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Datasheet for the decision of 29 October 2020

Case Number: T 1036/17 - 3.5.02

Application Number: 06761928.8

Publication Number: 1880459

IPC: H02J3/18

Language of the proceedings: EN

Title of invention:
Wind farm power control system

Patent Proprietor:
Siemens Gamesa Renewable Energy A/S

Former Opponent:
Senvion GmbH

Relevant legal provisions:
EPC Art. 123(2), 56

Keyword:
Continuation of the appeal procedure after withdrawal of the opposition
Amendments - Main request - extension beyond the content of the application as filed (no)
Inventive step - Main request (yes)

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Case Number: T 1036/17 - 3.5.02

D E C I S I O N
of Technical Board of Appeal 3.5.02
of 29 October 2020

Appellant: (Patent Proprietor)	Siemens Gamesa Renewable Energy A/S Borupvej 16 7330 Brande (DK)
Representative:	Aspacher, Karl-Georg Siemens Gamesa Renewable Energy GmbH & Co. KG Otto-Hahn-Ring 6 81739 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 21 April 2017 revoking European patent No. 1880459 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	R. Lord
Members:	C.D. Vassoille
	W. Ungler

Summary of Facts and Submissions

I. This is an appeal of the patent proprietor (appellant) against the decision of the opposition division revoking European patent no. 1 880 459.

II. The following documents are relevant for the present decision:

E3: GB 2 410 386 A
E3*: P. Cartwright et al.: "Co-ordinated voltage control strategy for a doubly-fed induction generator (DFIG)-based wind farm", 4 July 2004, IEE Proceedings: Generation, Transmission and Distribution, Institution of Electrical Engineers, Vol. 151, no. 4, pages 495 to 502, ISSN: 1350-2360.

III. In the decision under appeal, the opposition division came to the conclusion that the subject-matter of claim 1 of the main request, filed on 16 December 2016, was new but in view of E3/E3* did not involve an inventive step in the sense of Article 56 EPC.

IV. The parties were summoned to oral proceedings. In a communication under Article 15(1) RPBA 2020 annexed to the summons, the board set out their preliminary observations on the appeal, concluding *inter alia* that the subject-matter of claim 1 of the main request seemed to fulfil the requirement of Article 123(2) EPC, further that it seemed to be new in view of E3* and to involve an inventive step over the same document.

V. With letter of 27 July 2020, the respondent (former opponent) withdrew their opposition.

VI. Given that the board's preliminary opinion was favourable to the appellant, the oral proceedings could be cancelled and the decision issued in the written procedure.

VII. The appellant requested in writing that the decision under appeal be set aside and that the patent be maintained according to the main request filed on 16 December 2016 or, if this was not possible, according to one of the auxiliary requests 1 to 5 filed on 28 March 2018 with letter of the same date.

VIII. Claim 1 of the appellant's main request has the following wording:

" A method of controlling the dynamic power factor or the reactive power of a wind farm comprising a number of wind turbines (5, 7) which is to be driven with a requested power factor or a requested reactive power, connected to a utility grid by means of a substation (35) included or being connected to a substation controller (43), the output voltage of the electricity supplied by an individual wind turbine (5, 7) being controlled to a specific voltage set point by a power electronic converter (25, 27), in which

a) the wind farm power factor is measured and compared with the power factor requested for the utility grid, or the wind farm reactive power is measured and compared with the reactive power requested for the utility grid, respectively;

b) the substation controller (43) adjusts the ratio of the wind farm voltage to the utility grid voltage by means of a main transformer tap based on a difference signal representing the deviation of the wind farm

power factor from the requested power factor or the deviation of the wind farm reactive power from the requested reactive power, respectively, thereby causing a change of the output voltage at the individual wind turbines, and iteratively outputting adjustment signals, which are iteratively established on the basis of an iteratively received difference signal

c) the output voltage of the individual wind turbines (5, 7) is regulated by the power electronic converters (25, 27) to correspond again to the specific voltage;

at least steps b) to c) being performed until the power factor of the electricity supplied by the wind farm corresponds to the requested power factor or the reactive power of the electricity supplied by the wind farm corresponds to the requested reactive power, respectively."

Claims 2 to 6 are dependent on claim 1.

IX. Independent claim 7 of the appellant's main request has the following wording:

"A wind farm with a number of wind turbines (5, 7) for being collectively connected to a utility grid, comprising:
- individual wind turbines (5, 7) equipped with a power electronic converter (25, 27) for converting part or the whole of the electricity supplied by the wind turbine (5, 7), the power electric converter (25, 27) being equipped with a controller (73, 75) which is programmed for controlling the output voltage of the electricity supplied by the wind turbine (5, 7) to a specific voltage set point;

- means (43, 47) for measuring the wind farm power factor or the wind farm reactive power and comparing it with the requested power factor or the requested reactive power, respectively;
- adjusting means (39, 41) for adjusting the ratio of the wind farm voltage to the utility grid voltage, thereby causing a change of the output voltage at the individual wind turbines, where the adjusting means comprises a main transformer (39) with at least two taps and a tap changer; in which
- the individual wind turbines (5, 7) are equipped with regulating means (25, 27) which are programmed for regulating the output voltage at the individual wind turbines (5, 7) to correspond again to the specific voltage set point;
- the wind farm further comprises a substation (35) connecting the wind farm to the utility grid, the substation (35) including or being connected to a substation controller (43) which is connected to or includes the measuring means (47) for receiving a difference signal representing the deviation of the wind farm power factor from the requested power factor or the deviation of the wind farm reactive power from the requested reactive power, respectively, and to the adjusting means (39, 41) for outputting adjustment signals, the substation controller (43) being programmed to iteratively establish adjustment signals on the basis of an iteratively received difference signal."

Claims 8 to 13 are dependent on claim 7.

X. The arguments of the appellant, in so far as they are relevant for the present decision, may be summarised as follows:

The amended wording of claim 1 of the main request of "thereby causing a change of the output voltage at the individual wind turbines" was directly and unambiguously derivable from the original description on page 13, lines 16 to 24. In the embodiments of figures 4 and 5 of the original application documents, the requested power factor or the requested reactive power was not communicated to the converter controllers, just as was the case in the embodiments of figures 1 and 3. Furthermore, it was clear from the original application that adjusting the ratio of the wind farm voltage to the utility grid voltage to thereby cause a change of the output voltage at the individual wind turbines was also valid for the embodiments of figures 4 and 5.

Documents E3/E3* did not disclose feature a) of claim 1 of the main request, i.e. that the wind farm power factor was measured and compared with the power factor requested for the utility grid, or the wind farm reactive power was measured and compared with the reactive power requested for the utility grid, respectively. Furthermore, documents E3/E3* did not disclose that the substation controller adjusted the ratio of the wind farm voltage to the utility grid voltage based on a difference signal representing the deviation of the wind farm power factor from the requested power factor or the deviation of the wind farm reactive power from the requested reactive power, respectively, as recited in feature b) of claim 1. These differences were also acknowledged by the opposition division. The subject-matter of claim 1 additionally differed from documents E3/E3* in that adjustment was performed iteratively until the power factor or the reactive power of the electricity emitted

by the wind farm corresponds to the requested power factor or the requested reactive power.

Document E3 explicitly stated that the converters were controlled such as to maintain the total output at the desired total output and that a tap change transformer was only used if control by means of the converters failed to maintain the total output at the desired total output (see E3 on page 8, line 27 to page 9, line 6; page 20, lines 25 to 27 and page 24, lines 11 to 25). In document E3, therefore, the main control was performed by the converters of the individual wind turbines, and only if control was no longer possible by means of the converters, the tap change transformer was used in order to restore the controllability via the converters. To the contrary, the present invention claimed an iterative switching of the transformer until the reactive power or the power factor output by the wind farm corresponded to the reactive power or power factor requested for the utility grid. A corresponding method was neither disclosed by nor rendered obvious from E3/E3*.

XI. The arguments of the former opponent, submitted in writing during the appeal procedure and in so far as relevant for the present decision, may be summarised as follows:

Claim 1 of the main request did not fulfil the requirements of Article 123(2) EPC. The additional wording "thereby causing a change of the output voltage at the individual wind turbines" exclusively referred to a very specific embodiment of the invention according to figures 1 and 3, which did not require a communication of the requested power factor or requested reactive power to the controllers of the

converters of the individual wind turbines. The present claim 1, however, did not exclude a communication of the requested power factor or the requested reactive power to the individual converters, such that claim 1 also referred to embodiments which were not directly and unambiguously derivable from the original application documents. The above amendment of claim 1 thus constituted an inadmissible intermediate generalisation.

As regards the novelty assessment in the decision under appeal, the independent claim 7 did not contain the feature of "the substation controller adjusts the ratio...", which was present in claim 1, but merely referred to "adjusting means". The reasoning of the opposition division provided with regard to novelty therefore did not apply to the independent claim 7, which already for this reason was not new in view of E3/E3*. Furthermore, the opposition division in the decision under appeal only referred to the power factor in the context of the discussion of novelty while claim 1 also referred to the reactive power as an alternative to the power factor. In this respect, reference was made to section 3.5 of document E3*, which was concerned with high voltage direct current (HVDC) transmission. HVDC implied that the reactive current necessarily had to be zero (corresponding to a power factor of 1). As described in section 3.5 of E3* and illustrated in figure 6, this was adjusted by the on-load tap changer ("OLTC") in an iterative manner.

As regards inventive step of the subject-matter of claim 1, documents E3/E3* both disclosed several times the application of "control loops", which were iterative in their nature. The alleged difference between the subject-matter of claim 1 and documents E3/

E3* therefore did not exist. In this context, further reference was made to figure 6 and section 3.5 of E3* and correspondingly E3 on page 5, line 20 to page 6, line 11. Furthermore, since the subject-matter of claim 1 did not exclude a parallel operation of the converter control and an operation of the tap change transformer, the appellant's argument that a tap change transformer was only used in E3/E3*, if control via the converters failed to maintain the total output at the desired total output, was irrelevant.

Reasons for the Decision

1. The appeal is admissible.

2. Procedural matters

As mentioned above (point V), the sole opponent withdrew their opposition and consequently is no longer a party to the proceedings. It is established case law of the boards of appeal that a withdrawal of the opposition in appeal proceedings has no immediate procedural significance if the opposition division has revoked the European patent. The board must then re-examine the substance of the opposition division's decision of its own motion, setting it aside and maintaining the patent only if the latter meets the requirements of the EPC. In the present case, the board has consequently reviewed the decision in the light of the substantiated arguments and evidence which had been submitted by the former opponent before the opposition was withdrawn (see the Case Law of the Boards of Appeal, 9th edition 2019, III.Q.3.3).

3. Main request - Amendments (Article 123(2) EPC)

3.1 The additional wording of claim 1 of the main request of **"thereby causing a change of the output voltage at the individual wind turbines"** is directly and unambiguously derivable from the original application documents and integration of the respective wording in claim 1 of the main request in particular does not amount to an intermediate generalisation.

3.2 The original description on page 13, lines 16 to 24 discloses the following:

"*Then, the ratio of the wind farm voltage, at the sub station's 35 output 37, to the utility grid voltage is adjusted at the sub station 35 level. This change of the ratio of the wind farm voltage to the utility grid voltage causes a change of the output voltage at the individual wind turbines. Therefore, the output voltage at the individual wind turbines is regulated by the power electronic converters 25, 27 to correspond again to the specific voltage set point.*" (emphasis added)

The additional wording of claim 1 of the main request is thus directly and unambiguously derivable from the original application documents.

3.3 Furthermore, the appellant has convincingly argued that, contrary to the former opponent's argument, none of the embodiments described in the original application documents required the requested power factor or the requested active power to be communicated to the controllers of the power electronic converters of the individual wind turbines. The board is particularly convinced that the embodiments of the

invention according to figures 4 and 5 equally do not require a communication of the requested power factor or the requested reactive power to the controllers of the converters of the individual wind turbines (see in particular the original description on page 7, lines 21 to 25 generally referring to the "inventive wind farm"). As regards the embodiment of figure 4, the original description on page 18, lines 11 to 16 explicitly states that "This wind farm corresponds to the wind farm shown in Fig. 3 except for an additional set point adjustment unit 84...". From page 18, lines 31 to 34 it is further evident that the embodiment of figure 5 merely differs from the foregoing embodiments in that the power factor controller is replaced by a voltage controller.

Consequently, as submitted by the appellant, in all embodiments described in the application, a change of the ratio of the wind farm voltage to the utility grid voltage will result in a change of the individual wind turbines without requiring a communication of the requested power factor or requested reactive power to the controllers of the converters of the individual wind turbines. The board therefore can not recognise any inadmissible extraction of the feature in question from an inextricably linked connection with other features, disclosed in the context of figures 1 and 3.

4. The board has therefore arrived at the conclusion that the additional wording "thereby causing a change of the output voltage at the individual wind turbines" in the overall context of the further features of claim 1 of the main request is directly and unambiguously derivable from the original application documents as a whole, and in particular does not amount to an

intermediate generalisation. The same applies to the corresponding amendment in the independent claim 7.

The objections raised by the former opponent therefore can not justify an alleged failure of claims 1 and 7 of the main request to satisfy the requirement of Article 123(2) EPC.

5. Prior art / Validity of priority claims

5.1 In the decision under appeal, the opposition division decided on the validity of the priority claims of the patent under appeal and concluded that the priorities were validly claimed (see point 2.3 of the reasons for the decision under appeal). Document E3, which was published on 27 July 2005 and thus, after the priority date of the patent under appeal (13 May 2005), was consequently not to be considered prior art under Articles 54(2) and (3) EPC.

5.2 In the present decision, however, the question of whether the opposition division has correctly decided on the priority question can remain unanswered, since the subject-matter of claims 1 and 7 of the main request in any case involves an inventive step in view of both documents E3 and E3*, the latter of which was published before the priority date of the patent in suit. The disclosures of these two documents relate to the same subject-matter and, at least as far as the fundamental teaching is concerned, essentially correspond to each other. The board in the following assessment of inventive step refers to these documents as E3/E3*.

6. Main request - Inventive step (Article 56 EPC)

6.1 Distinguishing features

6.1.1 The opposition division was right to conclude in the decision under appeal (see section 6.3 of the reasons for the decision under appeal) that the subject-matter of claim 1 differs from E3/E3* in that the wind farm power factor is measured and compared with the power factor requested for the utility grid (feature a)) and in that the substation controller adjusts the ratio of the wind farm voltage to the utility grid voltage based on a difference signal representing the deviation of the wind farm power factor from the requested power factor (feature b)).

As was convincingly argued by the appellant in this context, section 3.5 of E3* discloses the use of a local on-load tap changer ("OLTC") in order to ensure the rotor current is controlled within a defined operation range. Furthermore, contrary to what was argued by the former opponent, the mere fact that section 3.5 of E3* refers to a high voltage direct current transmission ("HVDC") does not imply measuring and comparing the reactive power with the requested reactive power and in particular does not imply an adjustment of the ratio of the wind farm voltage to the utility grid voltage based on a difference signal representing the deviation of the wind farm reactive power from the requested reactive power.

6.1.2 The board is further convinced that documents E3/E3* do not disclose iteratively outputting adjustment signals, which are iteratively established on the basis of an iteratively received difference signal. From the former

opponent's mere reference to section 3.5 and figure 6 of document E3* in this respect, the board cannot recognise any disclosure of the before-mentioned feature. The former opponent's reference to the use of the term "control loop" in E3/E3*, without any clear indication of the respective passages or the relevant context with regard to the subject-matter of claim 1, also is not convincing. To the contrary, the board has no doubts that document E3* in section 3.5 (see also E3 on page 5, lines 8 to 16), as convincingly argued by the appellant, discloses a very specific control strategy to control the d-component of a rotor current by means of an OLTC, which is assigned to a respective converter of an individual wind turbine.

6.1.3 In conclusion, the subject-matter of claim 1 at least differs from documents E3/E3* in features a) and b). Corresponding distinguishing features are clearly present in the independent claim 7:

> "- means (43, 47) for measuring the wind farm power factor or the wind farm reactive power and comparing it with the requested power factor or the requested reactive power, respectively;
> - adjusting means (39, 41) for adjusting the ratio of the wind farm voltage to the utility grid voltage, thereby causing a change of the output voltage at the individual wind turbines, where the adjusting means comprises a main transformer (39) with at least two taps and a tap changer; [...]
> - the wind farm further comprises a substation (35) connecting the wind farm to the utility grid, the substation (35) including or being connected to a substation controller (43) which is connected to or includes the measuring means (47) for receiving a difference signal representing the deviation of the

wind farm power factor from the requested power factor or the deviation of the wind farm reactive power from the requested reactive power, respectively, and to the adjusting means (39, 41) for outputting adjustment signals, the substation controller (43) being programmed to iteratively establish adjustment signals on the basis of an iteratively received difference signal."

6.2 Objective technical problem

The board concurs with the opposition division in the decision under appeal that the objective technical problem may be considered as how to implement a centralised power factor control (see section 7.3 of the reasons).

6.3 Obviousness

6.3.1 The subject-matter of claim 1 of the main request is not rendered obvious by documents E3/E3*.

As was convincingly argued by the appellant, in documents E3/E3* there is nothing that would have prompted the skilled person to modify the control strategy of E3/E3* in particular such that the ratio of the wind farm is iteratively adjusted by means of a substation controller until the wind farm power factor or reactive power corresponds to the requested power factor or requested reactive power as further defined in claim 1 of the main request.

6.3.2 Documents E3/E3* are generally concerned with a wind farm comprising at least one wind turbine and the combination of a voltage controller and a tap change transformer ("On Load Tap Changer", "OLTC") arranged to

control a reactive power output of the wind farm. It is in particular clear from the disclosure of document E3 that a controller is arranged to calculate the total output of a wind farm and compare the total output to a desired total output, the controller being arranged such that, if the total output does not match the desired total output, then it is arranged to control the converters in order to attempt to maintain the total output at the desired total output and further arranged such that if control of the converters fails to maintain the total output at the desired total output, then it is arranged to cause the tap of the tap change transformer to be changed (see E3, in particular page 8, line 27 to page 9, line 6). From page 19, line 29 to page 20, line 6 of document E3 it is further clear that the d-component of the rotor current is used to vary a reactive power absorbed. The OLTC of the local transformer is then used to ensure that the rotor current of the wind turbine is controlled within a defined operating range (see E3, page 20, lines 25 to 27). The board further refers to the corresponding passages in document E3*, see in particular section 1 on page 496 as well as sections 3.4 and 3.5 on page 499.

6.3.3 The opposition division's reasoning in the decision under appeal, corresponding to what was argued by the former opponent, was based on the argument that the skilled person knew that a change of the ratio of the wind farm voltage to the utility grid voltage caused a change of wind farm output voltage, which thereafter was subject to compensation by the individual wind farm electronic converters. The board does not consider this reasoning sufficient to show that the distinguishing features were rendered obvious to the person skilled in the art in view of documents E3/E3*.

6.3.4 The board observes that documents E3/E3* are clearly centered on a coordinated active control of the converters which focuses on controlling the d-component of the rotor current in order to control the reactive power, and subsequent control of a tap change transformer. On the contrary, the subject-matter of claim 1 is directed to a control of the power factor or the reactive power exclusively by using a substation controller to measure and compare the wind farm power factor or the wind farm reactive power with the requested power factor and the requested reactive power, respectively, and (iteratively) adjusting the ratio of the wind farm voltage to the utility grid voltage by means of a main transformer tap based on a difference signal representing the deviation of the wind farm power factor or wind farm reactive power from the requested power factor and requested reactive power, respectively.

The mere presence in E3/E3* of a tap change transformer and the knowledge of the skilled person that adjusting the ratio of the wind farm voltage to the utility grid voltage causes the converter of an individual wind turbine to compensate for the voltage change, in any case does not constitute a sufficient reasoning for the conclusion that the skilled person would have modified the fundamentally different control structure of E3/E3* in order to arrive at the claimed invention.

The teaching of documents E3/E3* is in particular strongly focused on a combined control using the converter of an individual wind turbine and a tap change transformer. The steps according to claim 1 on the other hand describe a self-contained sequence of a method for controlling the dynamic power factor or the

reactive power of a wind farm, which are also reflected in the device features of independent claim 7. Documents E3/E3* and the present invention therefore concern fundamentally different control structures. It is not apparent to the board what would have prompted the skilled person to modify the specific control structure of E3/E3* in order to arrive at the claimed invention. The former opponent did not provide convincing arguments as to why the person skilled in the art, in view of the objective technical problem, would have implemented the considerable modifications of the specific control structure of E3/E3*.

6.3.5 The board has therefore come to the conclusion that subject-matter of claim 1 is not rendered obvious from documents E3/E3* in combination with the common general knowledge of the skilled person and that it consequently involves an inventive step in the sense of Article 56 EPC. The same applies to the independent claim 7, which comprises corresponding device features.

7. *Final remarks*

Given that claims 1 and 7 of the main request fulfil the requirement of Article 123(2) EPC and that the subject-matter of these claims involves an inventive step in the sense of Article 56 EPC, and considering that no further substantiated objections had been presented, the board had to accede to the appellant's main request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the opposition division with the order to maintain the patent with the following claims and a description to be adapted thereto:

   Claims: No. 1 to 13 of the main request filed on 16 December 2016 with letter of the same date.

The Registrar: The Chairman:

C. Rodríguez Rodríguez R. Lord

Decision electronically authenticated