mines, an inevitable corollary of closing coal-fired power stations.<sup>26</sup> In October 2020 an advisory group to the energy ministry on NERP suggested pushing the implementation target date back from 2033 to 2038 or 2043, a proposal likely to be resisted by the EU.<sup>27</sup>

If the government now acts on the commitments made in Glasgow, most coal-fired plants are likely to be closed without first being modernised. Low Carbon Ukraine’s research points to two scenarios with zero coal-fired generation in 2033. Both imply a substantial expansion of wind and solar, to an aggregate total of 18.1 GW or 25.4 GW; the “gas turbines” scenario envisages the construction of 7.8

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<sup>22</sup> KPMG, *Pidkhid do rozrobki Energetichnoy strategiyi Ukrayni 2050 (presentation)*, June 2021

<sup>23</sup> *Joint Statement of the US and Germany on Support for Ukraine, European Energy Security, and our Climate Goals*, 21 July 2021 <https://www.auswaertiges-amt.de/en/newsroom/news/joint-statement-usa-and-germany/2472084>

<sup>24</sup> Interfax Ukraine, “Ukraine offers \$25 bn worth energy decarbonisation project”, 3 September 2021; O&G Links, “Naftogaz plans to implement decarbonisation projects with US support”, 3 Sept 2021; “Biden urges Ukraine energy reforms”, *Argus FSU Energy*, 2 Sept 2021, p. 1

<sup>25</sup> S&P Platts, “COP26: Ukraine aims for 2035 coal phaseout”, 4 November 2021

<sup>26</sup> A thorough survey of this issue is: Aurora Energy Research, *The economic implications of phasing out coal in Ukraine by 2030* (Kyiv 2020)

<sup>27</sup> <https://energytransition.in.ua/aktualne/>, accessed November 2020; also Saha et al, *Implementing the National Emissions Reduction Plan*, op cit, p. 11

GW of open-cycle gas turbines, while a “renewable+” scenario implies that only 5.4 GW of OCGTs are built, only to provide network flexibility. Under a third “combined” scenario, which allows for a small fleet of coal-fired stations (4.3 GW) to remain open in 2033, just 3.4 GW of OCGTs would be built.<sup>28</sup> Further variables, not covered by Low Carbon Ukraine’s scenarios, would involve the construction of CCGT plants – that have higher capital costs, lower operating costs and higher energy efficiency – rather than OCGTs. Whichever way policy develops, it seems likely that the power sector will become a source of higher gas demand over the long term.

Paving the way for a substantial shift away from coal will require major investment in the electricity network. Government policy appears to be swinging in favour of a larger role for nuclear power, implemented both by extending the life of existing Soviet-built reactors and reviving the construction project for two new reactors, Khmelnytsky 3 and 4.<sup>29</sup> Renewables capacity (solar, wind and biomass) continued to grow rapidly in 2020, to 6.26 GW. Wind and solar more than doubled their share of generation to 6.8%. Market reform has lagged behind; curtailments of renewables generation, estimated by Ukrenergo, the TSO, at 1 TWh in 2020 – the immediate causes of which have included the high level of base-load coal and nuclear, and lack of negative prices – have become a serious problem. Network development has also not kept up; investment in physical integration and balancing capacities is urgent. Such problems will be addressed in the context of ongoing market reform, disputes about which type of purchase arrangement for renewable power should replace the now-outdated Feed in Tariff regime, and discussions about investment in nuclear.<sup>30</sup>

## (b) Heat provision

The reform of heating provision remains a key challenge. Although the *Energy Strategy*, the EU4Environment documents and the US-German joint statement all refer in general to energy efficiency, none gives the urgent attention to the heat sector that it deserves, and that could yield “low hanging fruit” for energy conservation. A glance at Ukraine’s energy balance shows the importance of the problem. See Table 4.

The heat sector comprises combined heat and power (CHP) plants and heat boilers that supply district heating systems, and a rising number of individual household boilers. In 2017, according to IEA statistics, the sector as a whole consumed 7.8 million tonnes of oil equivalent (mtoe) (9.3 bcm) of gas, and 2.7 mtoe of coal, and produced 10 mtoe of heat and electricity. The conversion efficiency of 82% was a considerable improvement on a decade earlier. But the accuracy of the statistics is limited. Naftogaz reported a much lower volume of gas supplied for district heat in 2017 than the IEA did, possibly because some volumes used in boilers were counted as supply to the residential sector. Whatever the reason, there is cause for concern in Naftogaz’s information for 2018-20. It shows that gas supply to the heat sector, particularly for heat plants supplying industry and the public sector, rose sharply. (See Table 6, below in Section 3.(d).) In 2020, Naftogaz reported that gas supply to the heat sector was 9.8 bcm, 31% of Ukraine’s total gas consumption.<sup>31</sup>

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<sup>28</sup> David Saha et al, *Implementing the National Emissions Reduction Plan*, op cit, pp. 17-25

<sup>29</sup> Mycle Schneider Consulting, *World Nuclear Industry Status report 2021*, pp. 389-391; Heinrich Boll Stiftung Kyiv, *Ukraine’s nuclear impasse* (Kyiv, 12 October 2020)

<sup>30</sup> Ukrenergo, “In 2020, the installed capacity of WPPs and SPPs increased by 41%”, 13 April 2021; Ukrenergo management report 2020; DTEK, *Integrated report 2020*; Baker Tilly/CMS, *Energy Sector of Ukraine 2021*, pp. 40-48

<sup>31</sup> For further comment on the statistical anomalies, and on the Ukrainian heat sector compared to that in other former Soviet countries, see S. Pirani, *Elusive Potential: Natural Gas Consumption in the CIS and the Quest for Efficiency* (OIES, 2011), pp. 33-70

**Table 4: Heat production, 2017 and 2008**

<b>Heat production, 2017 (mtoe)</b>			
Coal for CHP	2.14	Heat from CHP	3.42
Gas for CHP	3.01	Electricity from CHP	1.03
Other* for CHP	0.90		
Coal for heat plants	0.87	Heat from heat plants	5.70
Gas for heat plants	4.79		
Other* for heat plants	0.60		
<b>Total</b>	<b>12.3</b>	<b>Total</b>	<b>10.15</b>
<i>Conversion efficiency 82%</i>			
<i>Gas for district heating (reported by Naftogaz): 5.7 bcm (4.23 mtoe)</i>			
<b>Heat production, 2008 (mtoe)</b>			
Coal for CHP	0.58	Heat from CHP	3.13
Gas for CHP	5.63	Electricity from CHP	1.66
Other* for CHP	0.01		
Coal for heat plants	0.38	Heat from heat plants	9.69
Gas for heat plants	15.22		
Other* for heat plants	0.00		
<b>Total</b>	<b>21.82</b>	<b>Total</b>	<b>14.48</b>
<i>Conversion efficiency 66%</i>			
<i>Gas for district heating (reported by Naftogaz): 10bcm (8.3 mtoe)</i>			

\* Other = oil products, biomass and nuclear

Source: IEA energy balances

Beyond these potentially confusing statistics, five trends are clear. *First*, the share of CHP in Ukraine's heat supply to district heating systems is low, at 40%, compared to 72% in EU countries. In other words, the share of individual boilers is relatively high. *Second*, the infrastructure, built in the late Soviet period, is old, polluting and extremely wasteful of energy: indeed, of the plants covered by the NERP that do not meet emissions standards, 62 out of 84 are CHPs, accounting for about one-third of the power produced.<sup>32</sup> *Third*, due to the poor quality of service associated with this infrastructure, households are dropping out of district heating systems in large numbers, thus further detracting from their efficiency: a recent report estimated that the share of urban households served by district heating fell from 89% in 1995 to 55% in 2018.<sup>33</sup>

*Fourth*, in a small number of cases, gas-fired district heating is giving away to boilers and small power plants burning biomass. Ukrteplo, the heating supply company, has specialised in such installations. Ukraine has adequate supplies of biomass for this sector to expand.<sup>34</sup>

*Fifth*, the long-standing failure to reform heat sector institutions and intra-sector prices has obstructed change. Naftogaz last year attributed 44.5 billion uah of its 106.7 bn uah receivables outstanding to district heating companies, defining them as "the most problematic group of customers". In May this

<sup>32</sup> Cabinet of Ministers, *Natsional'nyi plan skorochennia vikidyv vyd velikikh spaliuval'nikh ustanovok*, November 2017, op cit, Annex 2; Saha et al, *Implementing the National Emissions Reduction Plan*, op cit, pp. 9-10

<sup>33</sup> Energy Security Project, *White Paper on transforming district heating in Ukraine: assessment and recommendations* (USAid/Ukraine, August 2020)

<sup>34</sup> Ukrteplo, "Season in Review", April 2020; Low Carbon Ukraine, *Exploiting benefits of small solar and biogas* (Berlin/Kyiv, November 2018)

year, the Public Service Obligation (PSO) on Naftogaz to supply the heat sector was finally cancelled, and shortly afterwards legislation was passed allowing the government to restructure, and pay some of, these debts. (See Section 3.d).<sup>35</sup>

A programme of insulating buildings and modernising district heating systems<sup>36</sup> is not currently among the priorities of the government or its international counterparts. Were it to rise up the agenda, such a programme could achieve substantial energy conservation, improve the housing conditions of many citizens, and reduce wasteful gas consumption that is currently subsidised by the government, and indirectly by international financial institutions.

### (c) Hydrogen

Much public attention is being paid to the potential for developing hydrogen production in Ukraine. In March this year, the UN Economic Council for Europe (UNECE) published a Draft Roadmap for the production and use of hydrogen in Ukraine, which stated that hydrogen could raise the energy efficiency of the Ukrainian economy to a level comparable to that of the EU, and that renewables-to-hydrogen projects present a significant investment opportunity.<sup>37</sup> It proposed a focus on the use of hydrogen in fuel cells to balance renewable electricity production and for energy storage; in transport; and in industry, particularly for fertiliser production. A Strategic Environmental Assessment scoping report, published in parallel, reached the headline conclusion that hydrogen development in Ukraine should focus on “green” hydrogen from renewables, and possibly from biofuel.<sup>38</sup> In addition to high-profile support from the US and German governments, there have also been a flurry of European-Ukrainian initiatives, including an agreement between the European Bank for Reconstruction and Development and GTSOU to develop hydrogen infrastructure.<sup>39</sup>

Ukraine currently produces a considerable volume of “grey” hydrogen – i.e., from gas, by steam methane reformation or oxidation, and with a heavy carbon footprint – at its fertiliser plants, probably about 1.1 million tonnes per annum.<sup>40</sup> (This production may account for about 13 MtCO<sub>2</sub>/year of Ukraine’s greenhouse gas emissions, or 4% of the total.<sup>41</sup>) Neither the UNECE report nor the public advocacy material by the EBRD or EU4Environment mention these volumes. And yet, in the context of a logical decarbonisation policy, a priority call on “green” hydrogen in Ukraine would be to displace this “grey” hydrogen. Indeed a wind-to-hydrogen project in Rivne aims to supply the fertiliser producer Rivneazot.<sup>42</sup>

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<sup>35</sup> “Shmygal’ ob’iavil o perekhode teplokomunenergo na rynochnye tseny”, LB.ua, 19 May 2021; “Shmygal zaiavliaet ob otsutstvii osnovanii dlia rosta tsen”, Interfax Ukraine 14 September 2021; “Shymgal rasskazal, chto budet s tsenamy”, UNIAN, 14 September 2021; “Zima prouchit Ukrainu za gazovy razryv s Rossiei, Russkoe agentstvo novosti, 21 September 2021. See also S. Pirani, *The Market Takes Shape*, op cit, pp. 10-13

<sup>36</sup> As proposed in Energy Security Project, *White Paper*, op cit

<sup>37</sup> UNECE, *Draft Roadmap for production and use of hydrogen in Ukraine* (Kyiv: UNECE, 2021), especially pp. 5-6 and 14-22; UNECE Regional Advisory Services web site <https://unece.org/sustainable-energy/regional-advisory-services/improving-capacity-government-ukraine-develop>

<sup>38</sup> UNECE, *Draft Roadmap for production and use of hydrogen in Ukraine* (Kyiv: UNECE, 2021), especially pp. 5-6 and 14-22; UNECE, SEA Scoping Report for the draft “Roadmap”, etc; UNECE Regional Advisory Services web site <https://unece.org/sustainable-energy/regional-advisory-services/improving-capacity-government-ukraine-develop>

<sup>39</sup> <https://www.powerengineeringint.com/hydrogen/ukraine-utility-and-ebrd-to-develop-green-hydrogen-infrastructure/>

<sup>40</sup> A presentation by researchers, commissioned by the UNECE, states current Ukrainian hydrogen demand as 1.15 million tonnes, more than 1.1 million tonnes of which is for ammonia production and the remainder for methanol production. See “Assessment of potential for a low-carbon hydrogen economy”, at <https://unece.org/sites/default/files/2021-10/UNECE%20-%20EBRD%20Regional%20H2%20Market%20Study%20Overview.pdf>. I assume that this demand is met on site by Ukraine’s fertiliser manufacturers, who produce hydrogen from natural gas as an intermediate product in the manufacture of ammonia-based fertilisers

<sup>41</sup> Author’s estimate. The IEA states that global “grey” hydrogen production of 70 million tonnes/year accounts for 830 MtCO<sub>2</sub> of CO<sub>2</sub> emissions, i.e. 11.85 units of CO<sub>2</sub> for each unit of hydrogen produced. See IEA, *The Future of Hydrogen* (Paris: IEA, 2020), p. 37

<sup>42</sup> News item on [ecopolitic.com.ua](http://ecopolitic.com.ua), 5 May 2021 <https://ecopolitic.com.ua/news/v-rovenskoj-oblasti-166-metrovye-vetryaki-budut-proizvodit-ekologicheskij-vodorod/>



The UNECE report, and the associated advocacy material, also make no mention of the importance of renewable energy for decarbonising Ukraine's electricity supply (see Section 3.a above). The potential for highly energy-intensive "green" hydrogen production is presented without reference to the more urgent need for renewable electricity capacity to replace coal-fired electricity generation.

The UNECE report includes projections that renewable electricity generation, which was 5.4 TWh in 2019 and 10.9 TWh in 2020, will rise from 12-22 TWh in 2025 to 25-52.5 TWh in 2035, and that between one-fifth and one-quarter of it will be used for hydrogen. See Table 5. Under these ambitious scenarios for renewables, hydrogen output from renewables would rise from about 54,000-99,000 tonnes in 2025 to 107,000-234,000 tonnes in 2035 – i.e. between one-twentieth and one-quarter of current Ukrainian demand for "grey" hydrogen.<sup>43</sup>

**Table 5: UNECE projections for "green" hydrogen production in Ukraine**

<b>Projections to 2035</b>		<b>2025</b>	<b>2030</b>	<b>2035</b>
Using energy strategy assumptions on renewable electricity	Renewable electricity, total, TWh	12	18	25
	Renewable electricity for hydrogen, TWh	2.729	4.093	5.458
	<i>Hydrogen production (tonnes)</i>	<i>53928</i>	<i>80892</i>	<i>107856</i>
Using Institute for Renewable Energy assumptions	Renewable electricity, total, TWh	21.6	35.5	52.5
	Renewable electricity for hydrogen, TWh	5.003	8.186	11.825
	<i>Hydrogen production (tonnes)</i>	<i>98868</i>	<i>161784</i>	<i>233688</i>
<b>Projections of "potential average annual production" (undated)</b>				
Using IRENA assumptions	renewable electricity capacity, GW	537		
	renewable electricity TWh	1516		
	<i>Hydrogen production (tonnes)</i>	<i>30.29 m</i>		
Using Institute for Renewable Energy assumptions	renewable electricity capacity, GW	771		
	renewable electricity, TWh	2273		
	<i>Hydrogen production (tonnes)</i>	<i>45.39 m</i>		
<b>Memo item. Ukraine electricity output, 2019, TWh</b>				
	<b><i>From wind, solar and biomass</i></b>	<b>5.4</b>		
	<b><i>From hydro</i></b>	<b>7.8</b>		
	<b><i>From nuclear</i></b>	<b>83</b>		
	<b><i>From coal and gas</i></b>	<b>63.1</b>		
	<b>Total</b>	<b>159.3</b>		

Note. Energy efficiency: the table reflects the UNECE assumption that 50.6 TWh of electricity produces 1 m tonnes of hydrogen. The IEA assumes 52.174 TWh. Volume/weight conversion: 1 bcm hydrogen = 89880 t (preferred to UNECE assumption that 1 bcm = 89006.1 t.

Source: Draft roadmap for production and use of hydrogen in Ukraine, pp. 33-35

These modest projections of hydrogen output do not justify the claim, already widespread in public discussion, that Ukraine should focus its efforts on exporting hydrogen to Europe through the gas transport network, in which spare capacity will be available as a result of the decline in east-west gas transit (see Section 4 below).<sup>44</sup> The European Commission and the EBRD have embraced this claim:

<sup>43</sup> UNECE, *Draft Roadmap*, op cit, pp. 33-35

<sup>44</sup> The authors of the UNECE report make a heroic attempt to bridge the gap between possible production numbers and inflated expectations, with a further (undated) projection of "potential average annual production" of hydrogen, in which 1516-2273 TWh

the EU Hydrogen Strategy refers to Ukraine as a “priority partner” in plans to import hydrogen, and envisages 40 GW of electrolyzers being installed in the Eastern and Southern Neighbourhood countries by 2030.<sup>45</sup> Should such hydrogen production capacity be installed in Ukraine, in that time frame, for export, it would represent missed opportunities both to accelerate the decarbonisation of Ukraine’s electricity supply, and to accelerate the decarbonisation of its hydrogen production. The claim that Ukraine’s energy efficiency could be raised to European levels by hydrogen production of any kind, let alone production for export, is absurd.

Discussion of the hydrogen-for-export proposal will encounter both technological and strategic problems. The physical difficulties of transporting hydrogen long distances through former gas pipelines are well known;<sup>46</sup> the additional compression required, which is about three times as great per unit of energy as for natural gas with the same energy content, is also a factor.<sup>47</sup> The strategic problems relate to the potential transition from gas transit to hydrogen transit. The discussion among European TSOs at present is limited to seeking agreement on low proportions of hydrogen (5-10%) that could be included in a methane-hydrogen mix. Under these conditions, GTSOU considers that no substantial hydrogen industry will emerge in Europe before 2025, and therefore that it must first focus on the evolution of the gas transportation business, and that it would be foolhardy to take on any obligations for its development.<sup>48</sup>

The conclusion is not that “green” hydrogen can never be produced in Ukraine. It is likely that Ukraine’s international partners will continue to press for it, and that investment funds may be forthcoming. Ultimately, any progress on developing hydrogen production will probably depend largely on those partners. But priority development of “green” hydrogen for export, rather than for decarbonisation in Ukraine, is illogical from an emissions reduction viewpoint, and may also be seen to be at odds with Ukraine’s economic and energy interests.

#### **(d) Gas market reform**

Over the next decade, new gas demand generated by economic growth, and potentially by changes in the electricity sector, could be cancelled out by even modest progress on energy conservation, primarily but not exclusively in the heat sector. If gas demand stagnates, or declines slightly, about two-thirds of it will continue to be met by domestic production, and one third from imports. Gas market reform will also make a difference: the phasing out of heavily subsidised prices in the heat and residential sectors may impact on demand. Over the longer term, the development of trading infrastructure and the continuation of corporate reform at Naftogaz could help stimulate change in the upstream.<sup>49</sup> The structure of gas consumption is shown in Table 6.

The reform of gas pricing has this year shuddered to a halt, due to the spike in European wholesale prices. The heat and residential sectors, that were traditionally regulated, comprise more than half of the market (18 bcm out of a total 31.2 bcm in 2020. See Table 6). A PSO, requiring Naftogaz to supply households at fixed prices, was cancelled in August 2020; Naftogaz entered the supply business, competing with RGC, the dominant player; efforts were made to open the market to other traders. With wholesale prices rising again, in January this year the government re-froze residential-sector prices, for February-March, at 6.99 uah/cubic metre. A PSO for the district heating sector was cancelled, as

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of renewable-generated electricity – 140-210 times Ukraine’s renewable energy generation in 2020 – is used to produce 30-45 million tonnes/year of hydrogen. It is unfortunate that these numbers, which are not worthy of serious discussion, appear in a report published by a UN agency. See Table 5

<sup>45</sup> European Commission, *A hydrogen strategy for a climate-neutral Europe* (Brussels, COM (2020)301, July 2020), pp. 19-20

<sup>46</sup> IEA, *The Future of Hydrogen* (Paris: IEA, 2019), pp. 70-74 and 76-78; Energy Research Partnership, *Potential Role of Hydrogen in the UK Energy System* (London, 2016), p. 11

<sup>47</sup> On compression, see Peter Adam et al, *Hydrogen infrastructure – the pillar of energy transition* (Siemens, 2020), p. 17

<sup>48</sup> A recent article by Olga Bielkova, director of international relations, GTSOU, was entitled “Why hydrogen will not replace natural gas transit in the near term”. O. Bielkova, “Pochemu vodorod ne zamenit tranzit”, *Novoe Vremia*, 13 August 2021

<sup>49</sup> See also S. Pirani, *The market takes shape*, op cit. This section updates, hopefully without repeating, what is written there

planned, but in May Naftogaz offered one-year contracts to households in a range of 7.8-13.5 uah/cubic metre, and to district heating companies at 7.42 uah/cubic metre.<sup>50</sup>

**Table 6: Ukraine gas consumption by sector, 2018–2020**

bcm		2018	2019	2020
<b>Industrial + public sector</b>	Industrial	9.4	8.1	9.1
	Public sector / religious	0.5	0.4	0.4
<b>Gas companies own use</b>	Transport & storage operators	1.9	1.9	1.3
	Gas distribution companies	0.1	0.2	0.5
	Gas dis co's: unauthorised withdrawals*	0.9	0.7	0.7
	Ukrgezvydobuvannya	1.4	1.3	0.9
	Ukrnafta	0.3	0.4	0.3
	Other	0.1	0	0
<b>Regulated sector*</b>	Heat for households	4.8	4.6	4.7
	Heat for industrial/ public sector	1.7	2.3	4.6
	Heat: unauthorised withdrawals*	0.6	0.5	0.5
	Households: direct use	10.6	9.5	8.2
<b>Total</b>	<b>32.3</b>	<b>29.9</b>	<b>31.2</b>	

\* Estimates by Naftogaz of the level of unauthorised withdrawals

Source: Naftogaz Ukrainy Annual Reports

Any hopes that pricing reform would be revived were dashed as wholesale prices soared. In September, the government froze prices for households at 7.96 uah/cubic metre, and for district heating companies at 7.44 uah/cubic metre. Electricity tariffs were also frozen for households using less than 250 kWh/month – a decision criticised by the World Bank as problematic for the electricity sector's finances. About 50 bn uah (about \$1.8 billion) of transit revenue was effectively transferred to Naftogaz to subsidise these volumes.<sup>51</sup>

The government's immediate, and arguably inevitable, response to the price spike should not obscure its efforts to address some long-standing obstructions to market reform. A decree issued in September required officials to draft legislation on a mandatory gas release programme by UGV, which would put volumes of its gas on to the Ukraine energy exchange (UEEX), and to develop an action plan to increase the liquidity of exchange based trading. UEEX reported 1.56 bcm of medium- and long-term sales in 2020, and 1.96 bcm in the first ten months of 2021. Short-term products (within-day and day-ahead) traded at far smaller volumes (15.5 million cu m in the first nine months of 2021); the exchange, which

<sup>50</sup> "Shmygal ob"iaivil o perekhode teplokomunenergo na rynochnye tseny", UNIAN, 19 May 2021; "Oktiabrskie tseny na gaz", Interfax Ukraine 29 September 2021. The government is often criticised for such delays in pricing reform. The context should be borne in mind. In May this year, the lower bound of the household price, which was close to the heating sector price, equated to about €23.40/MWh, i.e. close to the range of European wholesale prices; European household prices ranged from 1-3 times that level. But Russian household prices – with which Ukrainian consumers would no doubt compare the prices they pay – were around 5000 rubles/mcm, or around €5.50/MWh, i.e. about one quarter of the Ukrainian level

<sup>51</sup> Government of Ukraine, Postanova no. 1011, "Deiaky pitannia dyial'nosti aktsyonernogo tovaristva 'NAK Naftogaz Ukrainy'", 27 September 2021; "Shymgal rasskazal, chto budet s tsenamy", UNIAN, 14 September 2021; "Naftogaz rassmatryvaet vozmozhnost zakliucheniia kontraktov", Interfax Ukraine 13 September 2021; "Reshenie Kabmina snizit' tarif na e/e", Interfax Ukraine 13 September 2021

already trades gas in storage, has also launched a product for trading gas held in Ukrainian storage under the “customs warehouse” arrangement.<sup>52</sup>

The government’s decree also outlined a series of measures to unbundle gas distribution and supply activities, and required the energy regulator to consider revising the tariff structure for these sectors, in which large volumes of debt have accumulated. A law passed in June set out terms for restructuring 50 bn uah of these debts over the next five years.<sup>53</sup> Late last year the total accumulated debts to Naftogaz and GTSOU were quantified as 106.7 bn uah (\$3.77 bn): 48.1 bn uah from district heating companies, CHP and industrial enterprises; 23.6 bn uah from gas supply companies; and 35 bn uah in the form of unsanctioned offtake by regional gas distribution companies. A report commissioned by GTSOU from Ernst & Young in the summer of this year classified 3.5 bn uah of this back debt as resulting from “deviant offtake”, and said that a further 6.5 bn uah had accrued in February-March this year.<sup>54</sup>

Another factor that will influence gas market reform is forthcoming government decisions about the strategy, and senior management, of Naftogaz Ukrainy. The management was until April 2021 headed by Andriy Kobolev; in April, the government dismissed Kobolev, appointed Yuri Vitrenko in his place, and dealt with opposition to this within the supervisory board by dismissing and reappointing it. Further conflict ensued: the National Agency on Corruption Prevention deemed Kobolev’s dismissal illegal; that decision was overturned by the courts; other senior managers quit; in September, three independent board members, including the chair, Clare Spottiswoode (former director general of the UK gas regulatory body), resigned on the grounds that communication with management had broken down; and the government took over the supervisory board’s functions and announced a procedure by which a new board would be constituted.<sup>55</sup>

Three issues may underlie this complex dispute. The first is corporate governance: there is tension between European standards and Ukrainian practice. The second is strategy: there is tension between the decision made last year to focus Naftogaz on production, gas trading and supply, and long-standing government practice of using its control of Naftogaz, the country’s largest taxpayer, to address a wider range of problems. A third, related issue, articulated by the departing supervisory board members, was their concern about the government re-imposing effective price controls.<sup>56</sup>

It is unlikely that the government will review its approach to prices over this winter. But in the medium to long term, if and when European wholesale gas prices fall to their previous range, the instinct to retain subsidies in the form of low prices will clash with market reform policies. The direction taken at Naftogaz will make a difference to this, and also influence Ukraine’s success, or otherwise, in raising domestic gas production (see Section 5 below).

#### 4. Decline of the transit business

Ukraine’s gas transit business is in decline and the possibility remains that, after the expiry of the current contract at the end of 2024, transit of Russian gas across Ukraine will stop altogether.

In volume terms, Russian gas exports to Europe, including Turkey, up to 2030 are unlikely to be much greater than 200 bcm/year, although there are some scenarios in which they could be as high as 225

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<sup>52</sup> Government decree no. 452/2021; UEEX, Energy Trade in Ukraine: prospects for expanding horizons (conference presentation, October 2021); UEEX press release, “UEEX and gas storage operator have opened the possibility of trading in non-cleared gas”, 2 November 2021

<sup>53</sup> Law no. 3508-d; “Shmygal ob’iavil o zapuske restrukturyzatsii dolgov”, Interfax-Ukraine 4 September 2021; “Shmygal zaiavljaet ob otsutstvii osnovanii dlja rosta tsen”, Interfax Ukraine 14 September 2021

<sup>54</sup> Pirani, The market takes shape, pp. 10-11; Ernst & Young, *Advisory services on the assurance of financial sustainability of the GTSO*, 16 August 2021, p. x

<sup>55</sup> “Naftogaz supervisory board head supports new CEO’s suspension”, Reuters, 16 June 2021; “Court stops NACP’s order”, Interfax Ukraine 6 July 2021; “Ukraine’s Naftogaz CEO says new professional board needed”, 11 September 2021; Naftogaz Ukrainy press release, “The government will serve as Naftogaz supervisory board”, 27 September 2021

<sup>56</sup> “Members of Naftogaz supervisory board name reason for resignation”, Interfax Ukraine, 8 September 2021



bcm/year. A key factor is the availability of LNG for Europe, which in turn will depend on the level of LNG demand and the pace of new LNG capacity starting up.<sup>57</sup> For Russian gas exports to Europe, non-Ukrainian pipeline capacity will be 205.9 bcm, if the Nord Stream 2 pipeline is completed and operating at full capacity, and 194.9 bcm if, as is possible due to regulatory decisions, Nord Stream 2 is operating at 80% capacity.<sup>58</sup>

If Nord Stream 2 is operating at 80% capacity, and Russian exports are 200-225 bcm, the surplus of transit volumes over non-Ukrainian pipeline capacity would be 5.1-30.1 bcm. If Nord Stream 2 is operating at 100% of capacity, this surplus would be 0-19.1 bcm.<sup>59</sup> But if total Russian exports to Europe, including Turkey are lower, e.g. 180 bcm, no Ukrainian transit would be required. The caveat is that flows are not even all year round and that, even if the annual surplus of Russian exports over non-Ukrainian capacity is zero, the Ukrainian pipeline system provides by far the best flexibility and winter cover.

The author and his colleagues have in the past argued that under some scenarios Gazprom could export all volumes by other routes, and also that, for Gazprom, it would make commercial sense to retain options for the use of the Ukrainian system.<sup>60</sup> But the political tensions around Nord Stream 2 mean that the future of Ukrainian gas transit can not be forecast solely on the basis of the above numbers. Three possible scenarios after 2024 are: (1) A long-term transit agreement is reached, as proposed by the US and German governments' joint statement on Nord Stream 2,<sup>61</sup> transit is 0-35 bcm/year. (2) No long-term agreement is signed, but Gazprom continues to book capacity via Ukraine on a short-term basis, as it has been doing in Poland since the expiry last year of the transit contract; transit is 0-15 bcm/year. (3) Due to market and/or geopolitical factors, transit is reduced to zero.

At present, scenario (1) looks less likely than (2) or (3), although that could change in the event of an improvement in Russia-Europe relations. Scenario (3) is frequently portrayed as being extremely negative for Ukraine. Therefore, in order to assess the issues, this brief discussion is structured around questions about a zero-transit scenario.

#### ***a. How likely is it that the transit of Russian gas across Ukraine will be reduced to zero?***

Negotiations on the post-2024 contract are *de facto* being conducted largely at government level, in the context of the broader geopolitical interaction between Russia, Ukraine and European countries. Following the US-German joint statement, at the summit meeting between president Putin and chancellor Merkel of Germany in August, both leaders spoke about gas transit via Ukraine. Putin said that its future would depend on European commitments to buy volumes of Russian gas (on other occasions he has emphasised that this should be on long-term contracts), and Merkel said that a (political) special envoy, Georg von Walderssee, had been appointed to sound out the potential for compromise.<sup>62</sup> The recent negotiation on imports of Russian gas to Moldova, between Gazprom and Moldovan government representatives, was another reminder, if one was needed, that the issue of

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<sup>57</sup> A projection of gross Russian gas exports to Europe, including the Baltic states and Turkey, by a colleague, shows exports in 2021-2030 ranging from 158 bcm/year to 207 bcm/year, and averaging 191.4 bcm/year. Calculation by Mike Fulwood (OIES), using the Nexant world gas model.

<sup>58</sup> The design capacity of Nord Stream 2 is 55 bcm/year; 80% of that is 44 bcm/year. On the regulatory issues, see: Katja Yafimava, *Nord Stream 2: on the verge of sending gas to Europe* (OIES, November 2021)

<sup>59</sup> See S. Pirani, *Russian gas transit through Ukraine after 2019: the options* (Oxford Energy Insight, 2018), pp. 2-3. Table 1 on p. 2 shows the non-Ukrainian pipeline capacities and the surplus. In that Table, a Scenario C was presented, assuming that Nord Stream 2 would be used at 100% of capacity. See especially the penultimate row of the Table, "High Asian LNG demand scenario", which projects Russian exports to Europe of 187-225 bcm/year

<sup>60</sup> S. Pirani and K. Yafimava, *Russia's Gas Transit Across Ukraine after 2019* (OIES, 2016); S. Pirani *Adversity and Reform: Ukraine's gas market prospects* (OIES, 2017);

<sup>61</sup> *Joint Statement of the US and Germany on Support for Ukraine*, 21 July 2021, op cit

<sup>62</sup> "Vladimir Putin poobeshchal Angele Merkel' sokhraniti' ukrainskii tranzit gaza", *Vedomosti*, 20 August 2021

Russian gas supply to eastern European countries can not be understood purely in commercial terms.<sup>63</sup> All this suggests that zero transit, while not *commercially* logical for either side, remains possible.

**b. Would a reduction of transit to zero intensify military or geopolitical problems?**

Ukrainian politicians and Naftogaz executives have suggested that a reduction of transit to zero after 2024 would intensify the military and geopolitical tension between Russia and Ukraine. This argument has been made in the context of political opposition to completion of the Nord Stream 2 pipeline. For example, Yuri Vitrenko, CEO of Naftogaz, stated in September that the curtailment of transit would raise the risk of a “full scale military assault” on Ukraine by Russia, and that Ukraine sees transit as a guarantee against such an outcome.<sup>64</sup> No attempt is made here to assess the possibility of a military escalation, and/or an escalation of Russian involvement in it – beyond saying that both are possible, given the scale of the conflict and the level of Russian government support for the unrecognised republics in eastern Ukraine. So fears of such possibilities are well grounded. However, it is not obvious that the likelihood of these outcomes is influenced by the negotiations on post-2024 transit. The implication of the statements made is that the existence of transit stands in the way of military escalation, and that, should it be removed, the way would be clear for escalation. But there was Russian military involvement in the conflict in 2014-15, and the existence of transit did not stand in the way of it or, apparently, figure in Russia’s calculations. Of course, the improvement of trade and business links between Russia and Ukraine is desirable. But it does not follow that the absence of a transit contract would be a direct cause of military conflict. Rather, it could be seen as one more manifestation of the long-term deterioration of Russian-Ukrainian relations.

**c. What would be the effect of zero transit in business terms (infrastructure, finance, etc)?**

The impact of zero transit on the physical transportation infrastructure would be significant, but manageable. In a recent interview, Sergei Makogon, ceo of GTSOU, focused specifically on a zero-transit scenario. He pointed out that the transportation system would be modified to manage flows of gas produced in Ukraine and imported from Europe, and went out of his way to dismiss concerns about technical dangers as “complete nonsense”. Moreover, strategic plans to decommission parts of the transportation system have been made. GTSOU estimates that, of a total of 86 compressor stations currently in operation, 15 would be required in a zero-transit scenario, and 17 required with 30 bcm/year of transit.<sup>65</sup> It is likely that the Urengoy-Pomary-Uzhgorod and Progress lines will remain available for east-west transit; that the Soyuz pipeline may no longer be required; and that the south east line to Romania will be used only in west-east mode and/or for domestic deliveries. Parts of the system that remain in operation will over time have to be modernised. The challenge will be to fund such changes. GTSOU’s stated budget for its ten-year development plan (2020-29) is 38.8 billion uah (\$1.42 billion), more than half of which is for compressor station decommissioning.<sup>66</sup> This brings us to the undoubtedly serious problem that Ukraine would face in a zero-transit scenario, i.e. the loss of transit revenue. The

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<sup>63</sup> On 29 October Gazprom and Moldovagaz extended the commercial contract under which gas is supplied to Moldova. In parallel, Gazprom stated that an (unpublished) “protocol for the settlement of current issues in the gas sector” was signed by its CEO with Andrei Spinu, deputy prime minister. Spinu said that contract implementation is dependent on two further agreements being reached, on the settlement of \$700 million of back debts for gas and on other energy sector cooperation. President Maia Sandu of Moldova said these issues would be discussed at upcoming talks between the Moldovan and Russian foreign ministers. (See Gazprom press release, 29 October 2021; “Moldova will get 3bcm per year in new deal”, Al Jazeera, 1 November 2021 (interview with Spinu); and “Gas crisis in Moldova exposes problems in relations”, TASS, 5 November 2021.) It should be borne in mind that the back debts largely relate to gas supply to the unrecognised Transdnestr republic, that is policed by a Russian peacekeeping force. The Moldovan government, which has no control over the territory, has never acknowledged responsibility for these debts, and indicated after the contract negotiations that it would take the issue of the debt to commercial arbitration. (“Moldavia khochet obratit’sia v mezhdunarodnyi sud”, *Vedomosti*, 3 November 2021.) Given this background, and Gazprom’s direct interaction with the Moldovan government as well as Moldovagaz, Gazprom’s claim that there is no political aspect to the negotiations must be doubted

<sup>64</sup> “Glava ‘Naftogaza’ nazval garantii”, *Vedomosti*, 3 September 2021. Similar statements were made last year by Andriy Kobolev, then CEO of Naftogaz

<sup>65</sup> “Geopolitika: shantazh Gazproma v Evrope” [interview with Sergei Makogon], Liga.net, 13 July 2021; presentation by Sergei Makogon at the Adam Smith Ukraine Energy Forum, February 2020

<sup>66</sup> Presentation by Sergei Makogon at the Adam Smith Ukraine Energy Forum, February 2020, op cit

current contract is worth \$7.5 billion over five years, a level of transit revenue significantly lower than in the 2000s but still substantial. This loss would significantly impact GTSOU above all, and Naftogaz to a lesser extent, and must therefore be an issue of government energy policy.

#### **d. What direction would the transportation and storage business take in a zero-transit case?**

In a zero-transit scenario, the Ukrainian transportation system would have to be adapted to collect gas produced domestically (currently about 20 bcm/year) and gas imported over the western border (12-15 bcm/year), and supply it to consumers. A further significant element is the use of Ukraine's gas storage facilities – by far the largest in Europe, and mostly located close to the western border – by European as well as Ukrainian companies. GTSOU and Ukrtransgaz, which manages the storage, successfully launched cross-border storage products for European traders in 2020, meeting a spike in demand for storage services caused by depressed gas demand and the limited capacity of European storage. In October 2021, with European prices reaching record levels, re-exports of stored gas rose sharply.<sup>67</sup> The author and colleagues have argued that, over the long term, the potential of this business is limited by market and geographical factors: if there is spare capacity in European storage, it is difficult for Ukraine to compete due to the costs of transportation.<sup>68</sup> Nevertheless, this business is now established and will remain an element in Ukraine's integration into the European gas market.

To sum up: even if no long-term contract is signed (scenario 1 above) it would be commercially logical for Gazprom to retain the option of booking capacity in the Ukrainian system (scenario 2 above). If transit is reduced to zero (scenario 3 above), this will more likely be due to geopolitical factors than commercial ones. In any case, the important policy implications are (for the Ukrainian government) to manage the reduction in transit revenue, and oversee the funding of the adaptation and decommissioning of the transport system; and (for Naftogaz and GTSOU) to develop the storage, short-haul and reverse flow businesses, and manage adaptation and decommissioning.

## **5. Gas production outlook**

The potential for domestic production to grow is another key factor that will shape the Ukrainian gas sector. In the last five years, output has been steady at around 20 bcm/year, but, after reaching a 2018 peak of 21 bcm, declined again. Output from Ukgazvydobuvannya (UGV), Naftogaz's upstream division, is falling, due to the depletion of its main fields, while output from private companies is rising: in aggregate they produced 4.9 bcm in 2020. In January-October 2021, total output was 3.3% down year on year, while the private companies' output was up 1.2% year on year.<sup>69</sup>

Ukraine has adequate hydrocarbons resources. There are 779 bcm of proven reserves (38 years' worth at the current output level). Exploration activity has been low in recent years, and there are 267 years' worth of undiscovered resources. Of the proven reserves, almost all (97%) are formally under commercial development, but in many cases at a very early stage.<sup>70</sup>

Ukraine's existing fields are largely depleted. UGV, which operates these fields and has more than 2000 wells, reports that 95% of fields are more than 87% depleted; its five largest fields, that together account for 30% of Ukraine's total production, are depleted by between 79% and 90%.<sup>71</sup> UGV has partnered with international services companies to slow the rate of output decline with workover techniques. However, a comparative study, by advisory firm Baker Tilly and lawyers CMS, shows that, by

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<sup>67</sup> GTSOU, "Ukraine's gas imports", 9 November 2021 <<https://tsoua.com/en/news/ukraines-gas-imports-from-the-eu-exceed-exports-based-on-10-months-results/>>

<sup>68</sup> S. Pirani and J. Sharples, *European gas storage: backhaul helps open the Ukrainian safety valve* (OIES, 2020) and *Ukraine-EU gas market integration: short-term progress, long-term challenges* (OIES, 2021)

<sup>69</sup> Association of Gas Producers of Ukraine, *Digest: 3rd quarter of 2021*

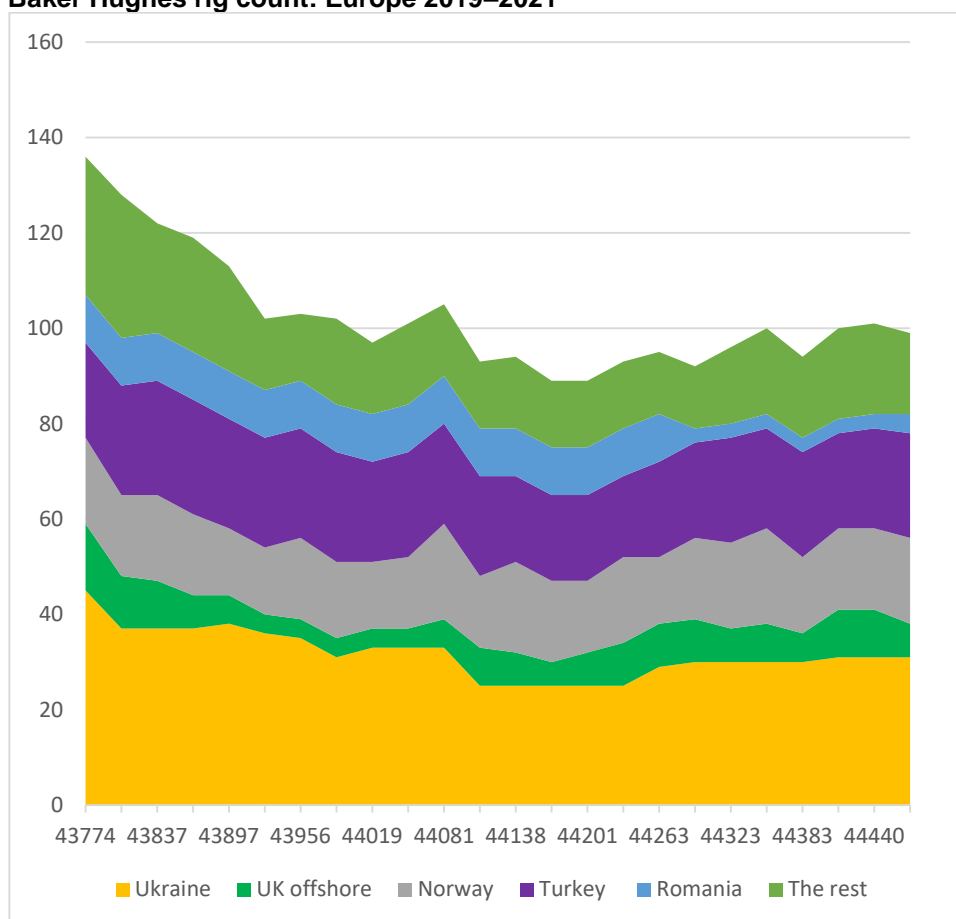
<sup>70</sup> Baker Tilly/CMS, *Energy Sector of Ukraine 2021*, pp. 69-70

<sup>71</sup> These are Shebelynske, depleted by 89%; Zakhidno-Khrestyshynske, 90%; Yablunivskie, 79%; Yefremivskie, 82%; and Melykhivske, 82%. Baker Tilly/CMS, *Energy Sector of Ukraine 2021*, p. 71

international standards, the production efficiency of the depleted fields is already quite high, implying that their output decline can not be slowed significantly further.<sup>72</sup>

New wells are being drilled extensively: UGV reported 258 new wells in 2016-20, and the largest private gas producer, DTEK Naftogaz, reported 18 new wells in 2013-19. Output from new wells has risen from 0.2 bcm in 2018 to 2.9 bcm (14.2% of total output) in 2020. Since 2019, Ukraine has been added to Baker Hughes's international rig count, and accounts for more rigs (31 in October 2021) than any other European country.<sup>73</sup> See Figure 3. There has also been a political push to stimulate new field development, and eight PSAs were signed in 2018-19 – four with Naftogaz and four with private companies, although none of these are foreign majors.

**Figure 3: Baker Hughes rig count: Europe 2019–2021**



Source: Baker Hughes international rig count. This chart includes the "Europe" category, with the exception of Sakhalin (Russia), which has been removed by the author

Despite all these efforts, Ukraine will struggle simply to maintain production at 19.5-20 bcm/year in the next few years. Naftogaz Ukrainy has stated that, in addition to its PSAs, it intends to raise output significantly by expanding its tight gas operations and working deep horizons of existing fields. Further, it looks to starting up production from the Yuzivska field, which was acquired by Shell under a PSA that it relinquished after the outbreak of military conflict in 2014. An assessment published jointly by Naftogaz and the Association of Gas Producers of Ukraine shows that these are the main hopes to

<sup>72</sup> Baker Tilly/CMS, *Energy Sector of Ukraine 2021*, p. 72; Naftogaz Ukrainy, *Annual Report 2020*, pp. 69-70

<sup>73</sup> Naftogaz reports; DTEK, *Integrated Report 2020*, pp. 70-75; Baker Tilly/CMS, *Energy Sector of Ukraine 2021*, pp. 74-77; Baker Hughes international rig count



compensate for the decline of existing fields in the coming years.<sup>74</sup> The projected output estimated for 2021 and 2025, unchanged at 19.7 bcm, is shown in Table 7.

**Table 7: Naftogaz / AGPU projections of natural gas output, 2021 and 2025 (bcm)**

	PSAs (UGV)	Tight gas	Yuzivska field	Carpathian fields	Conventional green fields	Deep horizons	Other	Existing fields	Private companies	Total
<b>2021</b>	0	0	0	0	0.1	0.1	0	14.6	4.9	<b>19.7</b>
<b>2025</b>	0.7	0.7	0.4	0.1	0.4	1.3	0.1	10.3	5.7	<b>19.7</b>

Source: *Assessment of Gas Production Industry Impact on the Ukrainian Economy*, slides 12-17

Industry observers argue that, if output is to be increased rather than simply tread water, substantial policy intervention is needed. The study by Baker Tilly and CMS showed that “it takes 3-5 years to start producing gas, which time is mostly spent on bureaucratic procedures”. This is true even for PSAs: notwithstanding the comparatively favourable terms, two years after the signings were completed, investor companies were stating that legal inconsistencies had prevented them from starting work.<sup>75</sup>

It seems that the principal prospects for increasing gas output lie with (i) political decisions that improve investment conditions and reduce the bureaucratic procedures for development of new fields; and (ii) political decisions that support the Naftogaz management in focusing on the upstream. This could pave the way both for UGV to reverse the decline in output from its resources, and for private producers to continue increasing output more rapidly. A further question is whether international companies, that had come close to making substantial investments in Ukraine in 2012-13, will return, in spite of the continuing military conflict. Finally, there is the question of whether, over the long term – in the context in which hydrocarbons markets face long-term decline due to decarbonisation policies, and competition for upstream investment will intensify<sup>76</sup> – Ukraine’s difficulties in attracting substantial investment will increase.

## 6. Gas balance outlook

Table 8 shows some indicative projections that may help to illustrate the possible effects of energy policy decisions on the gas balance, between now and 2030.

The first two columns show the actual balances in 2019 and 2020. Note that the net imports are lower than the total imports shown in Table 1 above, since those include volumes stored, but not consumed, in Ukraine.

Projections are shown for 2025 and 2030, according to two scenarios: (i) in which (a) market reform of the energy sector continues, and is aligned with Ukraine’s decarbonisation commitments, and (b) transit of Russian gas is reduced to zero, or a negligible level, after 2024; and (ii) in which (a) reform remains stagnant, due e.g. to political stasis, continuing tension with Russia, lack of foreign investment, etc, and (b) transit of Russian gas continues.

<sup>74</sup> Naftogaz Ukrainy, *Annual Report 2020*, pp. 71-78; Naftogaz Group / AGPU, *Assessment of Gas Production Industry Impact on the Ukrainian Economy (2021)*

<sup>75</sup> Baker Tilly/ CMS, *Energy Sector of Ukraine 2021*, p. 73; “Legal obstacles hamper Ukraine PSAs”, *Argus FSU Energy*, 15 July 2021, p. 1

<sup>76</sup> See M. Blondeel et al, “The geopolitics of energy system transformation: a review”, *Geography Compass* 2021:15

**Table 8: Indicative projections of Ukraine's gas balance, 2025 and 2030**

bcm	2019	2020	2025		2030	
	Actual	Actual	Reform progress, minimal transit	Stagnation	Reform progress, minimal transit	Stagnation
Industry & public sector	8.5	9.5	10	9	12.5	9
Gas companies own use	4.5	3.7	2.5	4	2.5	4
Heat	7.4	9.8	7	9	6	10
Households	9.5	8.2	7	9	7	10
<b>Total gas balance</b>	<b>29.9</b>	<b>31.2</b>	<b>26.5</b>	<b>31</b>	<b>28</b>	<b>33</b>
Domestic production	20.7	20.2	19.7	19.7	24	19
Net imports	9.2	11	6.8	11.3	4	14

Source: Naftogaz Ukrainy, GTSOU (actual), author's estimates (projections)

The projections are indicative. Obviously, there are other possible combinations of circumstances. Most western commentators hope that there will be reform progress on one hand, and a continuation of substantial transit on the other. The author sees no reason that these things will necessarily go together.

If there is reform progress, and minimal transit, gas consumption by industry and the public sector could rise, on increased economic activity. By 2030 this could include some gas being supplied for new electricity generation capacity. (Power stations are counted in the “industry and public sector” category, CHP in the heat sector.) But reform progress would also reduce consumption in other sectors. Minimal transit would reduce gas companies’ own use; so would effective market reform, which would cut unauthorised withdrawals. Reform progress could also result in lower consumption by the heat sector and households.

For production, for 2025, Naftogaz Ukrainy’s own estimate is used for both scenarios. For 2030, I have assumed that if there is reform progress, output could rise to 24 bcm; without it, output is likely to fall.

Perhaps the most striking difference between the two scenarios is the level of net gas imports. With reform progress and minimal transit, these could fall to 4 bcm by 2030; without, they could rise to 14 bcm.

## Conclusions

The *Energy Strategy of Ukraine to 2035* marked a change in policy, envisaging a shift away from heavy dependence on coal for power generation and a substantial expansion of renewables. It is vague on crucial issues of implementation, including the pace of coal phase-out and the approach to market reform. The way in which the strategy is implemented will depend on competing pressures on the Ukrainian government. Ukraine’s obligations under the Paris agreement should act as a spur to the government to prioritise decarbonisation measures. Foremost among these is the phase-out of coal-fired electricity generation: both the commitments given by government and DTEK at the COP 26 talks, and the National Emissions Reduction Plan, suggest that this could be completed early in the 2030s.

The NERP is one of Ukraine’s obligations under the Association Agreement with the European Union and its membership of the Energy Community. Other obligations relate to market reform, and foremost among these is gas pricing reform. The setback to the planned liberalisation of prices, caused by this year’s spike in European wholesale prices – and the effective return of the use of transit revenues to subsidise retail gas prices – is symptomatic of the position the government is in. As long as low gas

and electricity prices comprise a subsidy to households, both in reality and in public perception, there will be social pressure against price liberalisation, from a population with among the poorest living standards in Europe.

One aspect of this problem that can be addressed without any obvious cause for social opposition is the reform of the heat sector and of residential heating. The sector is the main beneficiary of subsidised gas volumes, and a prime example of wasteful gas consumption by worn-out infrastructure. Reform could address these problems, and the social issue of poorly heated buildings, simultaneously. Such reforms would require a concerted effort across government, to align policies on housing, municipal services supply and energy, and have so far eluded Ukraine as they have Russia and other east European countries. Other aspects of market reform have moved forward, including not only the very visible growth of the exchange-based gas market, but also the agreement reached on restructuring the debts of district heating companies and gas distribution companies.

The influence of European and international institutions is significant in other ways. The example of hydrogen shows that such influence can be a double-edged sword from Ukraine's point of view. In the public discussion about producing "green" hydrogen, the possibility of it being exported to Europe, in line with the EU hydrogen strategy, has been highlighted by the European Commission, UNECE and other international agencies. These discussions have not touched upon the need to (i) find a substitute for Ukraine's major "grey" hydrogen production for fertiliser manufacture, and (ii) prioritise the generation of renewable electricity for the grid, as a key element of decarbonisation in general and coal phase out in particular. A hydrogen-for-export strategy, implemented without attention to these problems, could be a setback for Ukrainian energy policy.

It has been argued above that the decline of the gas transit business is likely to continue. A zero-transit scenario is possible, although by no means certain, after 2024. Due to the political character of international negotiations on Russian gas exports to Europe, the fate of the transit business will be influenced by political factors as much as by commercial ones. The problems associated with a zero-transit scenario would be mainly financial. Firstly, transit revenue would be lost. Secondly, investment would have to be committed to adapting the transportation system to a different, scaled down, form of operation.

Finally, increasing domestic gas output has been and will continue to be an aim of Ukrainian energy policy. An increase in output, together with effective energy conservation measures, could reduce or even eliminate Ukraine's import requirement. In the next few years, though, Naftogaz and the private companies in the sector face a collective struggle to maintain output at 19.5-20 bcm/year. The depletion of existing fields is part of the problem, and the internationally available technologies are already being employed to address that. But there are also policy changes that could help, with respect to the licensing and regulatory regime. Whether Ukraine can attract back larger international companies is an open question.

Increasing domestic gas output is one way of reducing gas import dependence. (See Table 8 above.) But there are probably more gains that could be made by continuing change in the energy sector, in line with decarbonisation and market reform policies, that impact gas consumption. While the consumption of gas may increase in electricity generation at the expense of coal, and in industry on economic recovery, effective reform policies could result in these increases being more than cancelled out, by the further reduction of wasteful and unnecessary consumption of gas, especially in the heating sector.