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Datasheet for the decision of 3 February 2023

Case Number: T 0761/17 - 3.2.04

Application Number: 10173289.9

Publication Number: 2290236

IPC: F03D11/00, F03D7/02, F03D9/02

Language of the proceedings: EN

Title of invention:
Method and system for extracting inertial energy from a wind turbine

Patent Proprietor:
General Electric Company

Opponents:
Vestas Wind Systems A/S
Nordex Energy GmbH
Senvion GmbH

Headword:

Relevant legal provisions:
EPC Art. 100(c), 123(2), 54(2)
RPBA 2020 Art. 12(3)

Keyword:
Amendments - allowable (no)
Novelty - (no)
Statement of grounds of appeal - party's complete appeal case

Decisions cited:

Catchword:

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Beschwerdekammern

Boards of Appeal

Chambres de recours

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Case Number: T 0761/17 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 3 February 2023

Appellant: (Patent Proprietor)	General Electric Company 1 River Road Schenectady, NY 12345 (US)
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Party as of right: (Opponent 1)	Vestas Wind Systems A/S Hedeager 44 8200 Aarhus N (DK)
Representative:	Grünecker Patent- und Rechtsanwälte PartG mbB Leopoldstraße 4 80802 München (DE)

Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted on 27 February 2017 concerning maintenance of the European Patent No. 2290236 in amended form.**

Composition of the Board:

Chairman A. de Vries
Members: S. Oechsner de Coninck
T. Bokor

Summary of Facts and Submissions

I. The opponents 2 and 3 and the proprietor each appeal against the decision of the opposition division concerning maintenance of the European Patent No. 2290236 in amended form.

II. The opposition was based on the grounds of Articles 100(b) and c) EPC and Art 100(a) EPC in combination with lack of novelty and inventive step. In its written decision the Opposition Division held that the patent as amended according to auxiliary request 2 complied with the requirements of the EPC, having regard in particular to the following documents that also played a role in the present proceedings:

D3: DE 10 2006 054 768 A1

D27: El Mokadem et al.: "Experimental Study of Wind Generator Participation to Primary Frequency Control", 2007 International Aegan Conference on Electrical Machines and Power Electronics, 10.-12. September 2007, Bodrum, Türkiye.

III. In a communication dated 30 January 2020 in preparation for proceedings the Board gave a provisional opinion of the relevant issues.

Oral proceedings were held on 3 February 2023 in the presence of all parties.

IV. The appellant proprietor requests that the decision under appeal be set aside and the patent be maintained as granted (main request). Auxiliarily, they request to maintain the patent in an amended form on the basis of

one of the auxiliary requests 1 to 7, where auxiliary request 1 was filed with the grounds of appeal dated 7 July 2017, and auxiliary requests 2 to 7 were filed with the response to the opponents' grounds of appeal dated 23 November 2017, auxiliary request 2 corresponding to the upheld version.

V. The appellant opponents 2 and 3 request that the decision under appeal be set aside and the patent be revoked.

VI. The opponent 1, party as of right, requests the dismissal of the appeal of the proprietor.

VII. The wording of the independent claim 1 of the different requests reads as follows:

Main request (as granted; features notation from the impugned decision added in parentheses by the Board)

"A system for operating a wind turbine (10) during a curtailment operation (**feature 1.1**),
the wind turbine comprising a generator (26) and a wind turbine rotor (14) having at least one rotor blade (24), the wind turbine also comprising a drive train (40) that includes at least one shaft (28) coupled to the wind turbine rotor and configured to drive the generator, said system (10) (**feature 1.2**) comprising:

a control system (36) configured to increase a speed of rotation of the wind turbine rotor (14) beyond an optimum rated speed for the wind turbine (10) (**feature** 1.3)

determined from a torque-power curve (80) thereof (**feature 1.4**)

but not higher than a preset rated rotor speed during the curtailment operation of the wind turbine (**feature 1.5**),

thereby storing in the rotating drive train aerodynamic energy which would otherwise have been wasted due to the curtailment (**feature 1.6**),

said control system (36) being further configured to reduce a torque demand on the generator (26) such that the power generated (84) remains at or below a predetermined curtailment level (90) during said curtailment operation (**feature 1.7**); and

a frequency converter (44) configured to control excitation of the generator (26) to increase the torque demand on the generator (26) upon release of the curtailment operation so as to extract inertial energy stored in the drive train (40) upon release of the curtailment operation(**feature 1.8**)."

Auxiliary request 1

Claim 1 adds to granted claim 1 the following expression as its last feature:
",wherein said control system (36) is configured to allow the rotor speed to increase to the rated maximum rotor speed."

Auxiliary request 2

Vis-a-vis granted claim 1 this claim changes the term "preset rated rotor speed" to "preset rated *maximum*

rotor speed" (emphasis added to indicate amendment) and adds the following expression as its last feature: "wherein the control system (36) is further configured to automatically generate a signal indicating a desire for more output power upon the reduction of power generated (84) to below curtailment level (90)."

Auxiliary request 3

Claim 1 adds to claim 1 of auxiliary request 1 the following expression as its penultimate feature: "wherein the control system (36) is further configured to automatically generate a signal indicating a desire for more output power upon the reduction of power generated (84) to below curtailment level (90)."

Auxiliary request 4

Vis-a-vis claim 1 as granted claim 1 changes the term "preset rated rotor speed" to "preset rated *maximum* rotor speed" (emphasis added to indicate amendment) and adds the following final feature :
"wherein the control system (36) is further configured to automatically provide the frequency converter with an increased torque demand value upon the reduction of power generated (84) to below curtailment level (90)."

Auxiliary request 5

Vis-a-vis claim 1 as granted claim 1 adds the following final features :
""wherein the control system (36) is further configured to automatically provide the frequency converter with an increased torque demand value upon the reduction of power generated (84) to below curtailment level (90), wherein said control system (36) is configured to allow the rotor speed to increase to the rated maximum rotor speed."

Auxiliary request 6
Claim 1 adds to claim 1 according to auxiliary request 4 the following expression as its last feature:
"wherein curtailment follows a curtailment schedule."

Auxiliary request 7
Claim 1 adds to claim 1 of auxiliary request 5 the following final feature:
",wherein said control system (36) is configured to allow the rotor speed to increase to the rated maximum rotor speed."

VIII. The appellant-proprietor argued as follows:
- Omitting the feature "maximum" in relation to the preset rotor speed in claim 1 according to the main request and auxiliary requests 1, 3, 5 and 7 does not result in an unallowable extension of the subject-matter that goes beyond the content of the application as filed.
- The subject-matter of claim 1 according to the auxiliary requests 2 and 4 is novel over either D3 or D27.
- Auxiliary request 6 should be admitted.

IX. The appellant-opponents 2 and 3 and respondent opponent 1 argued as follows:
- The omission of the feature "maximum" from the feature "preset rated maximum rotor speed" in claim 1 according to the main request and auxiliary requests 1, 3, 5 and 7 results in an unallowable extension of its subject-matter.
- The subject-matter of claim 1 according to the auxiliary requests 2 and 4 lacks novelty over either D3 or D27.
- Auxiliary request 6 should not be admitted.

Reasons for the Decision

1. The appeals are admissible.

2. Added subject-matter - main and auxiliary requests 1, 3, 5 and 7

2.1 Main request

2.1.1 In its communication in preparation for the oral proceedings, section 3.1, the Board stated:

"*Granted claim 1 adds to claim 1 as originally filed the features derived from but not identical in wording to the dependent claims 3,4,5 and 6. These concern the frequency converter to control excitation of the generator (claim 3); the storage of inertial energy expressed in a more specific way than claim 4 derived from paragraph 21; the determination of the optimal rated speed from a torque-power curve (claim 5); and a preset upper speed not to be exceeded (claim 6). It may need to be debated whether the change in wording introduces subject-matter extending beyond the content of the application as filed (Art 100c) & 123(2) EPC).*

As in the decision under appeal, the question whether or not the application as filed disclosed a preset rated rotor speed defined in claim 1 as upper limit for storing inertial energy appears particularly critical for the main and auxiliary request 1, in the Board's view. Paragraph 21, lines 45 to 48 of the published application contains the explanation that the rotor speed may increase above the optimum rated speed for the torque-power curve, but does not increase beyond a "preset rated maximum rotor speed". The question arises

whether the skilled person interprets this "preset rated maximum rotor speed" to be the same as the "preset rated rotor speed" of claim 1. In the Board's view the further indication in lines 48 to 51 of paragraph 21 that the preset rated maximum rotor speed prevents or minimizes damage to the wind turbine due to an overspeed condition, indicates that the preset rated maximum speed is to be understood specifically as the rated maximum operating speed as a design operating limit, more related to the structural load limit than to the performance optimum. The "preset rated rotor speed" now defined in claim 1 appears broader than this specific disclosure and therefore appears to result in an unallowable generalization."

2.1.2 The appellant proprietor refrained from comment on this opinion of the Board either in writing or at the oral proceedings. Absent any further comment the Board sees no reason to change its provisional view regarding granted claim 1. It therefore concludes that the replacement of the original term "rated maximum rotor speed" by "preset rated rotor speed" results in an unallowable generalization.

2.2 Claim 1 according to auxiliary request 1 adds to granted claim 1 the features of granted claim 2 according to which the control system is further configured to allow the rotor speed to increase to the rated maximum rotor speed.

2.2.1 The appellant proprietor submits that the addition of the further features of claim 2 overcomes the above mentioned generalisation, because the rotor is allowed to increase its speed to the same upper limit.

2.2.2 The Board sees this differently. Although the added feature does indeed include the term " rated maximum rotor speed" disclosed in paragraph 021, it neither clarifies the preceding requirement relating to the preset rated rotor speed nor does it limit it to a rated maximum rotor speed during curtailment, as argued by the appellant proprietor. As already held above the two terms do not denote the same value or parameter. Taken together the two requirements (that of granted claim 1 - features 1.3 to 1.5 in the notation of the decision under appeal -, and that added, see point 2.2) can then be read as requiring that rotor speed may be increased up to a preset rated rotor speed, which is above the optimum rated rotor speed but never above the maximum allowable rated speed. At best therefore it sets an upper limit on the preset rated rotor speed limit. It can certainly not be read as negating the first requirement, that is allowing rotor speed to increase beyond the preset value up to the maximum value. The operation of the control up to any unspecified preset rotor speed is therefore still present unchanged in claim 1, and the Board's conclusion for granted claim 1 still applies.

2.3 Thus the Board confirms the decision's finding that the amendments to claim 1 of the main request extend the subject-matter beyond the content of the application as filed, Article 100(c) EPC, and also finds that the amendments to claim 1 according to auxiliary request 1 extend the subject-matter beyond the content of the application as filed, Article 123(2) EPC.

2.4 The same conclusion holds for claim 1 according to auxiliary requests 3, 5 and 7 because they also retain the undisclosed upper limit for a rotor speed not higher than a preset rotor speed during curtailment.

3. *Auxiliary request 2 - Novelty with respect to D3*

3.1 Claim 1 of auxiliary request 2 now specifies that the upper limit during curtailment is the preset maximum rated rotor speed, while now also requiring (final feature) that the control system automatically generates a signal for more output power when the power generated drops below to below curtailment level (90).

3.2 D3 describes a method for operating a wind turbine in a mode of limited power production ("leistungsbegrenzten Betriebsmodus" or similar, see Abstract and paragraph 0002), corresponding to curtailed operation in the sense of claim 1 (where *curtailing* is understood in the sense of "action of curtailing, shortening, diminishing", see OED). **Features 1.1** and **1.2** in the notation of the decision under appeal, are undoubtedly disclosed.

The sole figure of D3 shows characteristic curves that set out generator torque against generator rotational speed in a generator driven by the wind turbine and which curves are used for its control, paragraph 012. Thus all curve segments belong to a control logic of the control system adapted to operate the wind turbine to achieve a given torque for the electric generator at a corresponding rotational speed of the generator, paragraph 012, first sentence. The rotation speed of the generator (n_{getr}) is directly related to the speed of the rotor by the gear ratio ($ü_{getr)}$. The wind turbine operates with variable rotational speeds under the control of its control system ("Steuereinheit") which implements the control logic along the characteristic curves depicted in the figure by controlling generator electric torque ("Generatormoment" 10, paragraph 012)

as well as pitching of the blades ("Rotorblatt-winkelsteuerung", paragraph 009). The generation of the variable generator torque is not disclosed in further detail, but it is common ground that wind turbines are equipped with a frequency converter for ultimately transforming the electric current generated at a variable frequency due to variable wind speeds to an alternating current matching the frequency of the grid. The frequency converter is then used by the control system of the wind turbine to generate the required excitation of the generator to achieve a required torque demand.

3.3 D3 in paragraph 006 describes how, during curtailment torque is reduced once a limit torque ("Grenzmoment") is reached, which is associated with a limit rotational speed ("Grenzdrehzahl"). This is detailed further in paragraphs 014 and 015, which describe control along curve segment 20 from the operating point 21 defined by the limit torque M_{Soll} and corresponding limit speed n_{Gr}. Operation point 21 is located on the standard operating curve 18 which in non-curtailed operation would extend up to rated or nominal maximum torque M_n at rated rotational speed n_n.

As it lies on segment 18 in the characteristic field the limit rotational speed n_{Gr} is seen to correspond (via the gear ratio $ü_{getr}$) to an optimum rated rotor speed determined from the torque power curve 18 of the wind turbine. This value corresponds to the optimum rated speed defined in claim 1 beyond which the wind turbine rotor speed should be increased.

3.3.1 The appellant proprietor submits that controlled operation during that reduced operation should be read in connection with paragraph 009. From this paragraph

it would be derivable that instead of controlling the generator moment, the control system of D3 rather controls pitching of the turbine blades to increase speed from point 21 along the characteristic segment 20.

3.3.2 The Board rather concurs with the opposing view of the the appellant opponents and the respondent opponent. Not only must rotation speed be increased, for example by blade pitching as described in paragraph 009, at the same time generator torque must be reduced to ensure that the turbine follows the characteristic curve 20. As stated this is such that torque is reduced linearly until the maximum rotational speed is reached ("bis zu einem Maximalwert für die Drehzahl das Drehmoment linear abnimmt"). This increase of rotation speed is in particular possible as a result of increased wind speed, power capture being curtailed by operation along segment 20. When wind speed remains constant above operation point 21, the operation point remains on the segment 20 at a speed between n_{Gr} and n_{max} and a corresponding torque below M_{soll}, thereby keeping curtailed power. In any case blade pitching as described in D3, paragraph 009, to realize curve segment 20, is seen to be the same as the pitch control described by the patent itself in column 5, lines 19 to 25, to the same end. The important point is that in any given state of the turbine, the output power is determined by the rotational speed and the generator torque. It does not matter if this is achieved with or without pitching, both must be controlled at all times. This is because the output power of the turbine cannot be left uncontrolled any time, as it is the very purpose of operating in accordance with the control curves.

3.3.3 The Board concludes that **features 1.3 and 1.4** are also disclosed in D3.

3.4 As detailed in paragraph 015 of D3 during curtailment along the curve 20 generator torque (or torque demand on the generator in the wording of the claim) is reduced, while the rotational speed increases up to a rated maximum speed n_{max}. This rated maximum rotational speed corresponds (via the gear ratio) to the maximum rated rotor speed, **feature 1.5** (as amended in claim 1 of auxiliary request 2).

3.5 As indicated in paragraph 015, when operating along the curve segment 20, i.e. during curtailment, power remains at the predetermined reduced power level corresponding to limit torque M_{soll} ("so daß die dem Drehmoment M_{soll} entsprechende Leistungsvorgabe für die verminderte Leistung eingehalten wird") that is at a predetermined curtailment level in the wording of claim 1, **feature 1.7.**

3.6 D3 does not expressly state that during curtailment along curve segment 20 kinetic energy is stored. However, just as in claim 1, feature 1.6 ("thereby ...."), this is the result of allowing rotational and thus rotor speed to increase. Thus, from straightforward physics, as rotor speed increases, so does its kinetic energy and that of the drive train connected to it. This energy, which would be wasted in a curtailment under constant generator torque and rotor speed, is now effectively stored in the whole drive train comprised of rotor, shaft, gear box and generator, **feature 1.6.**

Thus D3 discloses a control system configured to increase a speed of rotation of the wind turbine rotor

as defined in claim 1. As stated it also implicitly comprises a frequency converter configured to control excitation of the generator as a necessary component of a variable speed turbine, required to control the generator torque demand.

3.7 **Feature 1.8** refers to excitation control of the generator "*upon release of curtailment ... so as to extract inertial energy*". Curtailment is thus released when the stored kinetic energy is recovered. In the patent, see figure 4 and paragraph 0024, this is at time 96, when recovery of stored energy, represented by the hatched area 100, begins. From time 96 onwards power is generated at a higher level 98 than normal; initially at curtailment level (which is still higher than normal) but then (time 104) dropping rapidly back to normal.

This corresponds to the situation in D3, described by curve segments 20 and 22. When wind speed again decreases operation is constrained by the control to follow the same segment 20 in reverse direction back to operation point 21 at M_{Soll} and n_{gr}. As the control adjusts rotational speed and generator torque in the reverse direction, energy stored as kinetic energy is recovered in order to maintain power output at curtailment level as long as possible. This is so because (for rapid wind speed changes) system inertia causes the decrease in rotational speed to lag behind the decrease in wind speed; indeed it is the inertia that allows kinetic energy to be stored at all. In reverse direction generator torque is controlled (by the implicit frequency converter controlling generator excitation) to increase. Segment 20 indeed must provide a practicable solution for essentially all wind conditions, i.e. also in the situation when the wind

stops completely (and very quickly). In such a situation the turbine has no power input, so it can only stay on the segment 20 by having an energy reserve somewhere to return to point 21. The only viable source of this energy reserve is the mechanical rotational energy of the system.

Contrary to the appellant proprietor's argument that D3 would not disclose what happens in the reverse direction, the very purpose of the characteristic curves as shown in the figure of D3 is to prescribe the control of the wind turbine in all conditions, no matter how the rotational speed might have to change as a result of changing wind speed. Control is in such a way that the characteristic curve is followed. There is certainly no hint in D3 whatsoever that in usual operation conditions the whole curve or only curve segment 21 would have to be abandoned when the wind speed again begins to drop.

Thus **feature 1.8** is also disclosed in D3.

3.8 As to the **final feature** of *"a signal indicating a desire for more output power"* that the control generates "*upon the reduction of power generated to below curtailment level*" this is seen to be implied by operation of the turbine in D3 beyond operation point 21 along curve segment 22. Rather than returning to normal operation along curve segment 18, generator torque is maintained at the level M_{soll} while rotational speed continues to drop. Given that power is the product of torque and rotational speed this can only mean that compared to operation along curve 18 more power is being produced. To follow curve segment 22 the control system generates corresponding signals. These commence at operation point 21 where power again drops

below curtailment level. Thus as the operation system passes operation point 21 to follow curve segment 22, that is when power drops below curtailment level, the system signals that more power is to be produced. That is so because the designer of the system decided there was a need for more power compared to standard operation. The respective control signals can be seen to indicate that desire for more power. Thus the final feature added to claim 1 in auxiliary request 2 is also seen to be disclosed in D3.

3.9 In the light of the above the Board concludes that D3 discloses all features of claim 1 of auxiliary request 2. The subject-matter of that claim therefore lacks novelty, Art 52(1) with Art 54 EPC.

4. Auxiliary Request 2 : Novelty with respect to D27

4.1 Independently of the above conclusion with respect to D3, the Board also concurs with the appellant opponents 2 and 3 and the respondent that the disclosure of D27 is novelty destroying for the subject-matter of claim 1. D27 is an experimental study concerning wind turbine participation in primary frequency control. D27, see abstract and page 1, right hand column, 1st paragraph, expressly uses blade and machine inertia to store kinetic energy as a power reserve. This power reserve serves as a means to control frequency of the generator to maintain grid stability.

4.2 In operation power is limited to a power reference value lower than the rated power $P_{ref} = \tau * P_n$, $\tau<1$,equation (9). As shown in Figure 5, which depicts the power versus turbine rotational speed, power is limited to the constant value τP_n above a rotational speed Ω_1 shown in red for higher speeds of the turbine

at the lower, curtailed power level. This speed is located on the dotted curve corresponding to operation points of maximum power efficiency, which is the rated characteristic curve for normal, non curtailed operation, see also the paragraph bridging pages 2 and 3. This operation where the turbine extracts a lower level of power than what is normally extracted at higher speeds corresponds to a curtailed operation in the sense of the patent, so that D27 is seen to disclose **features 1.1 and 1.2** (again using the notation in the decision under appeal).

4.3 As is apparent from Figure 5, the turbine operates beyond Ω_1 at higher rotational speeds, as the result of increased wind speed, with power kept constant at the power level $P_n=P_{ref}$. This is analogous to conventional control shown as dotted curve P_{MDP} in Figure 5 with cutoff at the higher, constant level of rated power P_n that is achieved first at an increased rotational speed Ω_2. Contrary to the appellant proprietor's view, the Board understands the curve (shown in red) beyond rated speed Ω_1 to show actual operational states at curtailed power τP_n for a range of speeds beyond rated speed up to a cut off, which the skilled person understands to be at or below maximum rated rotor speed, where it is no longer safe to operate the turbine, **feature 1.3** and **feature 1.5**.

4.4 As is evident from Figure 5 and the corresponding passage at the bottom of the left hand column on page 3, by controlling the turbine to generate power at a reduced level, the power reserve is created. This reserve is an actual reserve of available power, not a buffer of "potential" power that could be reaped from the wind, when needed, say when demand is high, as argued by the appellant proprietor. The abstract and

the 1st complete paragraph of the right hand column on page 1 of D27 state clearly that "the approach allows kinetic energy in the blade inertia to contribute to the power reserve". It also stands to reason that it cannot be reserve of potential power held in the wind, because how wind speed develops is largely unforeseeable and a higher wind speed (to be able to operate at rotor speed above Ω_1) may not be available when demand is high. Finally, that the power reserve is stored as actual kinetic energy of blades and generator is confirmed by figure 14(a) to (c) and the corresponding text on page 5, left hand column, 3rd complete paragraph. The Board concludes that the increase in rotor speed beyond Ω_1 is stored as kinetic energy in the blade and machine inertia, **feature 1.6.**

4.5 To keep generated electric power constant despite higher speed during curtailment as shown in Figure 5 the torque demand must be reduced accordingly, as follows from the relationship Power=Torque*Speed. To this end, see figure 6, the control system applies a torque demand or torque reference value T_{ref} as control parameter to the control of the generator of the permanent magnet synchronous type (PMSG) which sends required signals to the frequency converter "Conv 1" acting on the stator coils of the generator PMSG. Thus, whenever the control sends a certain torque demand it operates in the same way to use the frequency converter to control generator excitation as required by claim 1. It follows that D27 also discloses **feature 1.7.**

Thus the Board furthermore finds that the optimum rated speed for the wind turbine Ω_1 is also derivable and thus determined from a torque-power curve. Indeed operation at maximum power efficiency plotted on a power-speed curve up until $\tau P_n, \Omega_1$ corresponds to an

optimum rated speed determined from a torque power curve by the relationship P=T*Ω in the sense of claim 1, **feature 1.4.**

4.6 The Board further shares the appellant opponent's view that the decrease of frequency below the grid frequency f_0 triggers the control system to release curtailment and increase power (e.g. along the idealised frequency-power characteristic of figure 4, also called "droop line"). This is evidenced in figure 11 to 13 on page 5 of D27 which shows the results of simulations modelling operation of the power reserve (figure 13(a)) under simulated frequency variation (figure 13(b)) and wind conditions (figure 11(a)). Figures 11(b) and 12(a) show the power generated in normal MDP and power reserve mode respectively under the wind conditions of figure 11(a) but without grid frequency variation, with figure 12(b) showing the power reserve, which exists only when maximum (MDP) power is greater than reference power, page 5, left hand column, 1st complete paragraph. In figure 13(a) at about 20s where a first frequency drop is experienced, extra power shown below the red line of curtailment, at about -1750W, is extracted to restore frequency to grid level f_0. This happens again at around 200s and 270s where a reserve of power of about the same level is used to restore grid frequency. It does not happen at the 2nd frequency drop from about 100s to 150s as during that period wind speed is low (see figure 11(a)) and there is no power reserve (figure 12(b)).

The power reserve is effectively recovered once the controller has detected a frequency below required level, indicating that curtailed operation is released to extract kinetic energy stored partly in the drive train. As noted, this reserve of kinetic energy of the

wind turbine is also shown in figures 14.b and 14.c, see page 5, left-hand column, third full paragraph. There the rpm of the generator is higher on average than in the classical mode. This higher rpm corresponds to operation at a higher speed than needed for the curtailed power, i.e. above Ω_1.

As explained above in relation to the control of the curtailed power, the recovery of stored energy is also done by acting on the frequency converter such that it controls the excitation of the generator to increase torque demand. Absent such increased demand the control would not be able to feed the extra power needed to restore grid frequency. Thus D27 directly and unambiguously teaches to configure the frequency converter to actively control generator excitation to increase torque to extract stored inertial energy upon release of the curtailment operation, **feature 1.8.**

4.7 The Board further draws the same conclusion as concerns the **last feature** added to claim 1 of auxiliary request 2 as for D3. Any control system by its very nature generates command signals according to a control logic as a function of parameters as input signals in an automatic manner. Such signals needed to increase torque demand on the generator are seen to correspond to signals for increased output power for a certain time after release of curtailment, as in D27 upon reduction of wind speed.

4.8 It follows from the above that the subject-matter of claim 1 according to auxiliary request 2 lacks novelty with respect to either one of D3 or D27.

5. *Auxiliary request 4 - Novelty*

5.1 Vis-a-vis claim 1 of auxiliary request 2 claim 1 of this request replaces the last feature, now requiring the control system (36) to automatically provide the frequency converter with an increased torque demand value when power drops below curtailment level.

5.2 In the Board's understanding this merely restates the final feature of auxiliary request 2 in more concrete terms, replacing "a signal indicating a desire for more power" by "an increased torque demand value provided to the frequency converter". As stated previously, a frequency converter controlling the generator is implicit in the variable speed turbine of D3. As argued above, when operating along the curve segment 20 of the figure of D3 the generator torque is increased with respect to normal operation, as represented by segment 18, so as to generate extra power. This must be communicated to the converter by an appropriate signal - a torque demand signal - when control passes operation point 21 and power drops below curtailment. Thus, this feature is also disclosed in D3. A similar signal must be developed in document D27 when a frequency drop initiates the end of curtailment and extraction of kinetic energy. The Board concludes that both D3 and D27 also anticipate this further feature, so that the subject-matter of claim 1 of this request also lacks novelty.

6. *Auxiliary request 6 - admission*

6.1 Auxiliary request 6 was filed with the appellant proprietor's letter of 23 November 2017 in reply to the appeals filed by the opponents. It adds to claim 1 according to auxiliary request 4 a further feature of the curtailment (namely that the curtailment follows a curtailment schedule).

6.2 Section I on page 2 of appellant proprietor's letter of 23 November 2017 explains the basis for the amendments, but does not explain why the amendment renders the claimed subject-matter novel and inventive over the cited prior art. The request is thus unsubstantiated in this regard. According to established jurisprudence unsubstantiated requests were regularly not taken into account in application of Article 12(4) RPBA 2007, the version that still applies in this case pursuant to Article 25(2) RPBA 2020. This is so because they fail to meet the requirement of Article 12(2) RPBA 2007 that a party present its complete case, cf. CLBA, 9th (previous) edition, 2019, V.A.4.12.5. The Board adds that this requirement remains unchanged in the Rules of Procedure presently in force (RPBA 2020), cf. Article 12(3) RPBA 2020 and CLBA, 10th (current) edition 2022, V.A.4.3.5 b)(i).

6.3 At the oral proceedings the appellant proprietor declined to comment on this view of the Board, so that the Board sees no reason to divert from this established approach. It therefore decides not to admit auxiliary request 6, Article 12(4) with Article 12(2) RPBA 2007.

7. The Board thus confirms that the decision was correct in finding granted claim 1 to extend beyond the content of the application as filed. The Board finds that the decision erred on the novelty of claim 1 of the auxiliary request 2, and must therefore set it aside. As otherwise none of the auxiliary requests meets the requirements of the EPC or are admitted, it must revoke the patent pursuant to Article 101(2) and (3)(b) EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

G. Magouliotis A. de Vries

Decision electronically authenticated