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Bremen, 21 May 2024

Our reference: EA 3166-01 EP UST/jav/vfo

Applicant/proprietor: Evonik Operations GmbH
Application/patent no.: 15817339 / 3240620
Appeal reference: **T0323/24-3.3.02**

Opponent: Air Products and Chemicals, Inc.

Grounds for appeal pursuant to Article 108 EPC in conjunction with Rule 99(2) EPC:

The appeal lodged by the appellant, Evonik Operations GmbH, with its submission of 27 February 2024 against the decision by the opposition division of the European Patent Office of 18 January 2024¹ is hereby substantiated as follows:

I. Requests

We hereby maintain the requests in the notice of appeal of 27 February 2024, i.e. we hereby request:

1. that the contested decision by the opposition division of 18 January 2024 be set aside and that the European patent EP 3240620 be maintained in its entirety, with the opposition being rejected (main request);

¹ "decision" for short in the following.

2. that **D2a** and **D20** not be admitted into the appeal proceedings;
3. as an auxiliary measure, that the case be remitted to the department of first instance;
4. as an auxiliary measure, that oral proceedings be held pursuant to Article 116(1) EPC, should our main request not be granted in the written proceedings;
5. that any comments by the respondent (opponent) be sent to us for comment in good time before a decision is pronounced.

II. Table of contents for point III

Preliminary remark: The appellant is still of the opinion that **D6** is the closest prior art. The appellant has also already expressed this opinion at the opposition proceedings before the department of first instance. For this reason, the appellant's submission relating to the inventive step of the invention according to the contested patent in relation to **D1** only starts at page 49 of this statement of grounds of appeal. If the board of appeal agrees with the appellant's evaluation relating to **D6** as the closest prior art but will not maintain the contested patent as granted in the appeal proceedings on this basis, we request that the case be remitted to the opposition division.

We have structured the content of our submission under point III as follows:

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III. Reasons

In the oral proceedings held on 15 June 2023, the opposition division did not consider the subject matter of claim 1 of European patent EP 3240620 as granted to be patentable in the examination pursuant to Article 100(a) EPC in conjunction with Article 56 EPC due to an alleged lack of inventive step.

In this respect, in the following point 2 of the present statement of grounds of appeal, we will demonstrate that this decision is incorrect.

In the following, we will refer to arguments, facts, and evidence that have already been submitted by the contested patent proprietor, Evonik Operations GmbH, in the opposition proceedings before the department of first instance. We hereby maintain all of these facts, arguments, and evidence submitted before the department of first instance and introduce them into the appeal proceedings by reference in their entirety.

1. Disclosure of the invention (Article 100(b) EPC in conjunction with Article 83 EPC):

In its decision, the opposition division considered the subject matter of the granted claim 1 of the contested patent to be sufficiently disclosed pursuant to Article 83 EPC.² This evaluation is correct.

2. Inventive step (Article 100(a) EPC in conjunction with Article 56 EPC)

2.1 Main request:

Claim 1 according to the main request corresponds to claim 1 of the contested patent as granted. The subject matter of claim 1 according to the main request involves an inventive step pursuant to Article

² cf. decision of 18 January 2024, pages 6 to 7, point 3.2.

56 EPC.

Under point 4 of its decision, the opposition division deliberated on the inventive step of the subject matter of claim 1 according to the main request. In this respect, the opposition division's comments contain several incorrect arguments and evaluations, and this results in a legally incorrect assessment of the inventive step of the subject matter of claim 1 according to the main request on the part of the opposition division.

According to the established case law, in proceedings before the European Patent Office, the problem-solution approach is applicable to the assessment of inventive step. The decision demonstrates that the opposition division's application of the problem-solution approach is incorrect in several aspects, since it is based on incorrect and incomprehensible assumptions and arguments.

In the following, we will set out in detail why the subject matter of claim 1 according to the main request involves an inventive step pursuant to Article 56 EPC, contrary to the opposition division's decision. In so doing, we will correctly apply the problem-solution approach of the European Patent Office.

2.1.1 Preliminary remark – the respondent's notice of opposition contains a range of incorrect statements

Statement (i): "The problem according to the invention is artificial and unrealistic; the effects on the operating costs would be wrongly ignored"

On page 3, penultimate paragraph of the notice of opposition, the respondent asserts:

"The Patent proposes that this increase in operating costs can be ignored where energy is very cheap (see paragraphs [0005] and [0036]). However, this approach is artificial and unrealistic, as energy costs (e.g. the price of fuel or electricity required to operate the compressors) are in practice never so cheap as to be totally negligible, and any useful practical approach to economically optimising a gas separation process must therefore seek to factor in and balance the capital costs of the process (i.e. the initial costs of purchasing equipment) and ongoing operating costs (i.e. energy costs of operating the process plus maintenance costs of having to periodically replace equipment)."

These quotations and conclusions are incorrect in several respects.

For instance, it is e.g. clear from **D8a** and **D8b** that, in 2014, i.e. immediately before the priority date of the contested patent, the energy prices in the country with the lowest energy costs in the world (Kuwait (0.7 US cents/kWh)) were 99.93% lower than in the country with the highest energy costs (Venezuela (954.7 US cents/kWh)). Both countries are very important locations for the extraction of natural gas.

If the energy price in Kuwait in **D8a** and **D8b** is compared with the worldwide average, it is apparent that the energy price in Kuwait is still 95.7% lower.

It is evident *prima facie* that the energy price in Venezuela or other countries with high-cost energy has an entirely different weight in cost considerations and investment decisions than in Kuwait.

D8a and **D8b** also demonstrate that, in many oil and gas-producing countries, the energy price is very low; see e.g. Iraq, Oman, Saudi Arabia, Uzbekistan, etc. Even in many countries with large agricultural economies and thus a great need for biogas plants, the energy price is sometimes very low; see e.g. Russia, Ukraine, and Romania.

D8a and **D8b** also set out the energy prices in Europe. Here, too, it is demonstrated for 2014 that the energy prices in the country with the lowest energy costs (e.g. Romania) are less than a third of the costs in the country with the highest energy costs (Germany).

These examples very clearly demonstrate that the energy costs have an entirely different weight in the design of a gas separation plant depending on location, and, depending on location, the focus shifts from operating costs to investment and maintenance costs, and so the problems posed are neither artificial nor unrealistic.

Furthermore, we make reference to **D9**, paragraph 3.1.4, which reads as follows:

“The design of a membrane carbon dioxide removal system will be dependent on the following factors:

(iv) The location of the plant (on an offshore platform, the weight, footprint, and simplicity of operation are critical; onshore total costs is more significant)”

Point (iv) confirms the statements in paragraphs [0071] and [0072] of the contested patent, namely that there are locations at which the weight, the space requirements, and the complexity of the plant are decisive, and not the total costs. A plant according to the invention having a low total membrane area is lighter and smaller.

In paragraphs [0071] and [0072] of the contested patent, it is emphasized that the problem addressed by the present invention is to save on additional equipment and to reduce the complexity of the plant:

“The method of the present invention can be used to [...] produce, at one and the same time, a pure retentate stream (8) and a pure permeate stream (i i) in biogas and natural gas [...] CO₂ can therefore be released into the atmosphere [...] without any need for further treatment of the gas by a catalytic or thermal after burn or utilization in a combined heat and power plant [note: this addresses both weight and complexity of the plant]. [...] process according to the invention

needs a much lower level of apparatus complexity [...] than the known prior art processes.”

We also make reference to **D10**, page 1, third paragraph “*Space efficiency*”, in which it is explained that

“Membrane units can be assembled into compact modules, resulting in minimal space requirements. Membrane skids are advantageous and very common on offshore environments where space efficiency is necessary.”

and **D11**, page 2, right-hand lower corner:

“Our AH-Membrane Solution™ offers distinct advantages over conventional multi-step unit operations and spiral-wound cellulose acetate membrane alternatives. The benefits are magnified for offshore platform and FPSO applications where multiple contaminants must be removed from the gas stream”

and **D11**, page 4, left-hand upper corner:

“The small contained volume of the hollow fiber membrane is advantageous for offshore separation applications where space is limited and the natural gas product is of high value”

and **D11**, right-hand lower corner:

“Typically each membrane module operates in parallel; however, multiple membrane configurations (parallel or series) and stages are available to optimize client’s CAPEX and OPEX requirements”.

D9 to **D11** prove that the opponent’s statements that “the problem addressed in the patent is artificial and unrealistic” and that “the investment costs always have to be balanced with the operating costs of the plant” are incorrect. **D9** to **D11** prove that there are applications in which e.g. the space requirements, the weight, and the complexity of the plant are the decisive factors, and not the operating costs.

The method according to claim 1 of the contested patent makes it possible to significantly reduce the required total membrane capacity of the plant – with separation performance of the plant that is comparable to the prior art – and therefore to simultaneously significantly reduce the space requirements and the weight of the plant. In applications in which the space requirements in particular are a key factor, this is a significant advantage which is decisive, and not the somewhat higher operating costs, for example. The problem addressed in the patent therefore certainly has a specific practical reference.

Statement (ii): “an increase in the volume of recycled gas would automatically increase the investment

costs for compressors or vacuum pumps”

On page 3, last paragraph to page 4, first paragraph of the notice of opposition, the respondent asserts that

“membrane separation units are not the only pieces of equipment required by the process, in particular, the process also requires one or more compressors or vacuum pumps, which of themselves represent a heavy capital investment, if the volume of recycled gas is increased, then more gas needs to be recompressed (and/or withdrawn under vacuum), and a larger compressor (or vacuum pump) is required, increasing the cost of this equipment and thus the overall capital costs of the process.”

This is purely an assertion, without evidence. Furthermore, this statement is also incorrect.

The opponent has overlooked or is ignoring the fact that compressors always cover a certain volume flow rate range and can be regulated within this range. A change in the volume flow rate therefore does not automatically mean that a larger, heavier, and more expensive compressor needs to be installed, which could result in higher investment costs where applicable.

For instance, pages 8 to 10 of **D12** demonstrate that all the compressors used specifically for biogas purification by means of membrane processes have a capacity range, and not a “point capacity”, in terms of the volume flow rate that they can process.

If, for example, the method from Fig. 5 of **D1** is considered in the light of **D12**, this results in the following: An increase in the recycling rate of 24% in Fig. 5 to 100% (maximum value in claim 1 of the contested patent) would result in the gas volume to be compressed rising from 8304 mol/h (approx. 187 m³/h) to 13384 m³/h (approx. 300 m³/h). In both cases, according to **D12**, page 8, the compressor BVG 55-16.5DD INV would have to be used, which provides a free gas delivery of 0-300 m³/h and also has a discharge pressure of up to 17 barg(g), as specified in **D1**. The next smallest compressor BVG 30 - 16.5 CG INV would not be suitable for the method according to Fig. 5 or according to Fig. 7a of **D1**, or for the conversion at the 100% recycling rate, since it only has a free gas delivery of 0-160 m³/h.

Therefore, for the applications from **D1**, cited by the opponent as the alleged closest prior art, even in the event of an increase in the recycling rate to 100% (maximum value in claim 1 of the contested patent), there would be no need to replace the compressor BVG 55 - 16.5DD INV, much less to install another, larger and more expensive compressor, as asserted by the opponent. Therefore, a higher recycling rate, as in the method according to the invention, does not need the investment costs, the weight, and the space requirements for the compressor to increase.

By way of the method according to the invention and the resulting reduction in costs for the membranes

and their accessories (brackets, pipelines, etc.), it is therefore entirely possible to reduce the investment costs of a three-stage membrane separation plant.

Since the compressor does not need to be replaced, the space requirements and the weight of the compressor do not change, which is a great advantage of the method according to the invention for the above-described applications in which the space requirements and the weight are a key factor.

Statement (iii): “the recycled volume of 60 to 100% is merely a byproduct of the method and is not a separate and independently variable parameter”

On page 4, third paragraph and page 5, first paragraph of the notice of opposition, the opponent asserts that the process parameter “recycling a gas volume that totals 60 to 100 % by volume of the volume of the crude gas stream” would not contribute to reducing the membrane capacity required for the method, since the quantity of the recycled gas is merely a byproduct of:

- i) the starting composition of the crude gas stream to be separated;
- ii) the required compositions of the desired product streams; and
- iii) the membrane capacities, selectivities, and pressure differences (pressure ratios) in each of the separation stages.

These, too, are purely assertions, without evidence. By contrast, the examples in the contested patent demonstrate that these assertions are incorrect.

In addition, it is important to understand that the recycling rate of 60 to 100% is an operating parameter of the method according to the invention which can be adjusted or controlled by various technical means. In paragraph 61, third sentence of the contested patent, the selection of the membrane modules in stages (1) to (3), the pressures in the system, or the flows in the system are mentioned herein by way of example. What measure is used to adjust the recycling rate is irrelevant, provided that all the requirements of claim 1 are met.

The fact that there are various technical means for adjusting the recycling rate does not therefore mean, however, that this parameter is not a separate parameter, but just a *byproduct*.

The assertion (i) by the opponent that is cited above is also incorrect. This is demonstrated by Reference Example 1 (RE1) in comparison with Example 1.1 according to the invention (E1.1). E1.1 and RE1 use identical crude gas streams, yet the recycling rate is different. This demonstrates that the recycling rate can be adjusted independently of the composition of the crude substance.

The same results are obtained when Reference Examples 2 and 3 of the contested patent are

compared with one another, as shown in the following Table 1:

Table 1

Parameter	Reference Example 2	Reference Example 3
Membrane selectivity in all three separation stages	45	45
Crude gas CH ₄ /CO ₂ composition	50/50	50/50
Membrane capacities in all three separation stages	1	1
Quotient of pressure ratio over stage (3) to pressure ratio over stage (1)	1.33	1.33
Recycling rate	31.2	41.7

Despite an identical crude gas composition (parameter (i)) and identical membrane capacities, selectivities, and pressure differences (parameter (iii)) in both examples, recycling rates were adjusted differently. This comparison clearly demonstrates that, contrary to the opponent's assertions, the recycling rate is a process parameter that can be adjusted independently of parameters (i) and (iii).

For feature (ii), it should be noted that the product purity is a result of the membrane separation process and is not an operating parameter of the method. It is exactly the opposite of what the opponent asserted. Feature (ii) results from adjusting the operating parameters, the recycling rate, *inter alia*, and not vice versa.

A comparison of RE1 and E1.1 demonstrates that identical product gas compositions, starting from identical crude gases, are obtained despite different recycling rates; see the following Table 2:

Table 2

Parameter	RE 1	E 1.1
Membrane selectivity in all three separation stages	20	20
Crude gas CH ₄ /CO ₂ composition	50/50	50/50
Retentate stream (8) CH ₄ /CO ₂ composition	98/1.5	98/1.5
Retentate stream (11) CH ₄ /CO ₂ composition	1/99	1/99

Recycling rate	86.7	98
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If the opponent's assertions (i) and (ii) were correct, an identical recycling rate should also have been obtained in RE1 and E1.1. This is not the case, however, since, in E1.1, in comparison with RE1, not only the recycling rate (98 instead of 86.6) but also the ratio of the pressure ratio over stage (3) to the pressure ratio over stage (1) (1.00 to 0.77) and the membrane capacity in stage (2) in comparison with stage (1) (2.29 instead of 1) have been changed according to the invention.

All three of the features of claim 1 of the contested patent cited below:

- a) the volume of the recycled streams (9) and (10) corresponds in total to 60-100% of the volume of the crude gas stream
- b) the total membrane capacity of the separation stage (2) is greater than the total membrane capacity of the separation stage (1)
- c) the quotient of pressure ratio over stage (3) to pressure ratio over stage (1) is in the range of 0.5 to 8

can be adjusted independently of one another.

This is also demonstrated e.g. by the comparisons of Example 6 with Comparative Example 6, Example 7 with Comparative Example 7, and Example 8 with Comparative Example 8 of the contested patent. Each of these comparisons demonstrates that a change in parameters a) and b), with an identical value for parameter c) in each comparison, is possible and that the problems according to the invention, in particular that of reducing the membrane capacities, are still solved. For details, see the following Table 3:

Table 3

Parameter		E6	CE6	E7	CE7	E8	CE8
Membrane selectivity		45	45	45	45	45	45
Crude gas CH ₄ /CO ₂ composition	%	45/55	45/55	45/55	45/55	75/25	75/25
Retentate stream (8) CH ₄ /CO ₂ composition	%	97/3	97/3	97/3	97/3	97/3	97/3
Retentate stream (11) CH ₄ /CO ₂ composition	%	0.37/99.63	2.4/97.6	0.23/99.77	1.65/98.35	0.51/99.49	4.1/95.9
a) Recycling rate		85	35	66	32	66	32
b) Membrane capacity step (2) to (1)		3	0.73	1.53	0.66	5.1	1.65

c) Quotient of pressure ratio over stage (3) to pressure ratio over stage (1)		1.04	1.04	4.36	4.36	1.30	1.30
Methane loss	%	0.44	2.93	0.27	2.00	0.17	1.38
Total membrane capacity	%	72.1	100	81.4	100	78.9	100

The above Table 3 only demonstrates that, when adjusting parameters a) and b) according to the invention, with parameter c) being identical for each comparison, each of the following is applicable in the examples according to the invention in comparison with the comparative examples

lower total membrane capacities are obtained,

the product purities in the permeate product stream are higher, and

the methane loss is lower, which is also a problem addressed by the present invention (see paragraph 9 of the contested patent) and has been completely ignored by the respondent.

On the basis of a comparison of RE1 with E1.2, the following Table 4 additionally demonstrates that it is also possible to only change features b) and c) according to the invention, but to leave feature a) unchanged. This also achieves a reduction in the total membrane capacity.

In the following Table 4, E1.1 was also included in the comparison, in which all three features a), b), and c) were optimized.

Table 4

Parameter		RE 1	E1.1	E1.2
Membrane selectivity		20	20	20
Crude gas CH ₄ /CO ₂ composition		50/50	50/50	50/50
Retentate stream (8) CH ₄ /CO ₂ composition	%	98.5/1.5	98.5/1.5	98.5/1.5
Retentate stream (11) CH ₄ /CO ₂ composition	%	1/99	1/99	1.3/98.7
a) Recycling rate		86.7	98	86.7
b) Membrane capacity step (2) to (1)		1	2.29	1.97

c) Quotient of pressure ratio over stage (3) to pressure ratio over stage (1)		1	0.77	2.02
Total membrane capacity	%	100	85.1	85.5

Aside from the fact that features b) and c) can be changed independently of feature a) in order to solve the problems according to the invention, the above Table 4 also demonstrates that there is a synergistic effect when all of features a), b), and c) are optimized (E1.1 in comparison with RE1 and E1.2).

Statement (iv): “Examples 8 and Comparative Example 8a would not allow a statement to be made on technical effects of the method parameter ‘a) recycled volume of 60 to 100%’”

On page 4, paragraph 4 to page 5, first paragraph of the notice of opposition, the respondent asserts that Example 8 (E8) and Comparative Example 8 (CE8) would not allow a statement to be made on technical effects of the method parameter a) recycled volume of 60 to 100%. This assertion is also incorrect for the following reasons:

In CE8, all the process parameters meet the requirements of claim 1 of the contested patent, with the exception of the recycling rate. As a result of the recycling rate not being adjusted in the range claimed in claim 1 of the present invention, a third permeate stream having lower purity of just 95.9% CO₂ is obtained in CE8. Therefore, CE8 alone, i.e. without a comparison with E8, demonstrates that when not all the parameters in claim 1 of the contested patent are followed, two high-purity gas streams are not obtained. Providing two high-purity gas streams is an important problem addressed by the present invention (see paragraphs [0006], [0011] and [0071] of the contested patent). This problem has been ignored by the respondent, however.

Adjusting just one parameter, the “recycling rate”, outside of claim 1 of the contested patent gives this result. This is because E8 alone, i.e. without a comparison with CE8, demonstrates that when all the parameters in claim 1 of the contested patent are fulfilled, two high-purity gas streams are obtained. A comparison with CE8 is not required for this conclusion. E8 thus demonstrates that the combination of the method parameters according to claim 1 of the contested patent is not selected at random, but results in technical effects.

Contrary to the respondent’s assertion, it is also entirely possible and permissible to compare E8 with CE8.

Contrary to the respondent’s assertion, specifically it is irrelevant that, in CE8 in comparison with E8, in

addition to a) the recycling rate, b) the ratio of the total membrane capacities of separation stage (2) to separation stage (1) has also been changed. Instead, what is crucial is that, in CE8, all the parameters, with the exception of the recycling rate, have been selected according to the invention. Therefore, in CE8 in comparison with E8 in the light of claim 1, just one parameter (recycling rate) has been varied such that it falls outside of claim 1 of the contested patent. If this parameter were arbitrary and did not have a technical effect, then CE8 would also have to solve all the problems of the contested patent that E8 solves. However, this is not the case. As already explained, in CE8 only a moderate-purity permeate product stream is obtained and a high methane loss (1.4% in CE8 and 0.17% in E8) is observed. In addition, the total membrane area required for the considerably better product quality in E8 is 21.1% lower than in CE8.

2.1.2 Determination of the closest prior art

Under point 4.1 of the decision, the opposition division deliberates on the determination of the prior art closest to the subject matter of claim 1 according to the main request.

As a result, the opposition division considers Fig. 7a of **D1** to be the closest prior art. Even just this first step in taking the problem-solution approach on the part of the opposition division is incorrect. The patent proprietor (now: appellant) already set out in detail in its reply to the notice of opposition of 20 June 2022³ and in its submission of 14 April 2023⁴ that, when the Guidelines for Examination in the European Patent Office⁵ are correctly applied and taking into account the relevant Case Law of the Boards of Appeal in this case, **D6** (US 2013 0098 242 A1; either the Comparative Example or the examples according to the invention) is clearly the prior art closest to the subject matter of claim 1 according to the main request.

2.1.2.1 The contested patent formulates various problems of the invention according to the contested patent

Problem (i):

According to paragraphs [0006], [0011] and [0071] of the contested patent, two high-purity product streams (8) and (11) are obtained by way of the method according to the contested patent.

The fact that this problem is solved is demonstrated by the examples and comparative examples of the contested patent. In all the examples according to the invention, the methane content in the second retentate stream (8) is between 97 and 99% and the CO₂ content in the third permeate stream is

³ cf. the reply to the notice of opposition of 20 June 2022, from page 28, point 3.4.

⁴ cf. submission of 14 April 2023, from page 6, point 3.1.2.

⁵ "Guidelines" for short in the following.

between 97.5 and 99.87%.

Example 8 demonstrates that, by way of the method according to the contested patent, it is even possible to obtain a second retentate stream (8) having a purity of 99% and at the same time to obtain a third permeate stream having a purity of 99.49%.

Problem (ia):

According to paragraph [0011] of the contested patent, by way of the method according to the invention it is supposed to be possible to reduce the content of the greenhouse gas methane in the CO₂ product stream to the extent that the CO₂ product stream complies with strict environmental requirements and can be released into the atmosphere.

D14 (footnote [1]) provides an example of a limit value for methane emissions, which was valid until 2017, of 0.32%. This limit value had already been tightened up in the preceding years. Examples 2, 3, 5, 7, 8, and 9 according to the contested patent set out embodiments of the method according to the contested patent which already complied with this limit value in 2014. The comparative examples in the contested patent demonstrate, however, that the limit value cited above is not complied with therein.

Examples 5, 8, and 9 according to the contested patent demonstrate that even the limit value of 0.25% methane loss, issued in **D14** as the target until 2025, can be complied with by the method according to the contested patent. The contested patent thus demonstrates multiple times that problem (ia) cited above is solved.

Problem (ii):

According to paragraphs [0007] and [0011] of the contested patent, the method according to the contested patent is intended to be advantageous over the prior art in terms of the maintenance costs, in particular the costs of consumable materials.

By comparing Examples 1.1 and 1.2 with Reference Example 1 and by comparing Example 2 with Reference Example 2 and Example 3 with Reference Example 3, the contested patent compares the method according to the contested patent with the comparative example and Examples 1 and 3 of the closest prior art (**D6**). In each case, it has been found that the method according to the contested patent requires 8-15% lower total membrane capacities.

According to **D9**, chapter 3.1.2, last sentence, the service lives for the membranes commercially available on the priority date were 2 to 5 years. After this, the membranes need to be replaced. A service life of 2 years is half as long as assumed in **D1** (4 years) and thus doubles the costs for membrane maintenance compared with **D1**.

In Table 3, on page 2111, of **D9**, typical costs for membrane modules for gas separation are estimated at 100 USD. This corresponds to 75.28 EUR, at the exchange rate in 2014 (publication of **D1**). These costs are approximately 37% higher than the 55 EUR applied in **D1**.

It is clear from **D8a** that, in 2014, the energy price in Kuwait was only 0.7 US cents / kWh (corresponding to 0.0053 EUR / kWh). Kuwait is a very significant market for the application of natural gas purification according to the invention.

Furthermore, it is clear from **D8a** and **D8b** that, in many natural-gas-producing countries, the energy price in 2014 was very low; see e.g. Iraq, Oman, Saudi Arabia, Uzbekistan, etc. Even in many countries with large agricultural economies and thus a great need for biogas plants, the energy price is sometimes very low; see e.g. Russia, Ukraine, and Romania. For these countries, an average energy price of 0.05 EUR / kWh results from **D8a** and **D8b**, which corresponds to approx. 6.7 US cents / kWh at the USD exchange rate at that time.

Actual energy costs in 2014 in significant markets for the method according to the invention were between 0.0059 and 0.05 EUR / kWh, and were therefore much lower than the hypothetical energy price of 0.08 EUR / kWh assumed in **D8**.

It is clear from the comments in the last few paragraphs that the total cost balance in significant target markets for the method according to the invention is entirely different from that found in **D1**. **D15** makes the following profitability calculations for Example 2 according to the invention and reference Example 2, which corresponds to Example 1 of the closest prior art, **D6**, for multiple cost scenarios:

- Calculation of the yearly energy costs for the method according to Example 2 and Comparative Example 2
 - for Kuwait using the data from **D8a**, i.e. energy costs of 0.0053 €/kWh
 - for states with oil production or large agricultural economies and the cited actual energy prices according to **D8a** and **D8b**. Here, 0.05 €/kWh was taken as the average energy price for these states
 - using the hypothetical energy price from **D1** of 0.08 €/kWh
- Calculation of the yearly membrane costs on the basis of the price and service life for the following scenarios

using the membrane costs from **D1**, Table 3:

- operating duration of 8000 h/a (from **D1**)

- membrane costs of 55 €/m² (from **D1**)
- service lives of 2, 3, and 4 years (4 years from **D1**; 2 and 3 years from **D9**)

using the membrane costs from **D9**, Table 3:

- operating duration of 8000 h/a (from **D1**)
- membrane costs of 75.28 €/m² (from **D9**, Table 3)
- service lives of 2, 3, and 4 years (4 years from **D1**; 2 and 3 years from **D9**)

using the membrane plus skid costs from **D9**, Table 3:

- operating duration of 8000 h/a (from **D1**)
- using the membrane plus skid costs 376.42 €/m² (from **D9**, Table 3)
- service lives of 2, 3, and 4 years (4 years from **D1**; 2 and 3 years from **D9**)

The results of the calculations made by Mr. Piske demonstrate that, for the application in Kuwait, i.e. a country with extremely low energy costs, the savings made with the maintenance costs in the method according to the invention are always greater than the increase in energy costs to be accepted due to the higher recycling rate. The method according to the invention is always advantageous in terms of the stated problem. This result is irrespective of whether the membrane costs from **D1** or **D9** are applied and is also irrespective of whether the service life is 2, 3, or 4 years.

It is the same picture for countries with low, but not extremely low, actual energy costs of approximately 0.05 €/kWh. The method according to the invention is always advantageous in terms of the stated problem here, too. This result is irrespective of whether the membrane costs from **D1** or **D9** are applied and is also irrespective of whether the service life is 2, 3, or 4 years.

If the hypothetical energy and membrane costs from **D1** are applied, it is found that the method according to the invention is more cost-effective here, too, for membranes that only have a service life of 2 years.

If the hypothetical energy costs from **D1** and the membrane costs from **D9** are applied, it is found that the method according to the invention is more cost-effective not only for membranes that have a service life of 2 years, but also for those that have a service life of 3 years.

Lastly, if it is also taken into account that the total membrane capacities reduced according to the invention not only make savings in terms of membranes, but also the installations (skid) and the costs

for membrane + skid which are indicated in **D9** but not taken into account in **D1** are applied, it is found that the method according to the invention provides high economic advantages at service lives of 2 to 4 years, even if the hypothetical energy price from **D1** is taken as a basis.

D15 thus clearly demonstrates that the problem has been solved.

Problem (jia):

In addition to the maintenance costs for consumable materials as already discussed above, the method according to the invention is also intended to provide advantages in terms of investment costs in a further problem (see paragraphs [0005] and [0036] of the contested patent).

The respondent asserts that higher recycling rates would lead to additional investment costs for larger compressors, which would lead to higher rather than lower investment costs, and therefore this problem would not be solved.

At this point, we make reference to our previous comments under point 2.1.1.1, in which we have demonstrated in detail that the respondent's assertion that higher recycling rates would lead to additional investment costs for larger compressors is incorrect.

For instance, in the examples in **D1**, an increase in the recycling rate to 100% would not lead to a compressor other than BVG 55-16.5DD INV from **D12** needing to be used.

According to Fig. 6, **D1** applies approximately linear price increases for the investment costs for compressors. As demonstrated above, this is unrealistic and purely theoretical, since the actual price increases instead proceed in stages and it is not at all necessary to purchase a larger compressor when the recycling rate in **D1** is increased to max. 100%. In this case, by contrast with the assumption in **D1**, no additional investment costs accrue, since the investment costs for the compressor remain at the same stage.

Furthermore, we make reference to **D9**, page 2111, Table 3. This demonstrates that, in addition to the costs for the membranes, in terms of the investment costs, the costs for the entire infrastructure (skid) need to be taken into account. In comparison with only the membrane costs of 100 USD per m² membrane area, costs of 400 USD per m² membrane area need to be applied for this. In **D1**, however, these costs are not taken into account.

The profitability calculations in **D15** demonstrate that these investment costs of 400 USD per m² alone lead to yearly cost savings, and the additional energy costs due to increased recycling rates increase by a long way.

D1 thus provides unrealistic values and cannot be used as evidence that problem (iia) is not solved.

By contrast, **D15** provides evidence of the economic advantages of the method according to the invention and that problem (iia) is solved by the method according to the invention.

Problem (iii):

According to paragraphs [0008] and [0071] of the contested patent, the method according to the invention is intended to be used flexibly for purifying CH₄ and CO₂-containing gas streams. According to paragraph 8, it is also intended to be used for gas streams that contain other gases in addition to CH₄ and CO₂. The crude gases are in particular intended to be biogas and natural gas.

In the examples in the contested patent, it has been extensively demonstrated that the method according to the invention is suitable for separating gas streams containing CH₄ and CO₂. In Example 9, it has also been demonstrated that gas streams that also contain other gases in addition to CH₄ and CO₂ can also be purified, and at the same time problems (i) and (ia) are solved.

The method according to the invention is therefore not limited to the biogas application, but instead is suitable, *inter alia*, for applications such as the offshore applications discussed above under point 2.1.1.1.

Problem (iv):

According to paragraphs [0009] and [0071], methane losses are intended to be reduced with comparable performance (same throughput) in comparison with prior-art methods.

As set out in Table 4 (comparison of E6 with CE6, E7 with CE7, and E8 with CE8), this problem is solved. The comparisons of E2 with Reference Example 2 and E3 with Reference Example 3 demonstrate that this problem is solved.

Problem (v):

According to paragraph [0070] of the contested patent, the method according to the invention is intended to provide a methane product stream (8) that can be fed into gas pipelines (natural gas grid).

According to **D1** 6, page 26, Table 14, the Biomethan Quality Requirements for Injection into National Gas Pipelines from SoCalGas on the priority date of the contested patent required a maximum CO₂ content of 3%. GG&E required even less, at 1% CO₂.

D13, page 4, table, provided evidence that the requirements in Europe for feeding the methane product stream into the natural gas grid were max. 2.5% CO₂.

The requirements by SoCalGas from **D16** are met by all the examples according to the invention. Examples 1.1, 1.2, and 2, 3, and 8 also meet the requirements of **D13** and Example 8 meets those of CG&E from **D16**. This demonstrates that the method according to the invention solves this problem.

D1, however, does not solve this problem, since a methane product stream having a CO₂ content of 4% is obtained throughout this document. In order to obtain hypothetically higher methane purities, according to Fig. 11 of **D1**, membranes having a selectivity that, according to **D1**, page 9, left-hand column, first paragraph, did not even exist at that time and were still yet to be developed would have to be used, which is considered to be inefficient and unrealistic in **D1**, however.

Problem (vi):

According to paragraph 70 of the contested patent, problems (i), (ia), and (iii) to (v) are intended to be solved by a method which does not require any additional purification of the retentate stream, e.g. PSA or fine purification of the retentate product stream, in order to meet the requirements of problem (v).

According to paragraph [0071] of the contested patent, problems (i), (ia), and (iii) to (v) are intended to be solved by a method which does not require any additional purification of the permeate product stream, e.g. thermal post-treatment, in order to reduce the methane content and meet the environmental requirements (see problem (ia)).

According to paragraph [0072] of the contested patent, the plant according to the invention is intended to have low complexity in terms of equipment.

As explained in detail above, the examples of the contested patent demonstrate that these problems are solved. High-purity product streams are obtained without post-treatment steps.

As already likewise explained above, the method according to the invention is thus highly advantageous for applications and locations at which the weight, the size, and the complexity of the plant in particular are key factors, such as offshore applications.

2.1.2.2 D6 solves more problems in common with the contested patent than D1

Both **D6** and **D1** disclose a method for separating CH₄ from CO₂. Both documents thus solve the above problem iii.

Furthermore, **D6** discloses a method by means of which a methane product stream having a methane content of 98.5% and a permeate product stream having a CO₂ content of 99.5% can be obtained without post-treatment of the respective streams. By contrast, **D1** discloses a method in which a methane product stream having a methane content of only 96% is obtained. Although **D1** discloses, in

Fig. 11, a theoretical solution for achieving higher methane purities of the methane product stream, at the same time it is noted that, for methods of this kind, membranes having such a high selectivity would be required, which did not even exist on the publication date of **D1** and were still yet to be developed, which is considered in **D1** to be uneconomic and unrealistic, however.⁶

D6 thus also discloses solutions to the above problems (i), (ia), and (iv) that are each better than the corresponding solutions according to **D1**. **D1** does not provide any solutions whatsoever to problems v and vi.

D1, reference 14, refers to the international patent application WO 2002/00727, which corresponds to **D6** in terms of content, and in this respect indicates that methods described therein are intended to be optimized in terms of the total costs. In Fig. 5 and 7, **D1** discloses the corresponding total economic optima, which do not, however, solve problems (v) and (vi) set out under point 2.1.1.1 any longer. **D1** therefore teaches that an economic optimization from **D6** is only possible at the cost of the product quality in the methane product stream, and therefore the method from **D6** would no longer be able to be used for many fields of application.

According to the established Case Law of the Boards of Appeal of the EPO, when selecting the closest prior art,

“the formulation of the original problem and the intended use and the effects to be obtained should generally be given more weight than the maximum number of identical technical features” (T 870/96; see also T 66/97) ⁷

The contested patent deals with the problem of improving the method from **D6** in terms of the maintenance and investment costs and the plant complexity (weight, size, etc.) without having to accept any limitations in terms of the application.

In the view of a person skilled in the art, **D1** would not have been suitable for solving this problem/these problems indicated in the contested patent and would not have been taken into consideration for doing so, since the method disclosed therein is not at all suitable for certain areas of application, owing to a purity of the retentate product stream that is too low. For example, it does not fulfill the pipeline specifications documented in **D13** and **D16**.

A person skilled in the art would, however, proceed from **D6** as the closest prior art. According to the established Case Law of the Boards of Appeal of the EPO, for a person skilled in the art, in this respect it does not come down to the maximum number of features corresponding to the prior art, but to what

⁶ cf. **D1**: page 9, left-hand column, paragraph 1.

⁷ cf. Case Law of the Boards of Appeal of the EPO, 10th edition, page 217, point I.D.3.1.

teaching in the prior art is closest to the problem dealt with by a person skilled in the art.

2.1.2.3 Similarity to the technical problem

According to the Guidelines,

*“the closest prior art is generally that which corresponds to a similar use **and** requires the minimum of structural and functional modifications to arrive at the claimed invention”⁸.*

According to the Guidelines, **both** (i) the number of distinguishing features **and** (ii) the similarity to the technical problem therefore need to be taken into account when determining the closest prior art. The established Case Law of the Boards of Appeal (cf. **T 439/92**) also states that

“one of the criteria for determining the closest prior art [is] the problem already indicated in the patent.”⁹

Furthermore, the Case Law of the Boards of Appeal emphasizes the particular importance of the similarity to the technical problem when determining the closest prior art in that it states that

*“a document not mentioning a technical problem which was at least related to that derivable from the patent specification did not normally qualify as the closest prior art for inventive step purposes, however many technical features it may have in common with the subject-matter of the patent concerned (see also **T 410/93**, **T 708/96**, **T 59/96**, **T 827/00**, **T 979/00**, **T 496/02**, **T 1666/16**).”¹⁰*

With regard to the technical problem indicated in the contested patent, the opposition division also recognizes that

*“[t]he patent is directed to a process for achieving a particularly **high product purity** (see §[0006] of the patent) with explicit reference to **D6** in §[0011] and §[0035].”¹¹*

The opposition division therefore acknowledges that the technical problem of the contested patent consists in providing a product stream having a particularly high product purity and that, in this respect, the contested patent itself already explicitly makes reference to **D6** (more specifically, to the WO publication WO 2012/000727, which is identical in terms of content) as the starting point or point of comparison.

The contested patent even already makes reference to **D6** (or the WO publication WO 2012/000727,

⁸ cf. Guidelines for Examination in the European Patent Office, Part G-VII, 5.1 (emphasis added).

⁹ cf. Case Law of the Boards of Appeal of the EPO, 10th edition, page 221, point I.D.3.3 (emphasis added).

¹⁰ cf. Case Law of the Boards of Appeal of the EPO, 10th edition, page 221, point I.D.3.3.

¹¹ cf. decision of 18 January 2024, page 7, point 4.1.1.

which is identical in terms of content) in paragraph [0004] and states in this respect that

*“WO 2012/00727 [corresponds to **D6** in terms of content]; WO 2013/098024 and WO 2014/075850 represent the most optimized of all of these processes. In said patents an apparatus and a process are described which are optimized in view of product purity in combination with the lowest energy consumption. In other words, these processes provide two high pure product streams in an energy optimized way.”*

In paragraph [0005], the contested patent then also states that

“In recent times, however, a new problem has occurred, that is not solved in a sufficient manner by the apparatuses and processes of the prior art. The problem is that some gas separation plants are operated at sites where energy is very cheap. At such locations the focus of operators of separation plants lies on investment and maintenance costs rather than on an energy saving. No sufficient solution for this problem has been found in the prior art.” (Emphasis added.)

In the light of these comments, the contested patent poses the following problem in paragraph [0006]:

“It was thus, an object of the present invention to provide processes for separation and purification of gas mixtures, which have the disadvantages of the prior art only to a reduced degree, if at all. More particularly, processes, which are able to afford both, permeate gas and retentate gases are to be provided in high purities.” (Emphasis added.)

In this context, the contested patent again makes direct reference to **D6** (or the WO publication WO 2012/000727, which is identical in terms of content) in paragraph [0011]

“As shown in the examples, the new process, compared to the prior art processes, in particular WO 2012/00727, can be operated with a significantly reduced overall membrane capacity to obtain similar purification results. Thus, the costs for the membranes, which are expendable goods and have to be exchanged time by time, were reduced significantly.” (Emphasis added.)

The contested patent again repeats the technical advantages of the method according to the contested patent in paragraph [0035] with reference to **D6** (or the WO publication WO 2012/000727, which is identical in terms of content):

“Compared to the best prior art process according to WO 2012/000727, however, the process of the present invention allows to reduce the membrane capacities, required in sum for all separation stages in the process. Thus, the investment costs and in particular the maintenance costs can be reduced significantly.” (Emphasis added.)

In this context, the contested patent makes multiple explicit references to **D6**, and these are of course not random or arbitrary. Instead, this reference is made because **D6** is based on the same technical problem (or at least a very similar technical problem) to that of the contested patent. In relation to the technical problem on which it is based, **D6** accordingly states multiple times that

“[t]he invention relates to a specific apparatus, more particularly a chain of gas separation membrane modules, for separation of gas mixtures into two fractions each of elevated purity”¹²:

“[t]he invention relates to a specific apparatus, more particularly a chain of gas separation membrane modules, for separation of gas mixtures into two fractions each of increased purity”¹³:

“[p]roceeding from this prior art, it was an object of the present invention to provide apparatuses and processes for separation and purification of gas mixtures, which have the disadvantages of the prior art processes and apparatuses only to a reduced degree, if at all. More particularly, processes and apparatuses which afford both permeate gas and retentate gas are to be provided in high purities.”¹⁴

D6 is therefore likewise based on the technical problem indicated in the contested patent.

In its decision (and its preliminary opinion of 19 December 2022), the opposition division does not explicitly comment on the technical problem taken as a basis in **D6**, but it recognizes the above-mentioned reference to **D6** in the contested patent and also explicitly does not doubt that **D6** is based on the same technical problem as the contested patent.

In its decision, the opposition division does however certainly recognize that the technical statement of the problem on which **D1** is based is not comparable to that of contested patent and, in this respect, states the following:

“D1 does not consider the purity of the product streams as the variable to be optimized but as a boundary condition which has to be taken carefully and not unnecessarily too high (page 7, right column 2nd para.) [...]; as a result, in D1 the purity for the CH₄ stream is fixed at 96%, and for the embodiment of fig. 7a the purity of the CO₂ stream is set at 98%, which represents a rather coarse separation of the gas mixture not only compared with D6 but also when compared with the purity of the CO₂ product stream in other embodiment of D1 (in figs. 5 and 7b this value is >99%).”¹⁵

As a result, in relation to the criterion of similarity to the technical problem when determining the closest

¹² cf. D6: abstract (emphasis added).

¹³ cf. D6: paragraph [0001] (emphasis added).

¹⁴ cf. D6: paragraph [0022] (emphasis added).

¹⁵ cf. decision of 18 January 2024, page 7, point 4.1.1 (emphasis added).

prior art, it is clear that D6 is to be favored over D1. Although the opposition division appears to recognize this, it does not ascribe to this aspect the importance that is required in accordance with the Guidelines and the Case Law. Instead, this important aspect is not taken into account by the opposition division.

2.1.2.4 Number of distinguishing features

In relation to the number of distinguishing features in the examples in **D6** over the subject matter of claim 1 according to the main request, in its decision the opposition division states that

“except for the comparative example, the examples carried out according to the teaching of D6 differ from claim 1 of the patent in features F12 and F13”¹⁶.

The opposition division is therefore of the opinion that the examples according to the invention found in **D6** each have 2 distinguishing features (**F12** and **F13**¹⁷) over the subject matter of claim 1 according to the main request.

At the same time, the opposition division is of the opinion that the “comparative example” in **D6** differs from the examples of **D6** according to the invention in terms of the number of distinguishing features. In relation to the number of distinguishing features in the comparative example of **D6**, in this respect the opposition division appears to agree with the appellant’s opinion that the comparative example of **D6** differs from the subject matter of claim 1 according to the main request only on account of one feature (**F13**).¹⁸

In its decision, the opposition division identifies feature **F12** as the distinguishing feature of Fig. 7a of **D1** over the subject matter of claim 1 according to the main request.¹⁹

As a result, both the comparative example of **D6** and the embodiment according to Fig. 7a in **D1** each only have one distinguishing feature over the subject matter of claim 1 according to the main request. The examples according to the invention in **D6**, however, each also have a second distinguishing feature (namely **F12**).

2.1.2.5 D6 or D1 as the closest prior art?

In the following Table 1, we have summarized the properties of **D6** and **D1** that are relevant to

¹⁶ cf. decision of 18 January 2024, page 8, point 4.1.2, first paragraph.

¹⁷ Here and in the following, we always make reference to the feature numbering according to the feature analysis as found in the summons to oral proceedings of 19 December 2022; this feature analysis is also reproduced in the decision, on pages 3 to 5 therein.

¹⁸ cf. decision of 18 January 2024, page 7, point 4.1.1, last sentence.

¹⁹ cf. decision of 18 January 2024, page 8, point 4.1.2, last paragraph.

determining the closest prior art for the sake of improved clarity:

Table 5 Comparison of the properties of D6 and D1 that are relevant to determining the closest prior art.

	D6		D1
	Comparative example	Examples 1 and 3 according to the invention	Embodiment according to Fig. 7a
Number of distinguishing features ^a	1	2	1
Distinguishing feature(s) ^a	F13	F12, F13	F12
Similarity to the technical problem	+	+	-

^a over the subject matter of claim 1 according to the main request.

Even in its submission of 14 April 2023, the patent proprietor noted that, in its preliminary opinion of 19 December 2022, the opposition division had not carried out the critical examination of the equivalence of **D6** and **D1**, as required in accordance with the Guidelines.²⁰

In its decision, the opposition division still does not carry out a corresponding examination in a comprehensible manner, either.

Measured against the criteria for determining the closest prior art that are relevant in accordance with the Guidelines and the Case Law (cf. in this respect the above point 2.1.1, last paragraph), the comparative example of D6 should clearly be determined as the closest prior art, and the embodiment according to Fig. 7a in **D1** should be favored, since, with the same number of distinguishing features, it additionally also fulfills the criterion of similarity of the technical object (cf. in this respect the above Table 1).

Even in its reply to the notice of opposition of 20 June 2022 and in its submission of 14 April 2023, the patent proprietor noted that, according to the established Case Law of the Boards of Appeal of the EPO, when selecting the closest prior art, the formulation of the original problem and the intended use and the effects to be obtained should generally be given more weight than the maximum number of identical features (cf. **T 870/96**, **T 66/97**, and **T 314/15**).²¹

It is not apparent in a comprehensible manner from the opposition division's comments in its decision why the opposition division still considers the comparative example of **D6** even to be subordinate to the

²⁰ cf. submission of 14 April 2023, point 3.1.2, page 7, second paragraph.

²¹ cf. reply to the notice of opposition of 20 June 2022, point 3.4, page 29, penultimate paragraph and submission of 14 April 2023, point 3.2.1, page 8, penultimate paragraph.

embodiment according to Fig. 7a of **D1** when determining the closest prior art.

In this respect, the opposition division merely states that

“[...] when deciding which of the embodiments of D6 would be considered by the skilled person as starting point for the invention it is rather improbable that the comparative example of D6 will be selected as closest prior art”²².

The opposition division does not indicate any grounds for this evaluation.

In addition, according to the established Case Law of the Boards of Appeal of the EPO (cf. **T 855/15**)

“a consideration as to what the skilled person would do, in particular whether the skilled person “would select” a particular document in order “to arrive at the invention as claimed” would amount to hindsight reasoning [identical], because the skilled person would have to be assumed to know the invention before an argument could be made as to what he would do in order “to arrive at” it”²³.

Inasmuch as the opposition division wants to imply by the comments cited above that a person skilled in the art in principle does not take into account any comparative examples found in a prior-art document as a starting point for development, this argument is not convincing.

The term “comparative example” is relevant only for an internal comparison of the examples within **D6** and only indicates which of the examples found in **D6** are according to the invention and which are not according to the invention (i.e. whether or not they fall under the claims of **D6**). This term is, however, entirely irrelevant to a comparison of the examples found in **D6** with external data and examples. A comparative example within a prior-art document which is directed to a comparable statement of the problem (such as **D6** in the present case; cf. in this respect our above comments under point 2.1.1.1) is, however, in fact of particular interest to a person skilled in the art and, from their point of view, even has greater relevance, since it has clearly already been identified as a suitable starting point for exploring the corresponding statement of the problem within the prior-art document in question. This is the case in particular when a person skilled in the art uses technical means other than those known from the prior art in order to solve the corresponding technical problem. A person skilled in the art derives from the teaching of **D6** that the comparative example is indeed a suitable starting point for achieving optimization/maximization of the product stream purity and for developing and verifying corresponding methods focused on this.

In addition, the contested patent already notes in paragraph [0005] that this is a “new problem” that has

²² cf. decision of 18 January 2024, page 8, point 4.1.2, first paragraph.

²³ cf. Case Law of the Boards of Appeal of the EPO, 10th edition, page 250, point I.D.6.

not yet been solved by the prior art:

“In recent times, however, a new problem has occurred, that is not solved in a sufficient manner by the apparatuses and processes of the prior art.”

It is explicitly clear from the preceding paragraph [0004] of the contested patent that **D6** (or the WO publication WO 2012/000727, which is identical in terms of content), *inter alia*, is meant by the prior art cited in paragraph [0005]:

*“WO 2012/00727 [corresponds to **D6** in terms of content]; WO 2013/098024 and WO 2014/075850 represent the most optimized of all of these processes. In said patents an apparatus and a process are described which are optimized in view of product purity in combination with the lowest energy consumption.”*

For solving a “new problem” for which **D6** itself does not contain any proposed solutions, a comparative example is just as relevant (or even more relevant) as the examples according to the invention in **D6** for a person skilled in the art.

In the present case, the comparative example of **D6** also has the lowest number of distinguishing features of all the examples found in **D6** over the subject matter of claim 1 according to the main request (cf. in this respect the above Table 1), and as a result this comparative example is ascribed particularly high relevance from the point of view of a person skilled in the art.

The comparative example of **D6** is therefore the most promising starting point for developing the invention according to the contested patent, and the opposition division’s differing and completely unfounded evaluation is not convincing. This evaluation is primarily also supported by the fact that the contested patent itself explicitly applies a corresponding comparison²⁴ with the comparative example of **D6** in order to demonstrate the technical effect of the membrane area ratio according to the contested patent according to feature **F13**. The contested patent even goes as far as to construct another comparative example²⁵ that is not according to the contested patent in a targeted manner on the basis of the comparative example of **D6** in order to illustrate the technical advantages of a recycling rate according to the contested patent within the meaning of feature **F12**. In the contested patent, the comparative example of **D6** thus serves to explicitly illustrate the technical effects of a plurality of technical features of the invention according to the contested patent that are essential to the invention, and in this respect takes a position of particular importance within the contested patent.

Contrary to the opposition division’s evaluation, as a result, the comparative example of **D6** should

²⁴ cf. in this respect the contested patent, page 13, lines 22 to 33; the “Reference Example 1” in the contested patent corresponding to the “Comparative Example” in WO 2012/000727 A1, which is identical to the comparative example of **D6**.

²⁵ cf. in this respect the contested patent, page 15, lines 1 to 41.

therefore primarily clearly be favored over the embodiment according to Fig. 7a of **D1** when determining the closest prior art.

In relation to the suitability of Examples 1 and 3 of **D6** according to the invention as the closest prior art to the subject matter of claim 1 according to the main request, the opposition division limits its comments to the finding that these examples each comprise two distinguishing features (**F12** and **F13**).²⁶ The examples of **D6** according to the invention accordingly each comprise one distinguishing feature more than the embodiment according to Fig. 7a of **D1**.

In this respect, the opposition division completely ignores the patent proprietor's comments, as already explained above, relating to the weight given to the formulation of the original problem and the intended use and the effects to be obtained when determining the closest prior art according to the Case Law of the Boards of Appeal.

Examples 1 and 3 of **D6** according to the invention are distinguished from the embodiment according to Fig. 7a of **D1** in that they deal with the technical statement of the problem already explained in the contested patent (cf. in this respect the above point 2.1.1.1 and the above Table 1) (the contested patent, as set out above, also additionally seeks to reduce the total membrane area).

According to the Case Law of the Boards of Appeal, likewise already cited above, this circumstance relating to the statement of the problem is given a greater weight when determining the closest prior art than the fact that the embodiment according to Fig. 7a of **D1** comprises one fewer distinguishing feature. The opposition division does not acknowledge this circumstance any further in its decision.

Contrary to the opposition division's evaluation, as a result, Examples 1 and 3 of **D6** according to the invention should therefore also be favored over the embodiment according to Fig. 7a of **D1** when determining the closest prior art.

2.2 Comparative example of D6 as the closest prior art

2.2.1 Formulation of the objective technical problem to be solved

For the formulation of the objective technical problem to be solved, according to the Guidelines, the approach is to

“study the difference (also called “the distinguishing feature(s)” of the claimed invention) in terms of features (either structural or functional) between the claimed invention and the closest prior art, identify the technical effect resulting from the distinguishing features, and then formulate the

²⁶ cf. decision of 19 January 2024, point 4.1.2, page 8, first paragraph.

technical problem.²⁷

The only distinguishing feature of the subject matter of claim 1 according to the main request is feature **F13**

“the total capacity of the membranes, measured for nitrogen Grade 4.8 under standard conditions as defined in the description, used in the retentate separation stage (2) is higher than the total capacity of the membranes, measured for nitrogen Grade 4.8 under standard conditions as defined in the description, used in the feed stream separation stage(1), and”,

since all the separation stages according to the comparative example of **D6** comprise identical membrane areas.

Within **D6**, the “Comparative Example 1” therefore has the lowest number of distinguishing features over the subject matter of the granted claim 1 of the contested patent.

The contested patent directly compares the two examples “Example 1.1” and “Example 1.2” according to the contested patent with this closest prior art, namely “Reference Example 1” (“Comparative Example 1” of WO 2012/000727, which corresponds to “Comparative Example 1” in **D6**) and thus clearly determines the technical effect resulting from distinguishing feature **F13** over this closest prior art.

In this regard, the contested patent states that

“total membrane capacity, in sum for all three separation stages, of Example 1.1 was 14.9 % lower than in Reference Example 1. In other words, in the inventive set-up of the process, invest cost could be reduced because the required total membrane capacity could be reduced.”²⁸

In addition, the contested patent describes that

“[t]hese settings lead to a retentate (8) of the retentate separation stage (2) having a content of 98.5 Vol. % methane and 1.5 Vol. % carbon dioxide, analogue to Reference Example 1.”²⁹

Also in relation to the technical effect of the example “Example 1.2” according to the contested patent over this closest prior art, the contested patent states that

“[i]n Example 1.2 a total saving of 14.5 % of membrane capacity, in sum for all three separation stages, compared to Reference Example 1, was achieved.”³⁰

²⁷ cf. Guidelines for Examination in the European Patent Office, Part G-VII, 5.2 (emphasis added).

²⁸ cf. contested patent, paragraph [0096] (emphasis added).

²⁹ cf. contested patent, paragraph [0093] (emphasis added).

³⁰ cf. contested patent, paragraph [0099].

Also for the example “Example 1.2” according to the contested patent, a purity (“Purity CH₄ in Stream (11)”) of 98.5% results for the CH₄ product stream (8).³¹

The CO₂ product streams (11) in both examples according to the contested patent have a very high purity at the same time.³²

The technical effect of the examples according to the contested patent resulting from the single distinguishing feature over the comparative example of **D6** as the closest prior art is therefore

- (i) a reduced total membrane area and
- (ii) a high purity of both product streams.

The contested patent again explicitly specifies the quality requirements relating to the purity of the product streams in paragraphs [0011] and [0035] and in this respect is oriented toward the purities of the product streams achieved in **D6**.

The contested patent itself even goes a step further in dealing with the closest prior art (“Comparative Example 1” of WO 2012/000727 and **D6**; referred to as “Reference Example 1” in the contested patent) and modifies the operating state presented in the closest prior art in a targeted manner that is not according to the contested patent (the corresponding example is referred to as “Comparative Example 1” in the contested patent; cf. paragraphs [0100] to [0102] of the contested patent). Comparative Example 1 according to the contested patent has a recycling rate of 49%³³ within the meaning of feature **F12**, which thus does not fall within the range according to the granted claim 1 of the contested patent (“60 to 100 % by volume of the crude gas stream (17)”).

A direct comparison of Comparative Example 1 according to the contested patent with the closest prior art (referred to as Reference Example 1 in the contested patent) demonstrates that

“the membrane capacity, in sum for all three separation stages, required in Comparative Example 1, compared to Reference Example 1, was increased by 7.5 %.”³⁴

In addition, Comparative Example 1 has a lower purity of the CO₂ product stream (11) of just 97.5% in comparison with the closest prior art.³⁵

The technical effects ascertained for the examples according to the contested patent (Example 1.1 and

³¹ cf. contested patent, Table 1, right-hand column, line 5 and Table 2, right-hand column, line 7.

³² cf. contested patent, paragraph [0095], for Example 1.1 and Table 1, right-hand column, line 6 and Table 2, right-hand column, line 8 for Example 1.2.

³³ cf. contested patent, Table 4, right-hand column, line 1.

³⁴ cf. contested patent, paragraph [0102] (emphasis added).

³⁵ cf. contested patent, Table 4, right-hand column, line 8.

1.2) over the closest prior art are therefore negated for Comparative Example 1 (likewise in comparison with the closest prior art).

The objective technical problem addressed by the invention according to the contested patent is therefore that of modifying the closest prior art, i.e. the comparative example of **D6**, such that

- (i) a reduced total membrane area

and

- (ii) a high purity of both product streams

are achieved.³⁶

2.2.2 “Could/would approach” (Guidelines G VII, 5.3)

According to the Guidelines for Examination in the European Patent Office, in the next stage it needs to be checked

“whether there is any teaching in the prior art as a whole that would (not simply could, but would) have prompted the skilled person, faced with the objective technical problem, to modify or adapt the closest prior art while taking account of that teaching, thereby arriving at something falling within the terms of the claims, and thus achieving what the invention achieves.”³⁷

Comparative Example 1 of **D6** taking into account the teaching of **D6** as a whole:

D6 does not disclose any teaching that would have made it obvious to a person skilled in the art to select, proceeding from Comparative Example 1, a ratio of the membrane capacities of the retentate separation stage (2) and the feed stream separation stage (1) according to feature **F13** of the granted claim 1 of the contested patent in order to achieve a (i) reduction in the total membrane capacity in combination with an (ii) at least consistently high purity of both product streams (8) and (11).

In all the examples of **D6**, all the separation stages always have membrane areas of identical size.

Comparative Example 1 of **D6** taking into account the teaching of **D1**:

When we adopt the opposition division’s way of thinking in this respect, Comparative Example 1 of **D6** therefore does not appear to be readily combinable with the teaching of **D1**, since the flow rates and

³⁶ cf. in this respect also the preliminary evaluation by the opposition division according to point 7.3, paragraph 3 of the summons to oral proceedings of 19 December 2022.

³⁷ cf. Guidelines for Examination in the EPO, Part G, Chapter VII, 5.3.

the throughput, in particular according to Fig. 7a, 7b, and 5 of **D1**, differ greatly from the flow rates and the throughput according to Comparative Example 1 of **D6**. See the opposition division's corresponding consideration in the summons under point 7.4.4. If, specifically in the opposition division's view, the discussion of inventive step in relation to **D6** is not readily applicable to **D1**, the teaching of each of said documents needs to be far enough apart that they are not readily combinable.

A hypothetical combination (hypothetical because it is actually excluded for the stated reasons) of the teaching of **D6** (Comparative Example 7) and **D1** does not render a solution according to the contested patent obvious, either, because all the examples in **D1** have a significantly lower purity of the CH₄ product stream. Furthermore, **D1** does not disclose an example having a recycling rate within the meaning of feature **F12** which is in the claimed range of the granted claim 1 of the contested patent.

2.2.3 Combination of D6 (Comparative Example 1) with further prior art does not render invention according to the contested patent obvious

A combination of the teaching of **D6** (Comparative Example 1) and **D2** or **D6** (Comparative Example 1) and **D3** does not render the invention according to the contested patent obvious.

D2 is not prior art and is thus not relevant to the examination of patentability.

D2 was filed by the respondent, with the reasoning (cf. page 8, last paragraph to page 9, first paragraph of the notice of opposition) that

“in circumstances where the process parameters (i.e. crude gas starting composition, required product compositions, membrane material and costs, compressor costs, electricity costs, etc.) are such that the most economically optimised gas separation process happens to have a recycled gas flow rate that totals 60 to 100 % by volume of the crude gas stream, then the skilled person would in following the teaching of D1 as regards how to optimise the gas separation process have arrived at such a process in an obvious and non-inventive manner.”

As already stated, **D1** attempts to optimize the method from **D6** in terms of economic aspects and, in so doing, ends up with methods each having only 96% methane content in the methane product stream.

The respondent has not provided any reason why a person skilled in the art proceeding from **D1** should have selected a product purity of 98.5% methane in the methane product stream. These purities have in fact been exceeded in **D6**, cited in **D1**. Nevertheless, 96% was found to be the optimum in **D1**. Then setting the methane content in **D2** to 98.5% amounts to hindsight reasoning, which a person skilled in the art had not applied in the light of **D1** and its combination with **D6** since it constituted a deviation from the optimum found in **D1**.

Even if it were assumed that a person skilled in the art had calculated the computation model from **D1** using a methane content of 98.5%, by contrast with the respondent's assertion, they would not have ended up at a method according to claim 1 of the contested patent.

The respondent's simulation in **D2**, which is allegedly supposed to demonstrate this, is namely not a correct reproduction of **D1**. The statements from **D2** are incorrect and without merit for the following reasons in particular:

In the table on page 3 of **D2**, the respondent defends the fact that the compressor model from **D1** has not been used, but instead the "Aspen Standard Isentropic compressor model using Scholz eq. 6 to 8". The respondent nevertheless asserts in **D2** that its simulation is identical or equivalent to the approach in **D1**.

This assertion is incorrect. By contrast: The respondent's simulation from **D2** leads to nonsensical results in comparison with **D1**. For instance, Fig. 7a of **D1** demonstrates that a compressor power of 36.68 kW is required with the computation model used therein for the compression of a volume flow rate of 10144 mol/h. Page 8 of **D2**, however, arrives at a lower compressor power of 32.6 kW for a higher volume flow rate of 10768 mol/h. This does not make any sense. As the respondent itself repeatedly emphasizes in terms of the higher recycling rate in the present invention, a greater volume flow rate has to lead to a higher rather than a lower compressor power. This clearly demonstrates that the opponent's simulation in **D2** differs significantly from **D1** and thus does not lead to meaningful results.

Using equations 6 to 8 in **D1**, the appellant has attempted to reproduce the result of a volume flow rate of 10768 mol/h and a compressor power of 32.6 kW from page 8 of **D2**. That is not possible. The respondent's assertion on page 3 of **D2** that equations 6 to 8 of **D1** have to be used for the compressor are therefore clearly also incorrect.

The appellant has therefore reproduced the simulation from **D1** in Aspen itself and, in so doing, by contrast with **D2**, has complied with all the requirements of **D1**.

While page 8 of **D2** indicates an unrealistic compressor power of 32.6 kW for a volume flow rate of 10768 mol/h, the appellant's simulation gives a realistic compressor power of 38.6 kW for the same volume flow rate (cf. **D1**: 8, page 2).

The appellant has then recalculated the simulation on page 8 of **D2** again using its correct Aspen model. An identical output flow, identical product streams as on page 8 of **D2**, were assumed. As demonstrated on page 1 of **D18**, a correct simulation of this scenario gives a recycling rate of 58.8%, which is outside the range according to claim 1 of the contested patent and not within that asserted by the opponent.

As a result, **D2** is therefore irrelevant to the assessment of inventive step, since

- (i) it is not prior art,
- (ii) a person skilled in the art is not prompted to carry out the simulation from **D2** in any way, and
- (iii) **D2** is not a correct reproduction of **D1**.

D3 discloses an algebraic method for the simulation, which was filed by the opponent to verify **D2**. **D3** is not relevant to the examination of patentability.

D4 was consulted by the respondent in combination with **D1** during the discussion of inventive step because **D4** is allegedly supposed to render it obvious to increase the capacity of the retentate separation stage compared with the permeate separation stage.

We oppose this assertion. A person skilled in the art would not have combined **D4** either with **D1** or with **D6**.

Fig. 1 a) to g) of **D4** show circuits which have been simulated therein. The respondent refers to Fig. 10 and 11 of **D4**, which again refer to the circuit g) in Fig. 1 of **D4**. In circuit g) in Fig. 1 of **D4**, two compressors, one in the second permeate stream and one in the first permeate stream, are used, but none is used in the feed stream.

D1 exclusively discloses circuits comprising one compressor in the feed stream and no compressors in the first or second permeate stream. **D1** and **D4** therefore relate to completely different circuits. The teaching of **D4** is not applicable to the circuit in **D1**. A person skilled in the art would not have combined **D1** with **D4**.

The same applies to **D6**. The method from **D6** (see claim 1) is characterized in that the first permeate stream is not subjected to recompression. That is exactly what happens in **D4**, however. A person skilled in the art would have therefore recognized that the methods from **D6** and **D4** cannot be combined and the teaching of **D4** is not applicable to **D6**. A person skilled in the art accordingly would not have combined **D6** with **D4**.

D5 was consulted by the respondent in combination with **D1** during the discussion of inventive step because **D5** is allegedly supposed to render it obvious to increase the capacity of the retentate separation stage compared with the permeate separation stage.

With regard to this objection, it should be noted that **D5** relates to the separation of H₂ and N₂ and not to the separation of CH₄ and CO₂. Furthermore, **D5** relates exclusively to single-stage and two-stage

circuits, whereas **D1** and **D6** relate to three-stage circuits. **D5** thus relates to a completely different field and to statements of the problem that are different from those in **D1** and **D6**.

A person skilled in the art would not have combined **D5** either with **D1** or with **D6**.

2.2.4 Examples 1 and 3 of **D6** as the closest prior art

2.2.4.1 Formulation of the objective technical problem to be solved

The subject matter of claim 1 according to the main request differs from Examples 1 and 3 of **D6** on account of the features

- (i) **F12** (*“the gas volume recycled in the second permeate stream (9) and in the third retentate stream (10) totals 60 to 100 % by volume of the crude gas stream (17), and*

and

- (ii) **F13** (*“the total capacity of the membranes, measured for nitrogen Grade 4.8 under standard conditions as defined in the description, used in the retentate separation stage (2) is higher than the total capacity of the membranes, measured for nitrogen Grade 4.8 under standard conditions as defined in the description, used in the feed stream separation stage(1), and”*).

D6 discloses, for Example 1, a recycling rate within the meaning of feature **F12** of just 31.2%³⁸ and, for Example 3, of just 41.7%. Both Example 1 and Example 3 of **D6** are thus outside the claimed range in claim 1 of the contested patent.

All the separation stages in Example 1 and Example 3 of **D6** have identical membrane areas³⁹ and thus do not implement feature **F13** of the granted claim of the contested patent.

The contested patent makes a direct comparison of this closest prior art (Example 1 and Example 3 of **D6**) with examples according to the contested patent and thus determines the technical effect resulting from the above-mentioned distinguishing features.

The contested patent compares Example 2 according to the contested patent with Example 1 of **D6** (referred to as “Reference Example 2”⁴⁰ in the contested patent). In relation to the technical effect of Example 2 according to the contested patent over the closest prior art (Example 1 of **D6**), the contested patent finds that

³⁸ cf. **D6**: paragraph [0076], last line (Example 1) and paragraph [0080] (Example 3).

³⁹ cf. **D6**: paragraph [0075], line 4 (Example 1) and paragraph [0079], lines 7 to 9 (Example 3).

⁴⁰ cf. contested patent, paragraph [0103],

“[d]ue to the inventive modifications, the total membrane capacity required in Example 2 could be reduced, compared to Reference Example 2, by 15 %.”⁴¹

Furthermore, Example 2 according to the contested patent has a very high purity of the CH₄ product stream of 98.5%⁴², which meets the quality requirements explained above under point 3.2.1, which are oriented toward the closest prior art (WO 2012/000727 or **D6**). In addition, Example 2 according to the contested patent even has a purity of the CO₂ product stream of 99.7%, which is improved over the closest prior art⁴³.

The contested patent compares Example 3 according to the contested patent with Example 3 of **D6** (referred to as “Reference Example 3”⁴⁴ in the contested patent). In relation to the technical effect of Example 3 according to the contested patent over the closest prior art (Example 3 of **D6**), the contested patent finds that

“[c]aused by the inventive modifications a saving of 8 % of the total membrane capacity compared to Reference 3 was achieved.”⁴⁵

Example 3 according to the contested patent also has a very high purity of the CH₄ product stream of 98.5%⁴⁶, which meets the quality requirements explained above under point 3.2.1, which are oriented toward the closest prior art (WO 2012/000727 or **D6**). In addition, Example 3 according to the contested patent likewise has a purity of the CO₂ product stream of 99.7%, which is improved over the closest prior art⁴⁷.

The technical effect resulting from the distinguishing features **F12** and **F13** over the closest prior art is therefore

- (i) a reduced total membrane area

and

- (ii) a high purity of both product streams.

The objective technical problem addressed by the invention according to the contested patent is therefore that of modifying Example 1 of **D6** or Example 3 of **D6** such that

- (i) a reduced total membrane area

⁴¹ cf. contested patent, paragraph [0105] (emphasis added).

⁴² cf. contested patent, Table 6, right-hand column, line 7.

⁴³ cf. contested patent, Table 6, right-hand column, line 8.

⁴⁴ cf. contested patent, paragraph [0107],

⁴⁵ cf. contested patent, paragraph [0109] (emphasis added).

⁴⁶ cf. contested patent, Table 8, right-hand column, line 7.

⁴⁷ cf. contested patent, Table 8, right-hand column, line 8.

and

- (ii) a high purity of both product streams

are achieved⁴⁸.

2.2.4.2 “Could/would approach” (Guidelines G VII, 5.3)

Examples 1 and 3 of **D6** taking into account the teaching of **D6** as a whole:

D6 itself does not disclose any teaching that would have made it obvious to a person skilled in the art to select, proceeding from Examples 1 and 3, a ratio of the membrane capacities of the retentate separation stage (2) and the feed stream separation stage (1) according to feature **F13** of the granted claim 1 of the contested patent in order to achieve a (i) reduction in the total membrane capacity in combination with an (ii) increased or at least consistently high purity of both product streams (8) and (11).

D6 does not render it obvious to increase the recycling rate according to feature **F12**, either, but instead provides teaching leading away from this concept at best, since the recycling rate is increased in the comparative example of **D6** that is not according to the invention such that it falls within the claimed range of claim 1 of the contested patent (86.7%⁴⁹), but this does not result in an improvement in the purity of the product streams (8) and/or (11). The total membrane capacity also remains unchanged.

Examples 1 and 3 of **D6** taking into account the teaching of **D1**:

As already mentioned above, the technical teaching of **D6** and of **D1** cannot be readily combined with one another.⁵⁰

A (hypothetical; see above) combination of the teaching of **D6** (Examples 1 and 3) and **D1** does not render a solution according to the contested patent obvious; it instead provides teaching leading away from this concept.

Examples 1 and 3 of **D6** each teach a purity of the CH₄ product stream of 98.5% (paragraphs [0075] and [0079], respectively).

For the examples according to Fig. 7a and 7b, however, **D1** merely teaches a purity of the CH₄ product stream (8) of 96%.

⁴⁸ cf. in this respect also the preliminary evaluation by the opposition division according to point 7.3, paragraph 3 of the summons to oral proceedings of 19 December 2022.

⁴⁹ cf. D6: paragraph [0074],

⁵⁰ cf. in this respect point 7.4.4 of the summons to oral proceedings of 19 December 2022 and the comments under point 3.2.3.1.2 of the submission of 4 April 2023.

The examples according to Fig. 7a and 7b of **D1** each have a specific ratio of the membrane capacities (namely a ratio according to feature **F13** of the granted claim 1 of the contested patent). When adjusting this specific ratio of the membrane capacity, the purity of the CH₄ product stream (8) is significantly diminished in said examples of **D1** in comparison with **D6**, Examples 1 and 3. On the basis of the basic knowledge that **D1** teaches a lower purity of the CH₄ product stream of just 96%, a person skilled in the art proceeding from **D6** (Examples 1 and 3) would not have selected this specific ratio of the membrane capacities in separation stages (2) and (1) in any case, as disclosed in **D1**, Fig. 7a and 7b (and as falls within the claimed range of the granted claim 1 of the contested patent according to feature **F13**), since, instead of improving the purity of the CH₄ product stream (8), as they are seeking to do, they would have expected the purity to be diminished with such a modification.

A combination of Examples 1 and 3 of **D6** with another prior-art document does not render the subject matter of claim 1 according to the main request obvious. In this respect, we make reference to our above comments under point 2.1.2.3.

As a result, the subject matter of claim 1 according to the main request therefore involves an inventive step pursuant to Article 56 EPC proceeding from Examples 1 and 3 of **D6**.

2.2.5 Interim conclusion 1

As is clear from the above comments, the opposition division's decision to determine the embodiment according to Fig. 7a of **D1** as the prior art closest to the subject matter of claim 1 according to the main request is clearly incorrect.

Instead, taking into account the Guidelines and the established Case Law of the Boards of Appeal, the comparative example of **D6** and also Examples 1 and 3 of **D6** according to the invention should clearly primarily be favored over the embodiment according to Fig. 7a of **D1** when determining the closest prior art.

This early error by the opposition division in the first step in taking the problem-solution approach results in a legally incorrect decision of 19 January 2024, since the subject matter of claim 1 according to the main request clearly involves an inventive step pursuant to Article 56 EPC proceeding from the comparative example (or Examples 1 and 3) of **D6** as the (correct) closest prior art.

2.2.6 As an auxiliary measure – Fig. 7a of D1 as the closest prior art

As we have already set out in detail above and in the opposition proceedings before the department of first instance, **D1** is not suitable to be the prior art closest to the subject matter of claim 1 according to the main request.

If, however, the embodiment according to Fig. 7a of **D1** is taken as the closest prior art as an auxiliary measure for the purposes of the discussion, it becomes clear that the opposition division's evaluation relating to the inventive step of the subject matter of claim 1 according to the main request is also incorrect proceeding from Fig. 7a of **D1**. In this respect, we make reference to the comments under point 3.2.4 of the submission of 14 April 2023, maintain these comments, and introduce them into the appeal proceedings by reference in this respect.

In addition, we make the following comments in response to the opposition division's decision:

2.2.6.1 The opposition division ascertains the incorrect technical effect

2.2.6.1.1 Formulation of the objective technical problem to be solved

The subject matter of claim 1 according to the main request differs from the embodiment according to Fig. 7a of **D1** merely on account of the distinguishing feature:

F12 (*"the gas volume recycled in the second permeate stream (9) and in the third retentate stream (10) totals 60 to 100 % by volume of the crude gas stream (17), and*).

The example according to Fig. 7a in **D1** has a recycling rate within the meaning of feature **F12** of just approx. 51.6% and is therefore clearly below the claimed range according to claim 1 of the contested patent.

All the examples according to the invention in the contested patent which relate to the separation of gas mixture consisting of CH₄ and CO₂ have a CH₄ product stream having a purity of either 97% (Examples 4⁵¹, 5⁵², 6⁵³, and 7⁵⁴ of the contested patent) 98.5% (Examples 1.1⁵⁵, 1.2⁵⁶, 2⁵⁷, 11⁵⁸, and 12⁵⁹) or 99% (Example 8⁶⁰). The example according to Fig. 7a in **D1** (and all the other examples in **D1**) has a purity of the CH₄ product stream of just 96% and is therefore clearly below that which is achieved by the operating states according to the contested patent.

A simple comparison of the contested patent with **D1** as the (alleged) closest prior art results in a first technical effect, resulting from the distinguishing feature **F12**, of the invention according to the contested patent over Fig. 7a of **D1** thus being a higher purity of the CH₄ product stream.

⁵¹ cf. contested patent, Table 9, middle column, line 13.

⁵² cf. contested patent, Table 10, middle column, line 13.

⁵³ cf. contested patent, Table 11, middle column, line 13.

⁵⁴ cf. contested patent, Table 12, middle column, line 13.

⁵⁵ cf. contested patent, paragraph [0098],

⁵⁶ cf. contested patent, Table 2, right-hand column, line 7.

⁵⁷ cf. contested patent, Table 4, right-hand column, line 7.

⁵⁸ cf. contested patent, Table 15, middle column, line 13.

⁵⁹ cf. contested patent, Table 15, right-hand column, line 13.

⁶⁰ cf. contested patent, Table 13 (beginning on page 21), middle column, line 12.

The patent proprietor first carried out its own, correct reproduction of Fig. 7a of **D1** by Mr. Markus Priske, the inventor of the invention according to the contested patent, in order to facilitate a correct and direct comparison (cf. in this respect **D22**, “validation simulation”). On the basis of this correct reproduction of Fig. 7a of **D1**, the patent proprietor modified the distinguishing feature **F12** in order to arrive at a method within the range according to the contested patent according to the granted claim 1 of the contested patent. For this purpose, on the basis of this correct reproduction of Fig. 7a of **D1**, the recycling rate within the meaning of feature **F12** was increased from 51.6% (according to Fig. 7a of **D1**) to 61%, i.e. to a value slightly above the lower limit of the claimed range of claim 1 of the contested patent (cf. in this respect **D22**, variation 1).

As expected, the thus modified operating state “variation 1” falling under claim 1 of the contested patent has a higher purity of the CH₄ product stream (97%; “CH₄ Retentate Stage 2” = 0.97 mol/mol) compared with Fig. 7a of **D1** (96%), in line with all the examples according to the invention set out in the contested patent. Furthermore, as a second technical effect, the operating state “variation 1” demonstrates a significantly reduced total membrane capacity in comparison with Fig. 7a of **D1**. The total membrane capacity (“Total Area”) of the operating state “variation 1” is merely 493 m², while Fig. 7a of **D1** mentions a total membrane capacity of 524 m². This second technical effect is in line with the general teaching of the contested patent; cf. in particular paragraphs [0035] and [0036] thereof, which relate to the direct comparison with WO 2012/00727, corresponding to **D6**.

In addition, the patent proprietor has made another variation to the operating state parameters, with the recycling rate within the meaning of feature **F12** being 83%; the ascertained operating state “variation 2” is distinguished by a yet further increased purity of the CH₄ product stream (98%; “CH₄ Retentate Stage 2” = 0.98 mol/mol); the total membrane capacity (“Total Area”) is again reduced in comparison with Fig. 7a of **D1**.

The technical effects resulting from the distinguishing feature **F12** are therefore

- (i) a higher purity of the product streams and
- (ii) a reduced total membrane capacity.

In relation to these technical effects resulting from the distinguishing feature, in its decision the opposition division states that features **F12** to **F14** are in a dynamic interaction with one another, and therefore there is no clear evidence that feature **F12** itself contributes to the reduction in the total membrane capacity alleged by the patent proprietor and to the improvement in the purity of the product streams.⁶¹

⁶¹ cf. decision of 19 January 2024, point 4.2.3, page 10, first paragraph.

These comments by the opposition division are not comprehensible. The mere finding that a plurality of technical features that are essential to the invention are in a dynamic interaction with one another cannot lead to one of these features no longer being able to be ascribed a technical effect over the closest prior art.

In this connection, the opposition division does not express any doubt in the patent proprietor's comments set out above that the results presented by the appellant in **D22** for the operating states according to "variation 1" and "variation 2" demonstrate beyond doubt that, proceeding from the embodiment according to Fig. 7a of **D1**, an (i) increased purity of the CH₄ product stream and (ii) a reduced total membrane capacity are achieved by adjusting the recycling rate within the meaning of feature **F12** into the range according to the contested patent.

Furthermore, the opposition division even explicitly confirms that, with the comparative simulations in **D22**, the appellant was able to demonstrate that the advantages that are set out by the patent proprietor and described in the contested patent and that are achieved by implementing features **F12**, **F13**, and **F14** are achieved both for the comparatively low flow rate according to the contested patent and according to **D6** and for the significantly higher flow rate according to Fig. 7a of **D1**. In this respect, in its decision the opposition division states that

*"The patentee showed with document D22 that the conditions F12, F13 and F14 according to Claim 1 were reachable not only for the lower throughput of D6, but also for the throughput of fig. 7a of D1, which was questioned in the written submissions."*⁶²

In the results of the comparative simulations set out by the appellant in **D22**, the opposition division therefore recognizes both (i) a comprehensible and accurate reproduction of the embodiment according to Fig. 7a of **D1** (cf. in this respect the "validation simulation" in **D22**; this ensures the comparability of the comparative simulations with Fig. 7a of **D1**) and (ii) accordingly correct and comprehensible modifications to the embodiment according to Fig. 7a of **D1** (cf. in this respect "variation 1" and "variation 2" in **D22**).

Overall, in its decision the opposition division does not express any doubt that the appellant has plausibly demonstrated that, proceeding from Fig. 7a of **D1**, adjusting feature **F12** into the range according to the contested patent results in the technical effects mentioned by the appellant.

The only concerns that the opposition division puts forward in relation to the technical effects of the distinguishing feature **F12**, as plausibly demonstrated by the patent proprietor, proceeding from Fig. 7a of **D1** are based on the fact that, in the opposition division's view, it is still not beyond the realms of possibility that distinguishing feature **F12** does not result in the demonstrated technical effects alone,

⁶² cf. decision of 19 January 2024, point 4.2.3, page 9, first paragraph.

but in interaction with features **F13** and **F14**.

This question of whether the technical effects plausibly demonstrated by the appellant by means of **D22** over Fig. 7a of **D1** can be attributed solely to feature **F12**, or to a dynamic interaction of features **F12**, **F13**, and **F14**, is, however, irrelevant and cannot form the basis for a technical effect of feature **F12** being denied. The only key factor is that, proceeding from Fig. 7a of **D1**, adjusting the single distinguishing feature **F12** results in the demonstrated technical effect, provided that, at the same time, features **F13** and **F14** remain within the range defined by claim 1 of the contested patent. The appellant has substantiated this plausibly and comprehensibly by way of **D22**.

The key factor is that all three features **F12**, **F13**, and **F14** are adjusted at the same time; if this is the case, then the above-mentioned advantageous technical effects result.

In this connection, we note that the respondent (opponent) did not put forward any plausible and comprehensible experimental counter-evidence in this respect at any point in the opposition proceedings before the department of first instance, although it (i) acknowledged **D22** by the appellant (patent proprietor) in good time before the oral proceedings and (ii) had more than enough time and opportunity to respond to the appellant's critique of the plausibility of the respondent's experiments in **D2** (or **D2a**) and **D20**⁶³. In this connection, it should once again be noted that all the examples in the contested patent and in the prior-art documents **D1** and **D6** as well as respondent's reproductions in **D2**, **D2a**, **D20**, and **D22** are computer simulations and not experiments carried out in a technical system. It is common general knowledge in the art to carry out such simulations as part of the technical implementation of a patented invention in the present technical field and in order to compare it with the prior art. Computer simulations of this kind can be created without great effort and at short notice. The respondent itself has demonstrated by way of **D2** and the late-filed documents **D2a** and **D20** that it has the appropriate means and competencies to carry out such simulations, even if it has made errors and therefore has not delivered a correct reproduction of **D1**. All the arguments, facts, and/or evidence that may be put forward in future by the respondent in the appeal proceedings regarding this aspect would therefore clearly be late-filed, contrary to the requirements of the Rules of Procedure of the Boards of Appeal, and would not be admitted into the appeal proceedings.

As a result, the **objective technical problem** to be solved by a person skilled in the art is therefore that of modifying the example according to Fig. 7a of **D1** such that both

- (i) a higher purity of the product streams

⁶³ cf. in this respect the reply to the notice of opposition of 20 June 2022, point 3.5.4.3, from page 35, paragraph 5 and the submission relating to oral proceedings of 14 April 2023, point 3.2.4.2.2.

and

- (ii) a reduced total membrane capacity

are achieved.

2.2.6.1.2 “Could/would approach” (Guidelines G VII, 5.3)

Proceeding from the disclosure of Fig. 7a of **D1**, a person skilled in the art dealing with the objective technical problem would not be motivated or prompted to adjust a recycling rate that is in the range of feature **F12** of the granted claim 1 of the contested patent:

D1 merely discloses examples of which the recycling rate within the meaning of feature **F12** is either significantly below the claimed range according to claim 1 of the contested patent (24% for Fig. 5 and 51.6% for Fig. 7a) or significantly thereabove (129% for Fig. 7b). At the same time, all the examples in **D1** have a comparatively low purity of the CH₄ product stream of 96%. Taking into account the other teaching of **D1**, a person skilled in the art would thus not be prompted to increase the recycling rate (e.g. toward the value from Fig. 7b) proceeding from Fig. 7a (recycling rate of 51.6%), because the purity of the CH₄ product stream in **D1** is identical in any case (96%), irrespective of the individually disclosed recycling rate. The process parameters varied proceeding from Fig. 7a toward Fig. 7b have no influence on the purity of the CH₄ product stream.

The only teaching that can be found in **D1** for increasing the purity of the CH₄ product stream to above 96% is an increase in the membrane selectivity, as shown by Fig. 11 of **D1**. However, **D1** teaches, on page 9, left-hand column, paragraph 1, that such membranes did not even exist on the date of disclosure of **D1** and it did not appear to be economically feasible to develop such membranes, either. Proceeding from **D1**, a person skilled in the art therefore would not have been motivated to develop corresponding membranes in order to increase the purity of the CH₄ product stream to above 96% and would not have had a technical starting point for approaching this problem using other measures. By contrast, **D1** does not provide any reasonable expectation of success for even approaching this problem.

In terms of the CO₂ gas stream (permeate product stream in the permeate separation stage), we make reference to our comments under point 2.1.1.1; in comparison with the examples Fig. 7a, 7b, and 5, **D1** demonstrates that, proceeding from Fig. 7a, the total membrane area is increased (in Fig. 7b and Fig. 5) when a higher-purity CO₂ gas stream (permeate product stream in the permeate separation stage) is achieved (Fig. 7a has the lowest purity of this CO₂ gas stream in comparison with Fig. 7b and Fig. 5).

After studying **D1**, a person skilled in the art could not have presumed that, for solving one or even both

of the two objective technical problems, it might have been feasible to adjust a recycling rate in the range of 60 to 100%, i.e. as defined by the contested patent in claim 1 (feature **F12**).

In relation to an improved purity of the CH₄ product stream (first objective technical problem), as set out above, **D1** in fact provides teaching leading away from a solution to the objective technical problem according to the contested patent, since Fig. 11 of **D1** teaches that an improved purity of the CH₄ product stream, in particular a purity of > 96%, can be achieved by (drastically) increasing the selectivity of the membranes used (cf. in this respect **D1**, chapter 3.3.2).

Also in relation to a reduced total membrane capacity (second objective technical problem), **D1** provides teaching leading away from a solution to the objective technical problem according to the contested patent. In comparison with Fig. 7a, Fig. 7b of **D1** has a higher recycling rate and a higher total membrane capacity (sum of the individual membrane capacities). According to the teaching of **D1**, a person skilled in the art would therefore not have been prompted to increase the recycling rate within the meaning of feature **F12** proceeding from Fig. 7a of **D1** in order to achieve a lower total membrane capacity; by contrast, when considering Fig. 7b by way of comparison, they would have expected that an increased total membrane capacity would result from the increase in the recycling rate.

D1 therefore does not render the subject matter of the granted claim 1 of the contested patent obvious.

A combination of the teaching of **D1** and **D2** or **D1** and **D3** does not render a solution according to the contested patent obvious, either. In this respect, we make reference to our above comments under point 2.1.2.3.

D2 is also entirely unsuitable for the assessment of inventive step proceeding from **D1** as the closest prior art, since it is not a prior-art document and its content is also objectionable (cf. in this respect our comments below under point 2.1.5.2).

The opponent has introduced **D3** merely for the purposes of verifying (“cross-check”⁶⁴) its simulation results according to **D2**. **D3** relates to an algebraic model for modeling gas separation processes by means of membranes. A person skilled in the art dealing with the objective technical problem would not have consulted the teaching of **D3** proceeding from Fig. 7a of **D1** as the closest prior art.

A combination of the teaching of **D1** and **D4** does not render a solution according to the contested patent obvious, either. In this respect, we make reference to our above comments under point 2.1.2.3.

The subject matter of the granted claim 1 of the contested patent therefore involves an inventive step

⁶⁴ cf. notice of opposition of 4 February 2022, page 9, paragraph 2.

pursuant to Article 56 EPC.

2.2.6.2 D2 is entirely unsuitable for an assessment of inventive step proceeding from D1 as the closest prior art

In its notice of opposition of 4 February 2022, the respondent states, starting from page 9, that the simulation results set out in **D2** prove that a person skilled in the art dealing with the objective technical object would necessarily have arrived at a solution according to the contested patent proceeding from Fig. 7a of **D1**. In this regard, the opponent states that

“the change in the required purity of the CH₄ product does alter the values of the optimal membrane surface areas in the feed stream and retentate separations stages, the values of the optimal pressure ratios over the permeate and feed stream separation stages, and the resulting volume of gas that is recycled.”⁶⁵

According to the opponent’s comments, starting from an operating state according to Fig. 7a of **D1**, the improved purity of the CH₄ product stream of 98.5% that is sought inevitably leads to all the features (primarily features **F12**, **F13**, and **F14**) of the granted claim 1 of the contested patent being implemented.

Merely specifying a required composition or purity of a product stream (with the membrane separation areas necessarily being adjusted, e.g. as a result of a simulation) is not disclosed in either the contested patent or the prior art; this necessarily being done, as asserted by the opponent, is based on hindsight reasoning (which is not permitted). A person skilled in the art would merely have taken the technical measures that are disclosed in **D1** or another of the cited prior-art documents. **D1** discloses on page 2, right-hand column, paragraph 3:

“... feed gas conditions, product gas requirements and economic parameters such product gas pressure and energy costs considerably determine the optimal process configuration. Consequently, the optimal process configuration presented here, is identified by applying the boundary conditions set here.”

Although the “Product Gas Requirements” are boundary conditions in **D1** and can therefore be predefined as target variables, in chapter 3.3.2 **D1** teaches only the selectivity of the membranes as a technical measure for adjusting the product gas purity. A comparison of Fig. 7a and 7b of **D1** also teaches a person skilled in the art that adjusting the recycling rate while keeping the selectivity the same results in an identical product purity. Proceeding from **D1**, if they were seeking to raise the product gas purity to 98.5%, a person skilled in the art would have varied the selectivity and not, for example, the recycling rate and the membrane capacities while keeping the selectivity the same, as the respondent

⁶⁵ cf. notice of opposition of 4 February 2022, page 9, last paragraph.

has asserted is obvious and as it has carried out in its simulations **D2**, **D2a**, and **D20** on the basis of hindsight reasoning. The fact that higher product purities are achieved and the total membrane area can also be reduced by a suitable combination of the parameters **F12**, **F13**, and **F14**, even with the selectivity remaining unchanged (cf. **ES1**, submitted before the department of first instance, variations 1 and 2 in comparison with **D1**, Fig. 7a), is not rendered obvious by **D1**. Only a neutral consideration of ascertained operating states is correct; in this respect, the contested patent convincingly demonstrates that features **F12**, **F13**, and **F14** correspond to high product purities and low total membrane areas when said features are all fulfilled at the same time.

In the following, we will demonstrate (i) that **D2** as a whole is irrelevant to the examination of inventive step of the subject matter of claim 1 of the contested patent and (ii) that assumptions and assertions made by the opponent on the basis of **D2** are incorrect.

D2 allegedly relates to comparative tests (more specifically, comparative simulations) based on Fig. 7a of **D1**.⁶⁶ In its submission of 13 April 2023, page 13, paragraph 2, the respondent itself admitted that **D2** was not a correct reproduction of **D1** and therefore did not meet the requirements of the established Case Law of the Boards of Appeal. **D2** therefore does not have any reliability and relevance for the assessment of inventive step. The respondent attempts to correct its errors with and in **D2a**; however, **D2a** was filed late. We request that **D2a** not be admitted into the proceedings. As the respondent itself admitted, its work in **D2** was flawed; however, it would have been able to submit **D2a** without any difficulty or any mistakes on its part within the time limit for filing an opposition. Imprecise, flawed work (in **D2**) for which the respondent is responsible is not a reason to justify and allow its late submission in the proceedings. In the following, we will nevertheless provide comments on **D2a** in case this document is yet admitted into the proceedings.

According to the established Case Law of the Boards of Appeal,

“the assessment of inventive step is to be made at the effective date of the patent on the basis of the information in the patent together with the common general knowledge then available to the skilled person” (T1329/04, T 1545/08, T1433/14, T 488/16, T1322/17).⁶⁷

The fact that, on the priority date, it would have seemed unreasonable to a person skilled in the art to seek a higher purity of the CH₄ product stream by varying parameters **F12**, **F13**, and **F14** (as the opponent does in **D2a**) is clear just from the fact that **D1** itself, when achieving a high product purity, identifies a particular challenge in that it states that

“the required product purity has to be chosen carefully, since it has a tremendous impact on the

⁶⁶ cf. notice of opposition of 4 February 2022, page 2, penultimate paragraph and page 9, paragraph 1 to page 10, paragraph 2.

⁶⁷ cf. Case Law of the Boards of Appeal of the EPO, 10th edition, point I.D.4., point 4.3.2, page 237, paragraph 5.

*process performance and only the required natural gas standard should be met.*⁶⁸

D1 does not provide a reasonable expectation of success for solving the stated problem according to the contested patent and does not render this obvious either, but instead explicitly even provides teaching leading away from this.

According to the Case Law of the Boards of Appeal,

*“an interpretation of the prior art documents as influenced by the problem solved by the invention, where the problem was neither mentioned or even suggested in those documents, must be avoided, such an approach being merely the result of an a posteriori analysis” (T 5/81, OJ 1982, 249; T 63/97; T 170/97; T 414/98).*⁶⁹

Furthermore, Fig. 11 of **D1** teaches that a purity of the CH₄ product stream of > 96% can only be achieved by drastically increasing the selectivity of the membranes used (selectivity of > 120).⁷⁰ The results of the comparative simulation according to **D2a**, however, exhibit a selectivity of just 20 and a purity of the CH₄ product stream of 98%, and are therefore contradictory to **D1**. This also illustrates that the operating state according to **D2a** could not (and even less so in an obvious manner) result from the disclosure of **D1** on the priority date of the contested patent. This is because, according to the established Case Law of the Boards of Appeal,

*“The problem and solution approach precluded any analysis according to which the skilled person would have modified the closest prior art in a manner contrary to its very purpose. In other words, a finding that a claimed invention deviated from what was, in light of the aim pursued, the essence of a prior-art disclosure was enough by itself to conclude that it was inventive over that prior art” (see also T 2057/12).*⁷¹

In its argument based on **D2a**, the opponent is therefore clearly drawing upon impermissible hindsight reasoning within the meaning of the Case Law of the Boards of Appeal.

D2 and **D2a** are accordingly entirely irrelevant to the assessment of inventive step of the subject matter of claim 1 of the contested patent.

⁶⁸ cf. D1: page 7, right-hand column, paragraph 2.

⁶⁹ cf. Case Law of the Boards of Appeal of the EPO, 10th edition, point I.D.6., point 4.3.2, page 249, paragraph 3.

⁷⁰ cf. D1: page 9, Fig. 11 and page 9, left-hand column, paragraph 1 and right-hand column, paragraph 3.

⁷¹ cf. Case Law of the Boards of Appeal of the EPO, 10th edition, point I.D.6., page 249, last paragraph to page 250, paragraph 1.

2.2.6.3 The invention according to the contested patent also solves the objective technical problems in comparison with Fig. 7a of D1

Under point 7.4.4 of the preliminary and non-binding evaluation according to the summons to oral proceedings of 19 December 2022, the opposition division posed the question of

„whether the subject-matter of claim 1 contributes to reducing the total membrane capacity and obtain high purity in retentate and permeated simultaneously, as stated in §[0011], only at the working conditions of D6 or if it is also possible to reach the same results when the system works at much higher throughputs than the system of D6, for example at the throughput working range of D1. In particular, do the working conditions of D1 allow the recycling rate (feature F12) to be adjusted independently?“

This question is to be answered in the affirmative.

Specifically, the patent proprietor first carried out its own, correct reproduction of Fig. 7a of **D1** by Mr. Markus Priske, the inventor of the invention according to the contested patent, in order to facilitate a correct and direct comparison with Fig. 7a of **D1**.⁷² On the basis of this correct reproduction of Fig. 7a of **D1**, Mr. Priske simulated two further operating states, “variation 1” and “variation 2”. In relation to each of the technical effects achieved, we make reference to our above comments under point 3.2.4.1. Both of said operating states, “variation 1” and “variation 2”, are based on Fig. 7a of **D1** and have a throughput that is identical to Fig. 7a of **D1** and is higher in comparison with **D6** (“much higher throughput”⁷³). In this respect, we make reference to Mr. Priske’s comments according to **ES1**, submitted before the department of first instance, and in particular to the information in the associated appendix and to the comments by Prof. Wessling (co-author of **D1**) according to **ES2** (cf. in particular the response to question 6 therein).

Overall, the simulation results from Mr. Markus Priske demonstrate that the invention according to the contested patent also solves the objective technical problems in comparison with Fig. 7a of **D1**.

2.2.6.4 As an auxiliary measure: proceeding from the technical effect according to the opposition division’s decision

2.2.6.4.1 Formulation of the objective technical problem to be solved

As already set out above, in its decision of 18 January 2024 relating to the technical effect resulting from distinguishing feature **F12**, the opposition division states that all the simulation results submitted

⁷² cf. ES1: operating state “validation simulation”.

⁷³ cf. preliminary evaluation by the opposition division according to point 7.4.4, page 8, paragraph 1 of the summons to oral proceedings of 19 December 2022.

by both parties allegedly demonstrate that a technical effect can only be attributed to a dynamic interaction of features **F12** to **F14**, for which the subject matter of the granted claim 1 of the contested patent does not contain sufficient information.⁷⁴

In the opposition division's view, the objective technical problem can therefore only consist in providing an alternative to the method according to Fig. 7a of **D1**.

We have already demonstrated in detail above that this evaluation is incorrect.

Merely as an auxiliary measure and out of an abundance of caution, in the following we will apply the "could/would approach" of the problem-solution approach of the EPO proceeding from the objective technical problem (providing an alternative) that has been incorrectly formulated by the opposition division in order to demonstrate that the opposition division has taken an incorrect approach also and even when assessing the obviousness ("Obviousness"; point 4.3 of the decision of 18 January 2024) of the invention according to the contested patent proceeding from Fig. 7a of **D1** as the closest prior art.

2.2.6.4.2 "Could/would approach" (Guidelines G VII, 5.3)

In relation to the obviousness of distinguishing feature **F12** proceeding from Fig. 7a of **D1** as the closest prior art, in its decision of 18 January 2024 (page 11, point 4.3.2) the opposition division makes reference to two passages of **D1**. Solely on the basis of these two passages, the opposition division justifies its decision that the subject matter of the granted claim 1 of the contested patent is obvious from **D1** proceeding from Fig. 7a. In fact, however, neither of these passages of **D1** has the meaning that opposition division incorrectly attributes to it:

The opposition division first makes reference to the comments on page 6, left-hand column, fourth paragraph of **D1**, which in particular reads

*"However, the high recovery can only be obtained on cost of an increased recycle flow rate"*⁷⁵

However, here the opposition division overlooks the fact that the above-cited passage in **D1** immediately continues as follows:

*"The recycle flow rate (9,024 mol/h) is even higher than the raw gas flow rate (6,692 mol/h)."'*⁷⁶

This passage of **D1** cited by the opposition division is therefore clearly a more detailed explanation of Fig. 7b of **D1** and clearly does not render a recycling rate in the range of feature **F12** ("60 to 100 % by

⁷⁴ cf. decision of 18 January 2024, page 10, first paragraph.

⁷⁵ cf. decision of 18 January 2024, page 11, point 4.3.2, second paragraph.

⁷⁶ cf. **D1**: page 6, left-hand column, fourth paragraph (emphasis added).

volume of the crude gas stream”) of the granted claim 1 of the contested patent obvious, but instead discloses a recycling rate which is greater than 100% and therefore is clearly outside the range according to the contested patent as per feature **F12**. As already explained above under point 2.2.6.1.2, in relation to the recycling rate as per feature **F14**, **D1** merely discloses values which are clearly below or clearly above the range according to the contested patent as per feature **F14**. In this respect, the opposition division ignores the fact that, in addition to the higher recycling rate according to the operating state in Fig. 7b (in comparison with the operating state in Fig. 7a), the quotient of the pressure ratio of separation stages 3 and 1 is also outside the range of the contested patent as defined in feature **F14**.

When correctly analyzed together with the information in Fig. 7 of **D1** (instead of in an analysis incorrectly separated from the overall context, as performed by the opposition division), the passage of **D1** cited by the opposition division thus provides the teaching that not only feature **F12**, but also feature **F14**, has a different value from that indicated in claim 1 of the contested patent. This passage thus provides teaching leading away from claim 1 of the contested patent.

In addition, in its decision the opposition division makes reference to the third sentence under point 3.3.2 of **D1**, which reads as follows:

“Increasing the CH₄ level in the product gas results in increased permeation of CH₄ in the first gas permeation stage which increases the recycle flow rate”.

In this case too, the opposition division overlooks a crucial aspect: The above-cited technical teaching of **D1** relates directly and unambiguously to methods having just two separation stages, while the subject matter of the granted claim 1 relates directly to methods having three separation stages (cf. feature **F11**: “[...] feed stream separation stage (1), the retentate separation stage (2) and the permeate separation stage (3) [...]”).

The above-cited passage of **D1** is found under point 3.3.2 of **D1** and relates to Fig. 11 of **D1**⁷⁷. Fig. 11 of **D1** again

“shows the optimal CO₂/CH₄ selectivity as a function of the required CH₄ mole fraction in the product gas for a CH₄ feed mole fraction of 0.6 for the case in which only a single selectivity is optimized for all membrane stages.”⁷⁸

All the comments under points 3.3 ff. of **D1** relate to two method configurations that are to be compared with one another, which differ in that

⁷⁷ cf. D1: page 7, left-hand column, point 3.3.2, first sentence.

⁷⁸ cf. D1: page 7, left-hand column, point 3.3.2, first sentence (emphasis added).

“[i]n the first case a single selectivity is determined for all membrane stages while in the second case an optimal selectivity is calculated for each individual membrane stage.”⁷⁹

These two method configurations that are to be compared with one another are again shown in Fig. 8a and 8b of **D1**:

“Fig. 8(a) shows the optimal process flowsheet for the first case in which only a single selectivity is applied to all membrane stages”⁸⁰.

“Fig. 8(b) illustrates the process layout for the process optimization in which the membrane properties for each stage are determined individually.”⁸¹.

The method configurations according to Fig. 8a and 8b of **D1** each include just two separation stages and thus fundamentally differ from the method according to the contested patent as per the granted claim 1 of the contested patent, which comprises three separation stages (cf., for example, feature **F11**).

In this respect, it is clear to a person skilled in the art that statements which relate to methods having two separation stages cannot be applied to methods having three separation stages readily and across the board.

The opposition division’s evaluation that **D1**, proceeding from the three-stage separation method according to Fig. 7a of **D1** as the closest prior art, teaches that

“more purity is achieved by an increment in the recycle flow rate”⁸²

is therefore clearly incorrect. In this respect, the opposition division has failed to consider the passages of **D1** that it has cited and that support its decision in the correct technical context.

By contrast, the opposition division has overlooked an entirely essential aspect.

The passage cited by the opposition division

“Increasing the CH₄ level in the product gas results in increased permeation of CH₄ in the first gas permeation stage which increases the recycle flow rate”.

relates to changing the selectivity of the membranes in the first separation stage in a two-stage process, in which the retentate stream from the first separation stage is not separated any further and there is

⁷⁹ cf. **D1**: page 6, right-hand column, point 3.3, first paragraph (emphasis added).

⁸⁰ cf. **D1**: page 6, right-hand column, point 3.3, second paragraph (emphasis added).

⁸¹ cf. **D1**: page 6, right-hand column, point 3.3, third paragraph (emphasis added).

⁸² cf. decision of 18 January 2024, page 11, point 4.3.2, fourth paragraph.

no second recycling stream.

In the method according to the invention, however, there are two recycling streams, as shown in Fig. 7a and 7b of **D1**. The recycling stream is composed of the permeate stream (9) from the second separation stage and the retentate stream (10) from the third separation stage. The recycling rate is regulated in such a three-stage circuit by the second and the third separation stage, and not by the first.

The passage cited by the opposition division states that an increase in the CH₄ purity in the product stream leads to higher gas permeation through the first membrane separation stage. In other words: The volume flow rate of the permeate stream from the first separation stage increases. It is clear when comparing Fig. 7a and 7b of **D1** what the effects are of an increase in the volume flow rate of the permeate stream from the first separation stage in a three-stage circuit according to **D1**. In Fig. 7a, the volume flow rate of the permeate stream from the first separation stage is 3572 mol/h and is thus higher than in Fig. 7b, in which it is only 3063 mol/h. Nevertheless, the recycling rate in Fig. 7a, at 52%, is much lower than in Fig. 7b, at 129%. This is contradictory to the conclusions drawn by the opposition division and demonstrates that the decision under appeal is incorrect. In Fig. 7, **D1** teaches that an increase in the selectivity resulting in an increase in the volume flow rate of the permeate stream from the first separation stage leads to a reduction in the recycling rate in a three-stage circuit (as according to the contested patent); this provides teaching leading away from the subject matter of claim 1 of the contested patent and does not render it obvious.

As a result, **D1** (in isolation or in combination with another prior-art document) therefore does not render the subject matter of the granted claim 1 of the contested patent itself obvious if the objective technical problem to be solved is merely considered that of providing an alternative to the method according to Fig. 7a of **D1**.

The subject matter of the granted claim 1 of the contested patent therefore clearly involves an inventive step pursuant to Article 56 EPC.

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