

PUBLIC VERSION

**UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.**

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In the Matter of

**CERTAIN VARIABLE SPEED WIND
TURBINES AND COMPONENTS THEREOF**

Inv. No. 337-TA-641

**INITIAL DETERMINATION
Administrative Law Judge Carl C. Charneski**

Pursuant to the notice of investigation, 73 Fed. Reg. 16910 (2008), this is the Initial Determination in the matter of *Certain Variable Speed Wind Turbines and Components Thereof*, United States International Trade Commission Investigation No. 337-TA-641. See 19 C.F.R. § 210.42(a).

It is held that a violation of section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337, has occurred in the importation into the United States, the sale for importation, or the sale within the United States after importation of certain variable speed wind turbines or components thereof by reason of infringement of one or more of claim 121 of United States Patent No. 5,083,039 and claim 15 of United States Patent No. 6,921,985. It is further held that a violation of section 337 has not occurred by reason of infringement of claims 5, 7, and 8 of United States Patent No. 7,321,221.

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The following abbreviations may be used in this Initial Determination:

ALJ	-	Administrative Law Judge
ALJX	-	Administrative Law Judge Exhibit
CDX	-	Complainant's Demonstrative Exhibit
CPX	-	Complainant's Physical Exhibit
CX	-	Complainant's Exhibit
Dep.	-	Deposition
EDIS	-	Electronic Document Imaging System
FF	-	Finding(s) of Fact
JPX	-	Joint Physical Exhibit
JX	-	Joint Exhibit
PCL	-	Proposed Conclusion of Law (CPCL, RPCL or SPCL)
PFF	-	Proposed FF (CPFF, RPFF or SPFF)
PRF	-	Proposed Reply or Rebuttal Finding (CPRF, RPRF or SPRF)
RDX	-	Respondents' Demonstrative Exhibit
RPX	-	Respondents' Physical Exhibit
RX	-	Respondents' Exhibit
SX	-	Commission Investigative Staff Exhibit
Tr.	-	Transcript.

I. Background

A. Institution and Procedural History of This Investigation

By publication of a notice in the *Federal Register* on March 31, 2008, this investigation was instituted pursuant to subsection (b) of section 337 of the Tariff Act of 1930, as amended, to determine:

[W]hether there is a violation of subsection (a)(1)(B) of section 337 in the importation into the United States, the sale for importation, or the sale within the United States after importation of certain variable speed wind turbines and components thereof that infringe one or more of claims 104 and 121-125 of U.S. Patent No. 5,083,039 and claims 1-12, 15-18, and 21-28 of U.S. Patent No. 6,921,985, and whether an industry in the United States exists as required by subsection (a)(2) of section 337.

73 Fed. Reg. 16910 (2008).

The notice of investigation named as the complainant General Electric Company ("GE") of Fairfield, Connecticut. *Id.* The following companies were named as the respondents: Mitsubishi Heavy Industries, Ltd. ("MHI") of Tokyo, Japan; Mitsubishi Heavy Industries America, Inc. ("MHIA") of New York, New York; and Mitsubishi Power Systems, Inc. ("MPSA") of Lake Mary, Florida (collectively, "Mitsubishi" or "Mitsubishi respondents"). *Id.* The Commission Investigative Staff ("Staff") of the Commission's Office of Unfair Import Investigations is also a party in this investigation. *Id.*

Order No. 10 is an unreviewed initial determination granting GE's motion to amend its complaint and the notice of investigation to add claims 1-19 of United States Patent No. 7,321,221 to this investigation. *See* Notice of Commission Decision Not to Review an Initial Determination Granting Complainant's Motion to Amend the Complaint and Notice of

Investigation and Extending the Target Date (Oct. 8, 2009).

Order No. 30 is an unreviewed initial determination granting GE's amended motion for summary determination on the economic prong of the domestic industry requirement with respect to all three asserted patents. *See* Notice of Commission Decision Not to Review an Initial Determination Granting GE's Amended Motion for Summary Determination That the Economic Prong of the Domestic Industry Requirement Has Been Satisfied (Apr. 21, 2009).¹

The evidentiary hearing in this investigation commenced on May 11, 2009. At the commencement of the hearing, it was established that GE had narrowed the number of asserted claims to claim 121 of U.S. Patent No. 5,083,039 ("the '039 patent"); claims 5, 7, and 8 of U.S. Patent No. 7,321,221 ("the '221 patent"); and claim 15 of U.S. Patent No. 6,921,985 ("the '985 patent"). *See* Tr. 155.

The parties have filed post-hearing briefs, reply briefs, and proposed findings. The issues are ripe for determination.

B. The Patents and Products at Issue

1. Technological Background

All three asserted patents involve wind turbines used to generate electricity. Electricity is

¹ The notice of investigation (73 Fed. Reg. 16910 (2008)) provides that a determination must be made as to whether an industry in the United States exists, as required by 19 U.S.C. § 1337(a)(2). The domestic industry requirement consists of both an economic prong (*i.e.*, there must be an industry in the United States) and a technical prong (*i.e.*, that industry must relate to articles protected by the intellectual property at issue). *See Certain Ammonium Octamolybdate Isomers*, Inv. No. 337-TA-477, Comm'n Op. at 55, USITC Pub. 3668 (Jan. 2004). The complainant bears the burden of proving the existence of a domestic industry. *Certain Methods of Making Carbonated Candy Products*, Inv. No. 337-TA-292, Comm'n Op. at 34-35, USITC Pub. 2390 (June 1991). In any investigation, the domestic industry requirement must be satisfied as to each asserted patent. *See* 19 U.S.C. § 1337(a)(2).

supplied to utilities from many sources, including power plants that use fossil fuel, nuclear fuel, or water to turn generators, as well as wind turbines (sometimes called windmills). Wind turbines are often located on wind farms and they use the wind to turn their generators. Electrical energy produced by all of these sources is transmitted along power lines that are part of a system called a grid. Collins (Tutorial) Tr. 10, 36-37.

Electricity is transmitted at a certain voltage. Voltage is the potential difference between two points. Voltage has been described, by way of analogy, to the pressure that is placed on water in a garden hose; when one squeezes the trigger on the nozzle at the end of a hose, water flows out of the nozzle when the water pressure at the nozzle is less than the water pressure in the hose. Collins (Tutorial) Tr. 11-12.

The voltage of electrical energy arriving from the source is usually stepped up for transmission along the grid. Later, at substations along the grid, the voltage is stepped down to a level that is safe for distribution to, and use by, loads which consume power (including homes, factories and office buildings). Collins (Tutorial) Tr. 10-12; Toliyat (Tutorial) Tr. 81.

Electricity is transmitted on the grid in the form of alternating current, or “AC,” which means that the voltage and the flow of current alternate with time. The voltage, or current, is sometimes said to flow back and forth, *i.e.*, to push and pull. By contrast, the current used within battery-powered devices is direct current, or “DC.” DC flows in one direction. Collins (Tutorial) Tr. 14-15. Current, which is represented by the letter “I,” is measured in amperes, often referred to as “amps.” Collins (Tutorial) Tr. 12-13. “Resistance” is opposition to the flow of an electrical charge. Collins (Tutorial) Tr. 13.

In the United States, electricity is supplied at a rate of 60 cycles (*i.e.*, changes in voltage)

per second. Thus, electricity is said to be supplied at 60 hertz. The cycles, or oscillations of voltage and current, may be represented in the form of waves, specifically, mathematical sine, or sinusoidal, waves that flow up and down in an alternating pattern. Collins (Tutorial) Tr. 15-20; Habetler (Tutorial) Tr. 77.

If voltage pushes and electrical current flows at the same time (*i.e.*, as voltage increases so does current), all of the power flowing in the electrical power system is said to be “real power” (denoted by the letter “P”). This real power can be put to useful work by a consumer, and may be measured in terms of watts.²

However, the timing (or phases) of the voltage and the current can differ.³ The difference in phases is expressed in terms of a “power factor angle.” Thus, at a phase angle of 90 degrees, there is such a delay between the voltage and the current that one does not have any “real power,” but only “reactive power” (denoted by the letter “Q”). In that situation, power is not available for useful work, and cannot be measured in watts. Instead, the power is measured in “VARs” (which stands for “volt ampere reactive”). Reactive power has some uses (*e.g.*, it can be used in certain situations to increase voltage), and is sometimes supplied to the grid. It is often the case that a shift at less than a 90 degree angle is present in an electrical system, such that both real and

² The output of the wind turbines at issue in this investigation are measured in megawatts (MW). *See* Habetler (Tutorial) Tr. 63-64; Joint Submission and Stipulations, ¶¶ 4, 5, 7, 8, 10, 11 and 12 (May 7, 2009) (“Stips.”).

³ If the voltage decreases, but the current does not decrease until later, the current is called a “lagging current.” The current is said to lag the voltage in phase. However, if the current is ahead of the voltage, there is a “leading current.” Collins (Tutorial) Tr. 26-27.

reactive power are present at the same time.⁴ Collins (Tutorial) Tr. 20-29, 32-33, 39-40.

Due to the fact that AC voltage oscillates, power systems typically do not supply power as single-phase, which could be represented as a single sine wave. Rather, in order to supply constant power, power systems usually combine three sources of voltage (or pumps) so that at any given time, the voltages are at different stages of oscillation (which may be represented by three evenly offset sine waves). Such a system is said to be a three-phase system and the delay in oscillations that appears when comparing one wave to another is called a phase shift. Collins (Tutorial) Tr. 18-20; Toliyat (Tutorial) Tr. 87-88.

Despite the fact that the loads drawing on the grid do not remain constant, the electricity supply on the grid is managed to provide steady, constant power. Collins (Tutorial) Tr. 34-35, 40; Habetler (Tutorial) Tr. 85-87. Indeed, most generators that provide power for the grid (such as coal-burning or nuclear power plants) are able to provide a consistent output to the grid because the amount of fuel used to produce electricity can be regulated. However, one cannot regulate the wind. Thus one cannot control when wind turbines or wind farms will supply power, and when they will not. The variability of output from wind turbines, however, has not presented a major problem for grid stability because wind energy has supplied only a small amount of power in comparison to the amount of power derived from conventional sources. Yet, as the use of wind turbines increases, so do the challenges presented by connecting wind turbines to the grid. Collins (Tutorial) Tr. 11-12, 36-40.

⁴ Sometimes, instead of referring to the phase angle, one may refer to a power factor in which 1 represents 100 percent real power; 0 represents no power available for useful work (equivalent to a 90 degree angle); and .5 indicates that 50 percent of the power being transmitted is available for useful work. Collins (Tutorial) Tr. 29-32.

In addition, there is also a question of the frequency (or hertz) of the electric output from the wind turbine when there is insufficient wind to generate electricity. This is because, in basic terms, electricity is generated by rotating a magnet through coils of wire, with the rotation speed of the magnet determining the hertz of the generator output. In conventional power systems, a so-called “synchronous” generator is used, which converts mechanical energy into electrical energy. A synchronous generator can be operated only at the speed required for a 60 hertz output.

Modern wind turbines, however, are not so limited. They are called “variable speed wind turbines” because, unlike a synchronous generator, they generate electricity as the blades turn at various speeds, depending upon the amount of wind that is available.⁵ Variable speed wind turbines use a type of induction generator that is sometimes called an “asynchronous” generator. In an asynchronous generator, the rotation speed of the magnet determines the frequency of the output and it varies with wind speed. Collins (Tutorial) Tr. 38-40, 58.

Thus, if one were using a generator whose output would differ in hertz depending on the rotation of the wind turbine blades, then use of a “power converter” would be required to ensure that any power generated by the wind turbines is supplied to the grid at 60 hertz.⁶ Power

⁵ The older, fixed-speed wind turbines could only operate at a single speed (with about a 1 to 2 percent variation), and in that way they provided power at the desired frequency, *e.g.* 60 hertz. They were prone, among other things, to mechanical stress in the gearbox and other components due to wind gusts. Collins (Tutorial) Tr. 40.

⁶ The configuration of such a generator is sometimes called a “squirrel cage” because, in a manner reminiscent of a squirrel cage (or spinning wheel), there is a fairly direct, mechanical correlation (through a gearbox) between the wind turbine blades and the spinning (*i.e.*, the rotating) part of the generator. Further, with a squirrel cage generator, there is no power connection to the generator’s rotor, only to the stationary part of the generator. All of the power, (continued...)

converters may include capacitors,⁷ diodes,⁸ switches and other components and circuitry. They may be located in the body of the wind turbine (such as in the tower base), or they may be external to the turbine.⁹

A common design uses a power converter as an intermediary between a wind turbine and the power grid. Such a power converter typically converts the wind turbine output from AC to DC current, then (with the assistance of a capacitor) smooths the DC current out to the constant frequency required by the grid, and finally (through a component called an “inverter”) converts the output back to AC as required by the grid. Collins (Tutorial) Tr. 38-44, 50.

Another way to address the frequency problem caused by the variable speed of a modern turbine is to use a generator that adjusts its own internal magnetic field so as to influence the output at the “stator” (*i.e.*, at the stationary part of the rotor system). With such a generator, the output of the stator is synchronized with the frequency of the grid. Thus, the stator output can be connected directly to the grid. This type of generator is called a “doubly-fed induction generator” or “DFIG.” Collins (Tutorial) Tr. 44-45; Habetler Tr. 68.

A DFIG takes some energy from the grid, which goes through a power converter, and

⁶(...continued)

therefore, must flow through the power converter to reach the grid. Thus, the converter is called a “fully rated” converter because it handles all of the current from the generator. *See* Habetler (Tutorial) Tr. 67.

⁷ A capacitor can store energy in an electric field. Toliyat (Tutorial) Tr. 94.

⁸ A diode is a unidirectional switch, *i.e.*, it lets current flow in only one direction. Toliyat (Tutorial) Tr. 92-93.

⁹ The power converters may actually consist of two converters, *i.e.*, a generator (or rotor) side converter and a grid side converter. *See* Collins (Tutorial) Tr. 44, 47-51; Habetler (Tutorial) Tr. 69-70, 72-73.

then connects to the generator's rotor in order to create a magnetic field.¹⁰ The rotation of the rotor (which is driven by wind turbine blades connected through a gearbox covered by the “nacelle”) combines with the magnetic field (which is created with the assistance of the power converter), resulting in a 60 hertz output at the stator.¹¹ Inasmuch as wind speed is subject to change, a DFIG's converter (specifically, the generator-side converter) must be ready to make variable adjustments to the current supplied to the rotor in order to assure a total of 60 hertz at the output. Collins (Tutorial) Tr. 45-47.

In addition to the challenges presented by the instability of the wind for connecting wind turbines to the grid, sometimes an event on the grid itself presents a problem for the electrical components associated with a wind turbine. Problems on the grid might have the potential to create an overcurrent or overvoltage in the turbine. For example, although a lightning strike is a rare grid event, when it does occur, it might cause a power line to break, resulting in a low voltage event on the grid. The grid usually reacts quickly to compensate for such occurrences (*e.g.*, by the use of circuit breakers near the event). Nevertheless, there may be short periods of time when wind turbines connected to the grid could be affected. Collins (Tutorial) Tr. 53-54.

One common concern during a low voltage event is that as voltage drops on the grid, high

¹⁰ In a DFIG, the current is fed to rotor windings. The rotor itself does not closely resemble a spinning wheel, and thus a DFIG is not called a squirrel cage generator. *See* Habetler (Tutorial) Tr. 67-71.

¹¹ In a DFIG, there are two points of connection through which power flows to the grid. Most of the power flows from the stationary part of the generator to the grid; and some of the power flows out of the rotor, through a power converter, and back to the grid. Thus, in contrast to the converter used with a squirrel cage generator, the power converter used for a DFIG does not handle all of the current from the generator. Consequently, the DFIG's power converter is a partial-power converter. Such a converter is referred to as “partially rated.” *See* Collins (Tutorial) Tr. 45; Habetler (Tutorial) Tr. 68, 74-75.

current can develop in the rotor. Because current tends to travel from areas of high pressure (or voltage) to low pressure, a large current can then flow out of the rotor and into the power converter. Such a current could cause damage to some of the power converter components.¹² Therefore, various devices have been developed to clamp, or divert, energy coming from the rotor or from the grid in order to prevent damage to a power converter. One such device is a circuit called a “crowbar,” with reference to the effect that it has on the flow of energy. *See* Collins (Tutorial) Tr. 56-57; Toliyat (Tutorial) Tr. 87-89.

Also, modern wind turbines are designed to “ride through” grid events, including drops in grid voltage (which may last for less than a second, or for up to a few seconds), *i.e.*, they are designed so that they will continue to operate and remain connected to the grid.¹³ This is particularly important in areas in which wind turbines are significant suppliers of electricity. Accordingly, some utility operators have begun to hold wind energy generators to the high standards applied to conventional generators with respect to riding through grid events. For example, German utilities have developed wind turbine standards called “E.ON” that cover low voltage ride-throughs. Collins (Tutorial) Tr. 59-60; Collins Tr. 2311 (spelling of acronym).

¹² The high current could reach at least as far as the DC bus within the converter. *See* Collins (Tutorial) Tr. 56-57; GE Tutorial Exs. at 26 (filed with the Comm’n Sec’y on April 30, 2009, and available on EDIS) (DC bus illustrated between the machine (or generator-side) converter and the grid converter).

¹³ Low voltage ride-through may be referred to as “LVRT.” *See* CX-6/RX-6 (‘985 patent) at col. 1, lines 29-34; Lyons Tr. 243-245.

2. Overview of the Asserted Patents

a. The '039 Patent

United States Patent No. 5,083,039, entitled “Variable Speed Wind Turbine,” issued on June 21, 1992, to Robert D. Richardson and William L. Erdman, and at that time was assigned to U.S. Windpower, Inc. CX-1/RX-1 ('039 patent). A reexamination certificate for the '039 patent issued on November 16, 1999, which states that no amendments had been made to the patent, and that the patentability of claims 1-138 (*i.e.*, all patent claims) had been confirmed. *See Id.*

The '039 patent relates to a variable speed wind turbine “comprising a turbine rotor that drives an AC induction generator, a power converter that converts the generator output to fixed-frequency AC power, a generator controller, and an inverter controller. The generator controller uses field orientation to regulate either stator currents or voltages to control the torque reacted by the generator. The inverter controller regulates the output currents to supply multi-phase AC power having leading or lagging currents at an angle specified by a power factor control signal.” CX-1 ('039 patent), Abstract.

GE asserts claim 121 against Mitsubishi. GE Br. at 51; Tr. 155.

b. The '221 Patent

United States Patent No. 7,321,221, entitled “Method for Operating a Wind Power Plant and Method for Operating It,” issued on January 22, 2008, to Andreas Bucker, Wilhelm Janssen and Henning Lütze, and at that time was assigned to GE. CX-9/RX-9 ('221 patent).

The '221 patent relates to “a method of operating a wind turbine, wherein rotor windings of an induction generator, which comprises stator coils coupled to a voltage grid, fed or supplied with rotor currents by a feed-in or supply unit are driven by a rotor of the wind turbine; wherein

the frequencies of the fed-in or supplied rotor currents are controlled depending on the rotor rotation frequency and the feed-in unit is electrically decoupled from the rotor windings in the case predetermined variations of the grid voltage amplitude.” CX-9 (‘221 patent) at col. 1, lines 10-19. The patent also relates to “a wind power plant operable with such a method.” *Id.*

GE asserts claims 5, 7, and 8 against Mitsubishi. GE Br. at 38; Tr. 155.

c. The ‘985 Patent

United States Patent No. 6,921,985, entitled “Low Voltage Ride Through for Wind Turbine Generators,” issued on July 26, 2005, to Wilhelm Janssen, Henning Luetze, Andreas Bruecker, Till Hoffmann and Ralf Hagedorn, and at that time was assigned to GE. CX-6/RX-6 (‘985 patent).

The ‘985 patent relates to a wind turbine that “includes a blade pitch control system to vary a pitch of one or more blades and a turbine controller coupled with the blade pitch control system. A first power source is coupled with the turbine controller and with the blade pitch control system to provide power during a first mode of operation. Uninterruptible power supplies coupled to the turbine controller and with the blade pitch control system to provide power during a second mode of operation. The turbine controller detects a transition from the first mode of operation to the second mode of operation and causes the blade pitch control system to vary the pitch of the one or more blades in response to the transition.” CX-6 (‘985 patent), Abstract.

GE asserts claim 15 against Mitsubishi. GE Br. at 21; Tr. 155.

3. The Level of Ordinary Skill in the Art

With respect to each asserted patent, the parties have stipulated that a person of ordinary skill in the relevant art at the time that each patent application was filed would have had a B.S. degree in electrical engineering, or an equivalent degree program, with two to three years of experience in power electronics and, or, electronic machines. *See* Stips., ¶¶ 6, 9, and 13; Staff Br. at 11 & n.11.¹⁴

4. The Products Accused in This Investigation

GE accuses two models of Mitsubishi 2.4 MW wind turbines of patent infringement, *i.e.*, the MWT 92 and the MWT 95. GE Br. at 7, 11. The parties stipulated that these models are identical for the purposes of the infringement analysis to be conducted in this investigation. Stips., ¶¶ 4, 7, 10; Staff Br. at 7 & n.8. The MWT 92 and MWT 95 are referred to collectively as the “MWT.”

In addition, Mitsubishi relies on a new version of its 2.4 MW wind turbines, *i.e.*, the EPSS wind turbine, as a design-around that allegedly precludes infringement of the ‘985 patent. *See* Order No. 43 (Denying GE’s Motion *in Limine* to Preclude Evidence or Argument Regarding Respondents’ Purported Design Around of U.S. Patent No. 6,921,985); Mitsubishi Br. at 70.[

]

¹⁴ Section III. A. (Claim Construction) contains a discussion of the legal significance of the hypothetical person of ordinary skill.

GE's infringement allegations are directed generally to the MWT, with no distinction as to the original version or the EPSS version. *See* GE Br. at 1. As indicated above, the changes made to the MWT that distinguish the EPSS version from the original version are relevant only to the asserted claim of the '985 patent. Thus, it is only with respect to the '985 patent that the parties' infringement arguments distinguish between the original MWT and the EPSS version. *See, e.g.* Mitsubishi Br. at 18-19, 42, 50, 68-70. Consequently, all findings regarding alleged infringement of the '039 patent and the '221 patent apply to the MWT, in both its original and EPSS versions. As for the '985 patent, separate infringement findings are made with respect to the original and EPSS versions of the MWT.

5. The Domestic Industry Products

In its domestic industry case, GE relies on three of its 1.5 MW wind turbine models, *i.e.*, the SLE, XLE, and SE. The parties have stipulated that these models are identical for the purpose of evaluating whether GE satisfies the technical prong of the domestic industry requirement for each of the asserted patents. *See* Stips., ¶¶ 5, 8, 12; Staff Br. at 6-7 & n.7. The SLE, XLE, and SE are referred to collectively as the "GE Turbine."¹⁵

II. Jurisdiction and Importation

No party has challenged the Commission's *in rem* jurisdiction over the accused products;¹⁶ nor has any party contested the Commission's personal jurisdiction over it.

¹⁵ As discussed at page 3, *supra*, it already has been held that GE has satisfied the economic prong of the domestic industry requirement with respect to all three asserted patents.

¹⁶ Although GE attempted through a motion *in limine* to preclude the Mitsubishi respondents from presenting evidence concerning the EPSS, the undersigned ruled in a pre-hearing order that the EPSS is within the scope of this investigation. *See* Order No. 43

(continued...)

In addition, GE and the Mitsubishi respondents entered into a stipulation that addressed some of the jurisdiction and importation questions relevant to this investigation. In particular, they stipulated that respondents MHI and MPSA have sold for importation, imported and, or, sold after importation into the United States, the accused MWTs. Further, GE and the Mitsubishi respondents stipulated that the Commission has jurisdiction over the accused products, as well as MHI and MPSA. *See* Joint Submission and Stipulation Regarding Complainant General Electric Company's Motion for Summary Determination of Importation (May 4, 2009). The Staff does not contest those stipulations. *See* Staff Br. at 8.

The stipulations, however, do not address the activities or status of Mitsubishi respondent MHIA. [

¹⁶(...continued)
(Denying GE's Motion *in Limine* to Preclude Evidence or Argument Regarding Respondents' Purported Design Around of U.S. Patent No. 6,921,985). Further, GE admits in its brief that an EPSS has been imported into the United States. *See* GE Br. at 16. Thus, it has been established that the EPSS has been imported and is subject to the Commission's jurisdiction.

¹⁷ [

]

It is undisputed that according to the plain language of the statute, and the notice of investigation (quoted above), any violation must pertain to the sale for importation, importation, or sale after importation of an accused product. GE has offered only scant argument in this regard. GE has not argued or demonstrated that MHIA has directly imported or sold an accused product; nor has GE advanced a legal theory under which the actions of its subsidiary, MPSA, would be chargeable to the parent company. *See* GE Br. at 98. Consequently, it cannot be found that MHIA is in violation of section 337.

III. General Principles of Patent Law

A. Claim Construction

Pursuant to the Commission's notice of investigation, this is a patent-based investigation. *See* 73 Fed. Reg. 16910 (2008). Accordingly, all of the unfair acts alleged by GE are instances of alleged infringement of the asserted patents. Any finding of infringement or non-infringement requires a two-step analytical approach. First, the asserted patent claims must be construed as a matter of law to determine their proper scope.¹⁸ Second, a factual determination must be made as to whether the properly construed claims read on the accused devices. *See Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 976 (Fed. Cir. 1995) (*en banc*), *aff'd*, 517 U.S. 370 (1996).

Claim construction begins with the language of the claims themselves. Claims should be given their ordinary and customary meaning as understood by a person of ordinary skill in the art,

¹⁸ Only those claim terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Vanderlande Indus. Nederland BV v. Int'l Trade Comm.*, 366 F.3d 1311, 1323 (Fed. Cir. 2004); *Vivid Tech., Inc. v. American Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

viewing the claim terms in the context of the entire patent. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13 (Fed. Cir. 2005), *cert. denied*, 546 U.S. 1170 (2006).¹⁹ With respect to claim preambles, the Court of Appeals for the Federal Circuit has explained that:

[A] claim preamble has the import that the claim as a whole suggests for it. In other words, when the claim drafter chooses to use both the preamble and the body to define the subject matter of the claimed invention, the invention so defined, and not some other, is the one the patent protects.

Eaton Corp. v. Rockwell Int'l Corp., 323 F.3d 1332, 1339 (Fed. Cir. 2003) (quoting *Bell Communications Research, Inc. v. Vitalink Communications Corp.*, 55 F.3d 615, 620 (Fed. Cir. 1995)).

In some instances, claim terms do not have particular meaning in a field of art, and claim construction involves little more than the application of the widely accepted meaning of commonly understood words. *Phillips*, 415 F.3d at 1314. “In such circumstances, general purpose dictionaries may be helpful.” *Id.*

In many cases, claim terms have a specialized meaning and it is necessary to determine what a person of skill in the art would have understood the disputed claim language to mean. “Because the meaning of a claim term as understood by persons of skill in the art is often not immediately apparent, and because patentees frequently use terms idiosyncratically, the court looks to ‘those sources available to the public that show what a person of skill in the art would

¹⁹ Factors that may be considered when determining the level of ordinary skill in the art include: “(1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field.” *Environmental Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 696 (Fed. Cir. 1983), *cert. denied*, 464 U.S. 1043 (1984).

have understood disputed claim language to mean.”” *Id.* (quoting *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1116 (Fed. Cir. 2004)). The “sources” identified by the *Phillips* Court include “the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art.” *Id.*

In cases in which the meaning of a claim term is uncertain, the specification usually is the best guide to the meaning of the term. *Id.* at 1315. As a general rule, the particular examples or embodiments discussed in the specification are not to be read into the claims as limitations. *Markman*, 52 F.3d at 979. However, the specification is always highly relevant to the claim construction analysis, and is usually dispositive. *Id.* Moreover, “[t]he construction that stays true to the claim language and most naturally aligns with the patent’s description of the invention will be, in the end, the correct construction.” *Id.* at 1316.

Claims are not necessarily, and are not usually, limited in scope to the preferred embodiment. *RF Delaware, Inc. v. Pacific Keystone Techs., Inc.*, 326 F.3d 1255, 1263 (Fed. Cir. 2003); *Decisioning.com, Inc. v. Federated Dep’t Stores, Inc.*, 527 F.3d 1300, 1314 (Fed. Cir. May 7, 2008) (“[The] description of a preferred embodiment, in the absence of a clear intention to limit claim scope, is an insufficient basis on which to narrow the claims”).

Furthermore, claim interpretations that exclude the preferred embodiment are “rarely, if ever, correct and require highly persuasive evidentiary support.” *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1583 (Fed. Cir. 1996). Such a conclusion can be mandated in rare instances by clear intrinsic evidence, such as unambiguous claim language or a clear disclaimer by the patentees during patent prosecution. *Elektro Instrument v. O.U.R. Sci. Int’l*, 214

F.3d 1302, 1308 (Fed. Cir. 2000); *Rheox, Inc. v. Entact, Inc.*, 276 F.3d 1319 (Fed. Cir. 2002).

If the intrinsic evidence does not establish the meaning of a claim, then extrinsic evidence may be considered. Extrinsic evidence consists of all evidence external to the patent and the prosecution history, including inventor testimony, expert testimony, and learned treatises. *Phillips*, 415 F.3d at 1317. Inventor testimony can be useful to shed light on the relevant art. In evaluating expert testimony, a court should discount any expert testimony that is clearly at odds with the claim construction mandated by the claims themselves, the written description, and the prosecution history, in other words, with the written record of the patent. *Id.* at 1318. Extrinsic evidence may be considered if a court deems it helpful in determining the true meaning of language used in the patent claims. *Id.*

This investigation involves a claim that is alleged to contain a means-plus-function limitation. When a claim uses the term “means” to describe a limitation, a presumption arises that the inventor used the term to invoke the means-plus function format authorized by 35 U.S.C. § 112, ¶ 6.²⁰ *Altiris, Inc. v. Symantec Corp.*, 318 F.3d 1363, 1375 (Fed. Cir. 2003). “This presumption can be rebutted when the claim, in addition to the functional language, recites structure sufficient to perform the claimed function in its entirety.” *Id.*

²⁰ The relevant portion of section 112 provides:

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

35 U.S.C. § 112, ¶ 6.

Once a court concludes that a claim limitation is a means-plus-function limitation, two steps of claim construction remain: 1) the court must first identify the function of the limitation; and 2) the court must then look to the specification and identify the corresponding structure for that function. *Biomedino LLC v. Waters Technologies Corp.*, 490 F.3d 946, 950 (Fed. Cir. 2007). If there is no structure in the specification corresponding to the means-plus-function limitation, the claim will be found invalid as indefinite. *Id.*

While the specification must contain structure linked to claimed means: “[a]ll one needs to do in order to obtain the benefit of [§ 112, ¶ 6] is to recite some structure corresponding to the means in the specification, as the statute states, so that one can readily ascertain what the claim means and comply with the particularity requirement of [§ 112,] ¶ 2.” *Id.* (citing *Atmel Corp. v. Info. Storage Devices, Inc.*, 198 F.3d 1374, 1382 (Fed. Cir. 1999)). Additionally, interpretation of what is disclosed in the specification must be made in light of the knowledge of one skilled in the art. *Atmel*, 198 F.3d at 1380.

Thus, in order for a means-plus-function claim to be valid under section 112, the corresponding structure of the limitation “must be disclosed in the written description in such a manner that one skilled in the art will know and understand what structure corresponds to the means limitation. Otherwise, one does not know what the claim means.” *Id.* at 1382. Further, “the testimony of one of ordinary skill in the art cannot supplant the total absence of structure from the specification.” *Id.* (quoting *Default Proof Credit Card Sys., Inc. v. Home Depot U.S.A., Inc.*, 412 F.3d 1291, 1302 (Fed. Cir. 2005)).

“A means-plus-function claim encompasses all structure in the specification corresponding to that element and equivalent structures.” However, “[t]he statute does not

permit limitation of a means-plus-function claim by adopting a function different from that explicitly recited in the claim. Nor does the statute permit incorporation of structure from the written description beyond that necessary to perform the claimed function.” *Micro Chem. Inc. v. Great Plains Chem. Co., Inc.*, 194 F.3d 1250, 1258 (Fed. Cir.1999).

B. Patent Infringement

Under 35 U.S.C. §271(a), direct infringement consists of making, using, offering to sell, or selling a patented invention without consent of the patent owner. The complainant in a section 337 investigation bears the burden of proving infringement of the asserted patent claims by a “preponderance of the evidence.” *Certain Flooring Products*, Inv. No. 337-TA-443, Comm’n Notice of Final Determination of No Violation of Section 337, 2002 WL 448690 at 59, (Mar. 22, 2002); *Enercon GmbH v. Int’l Trade Comm’n*, 151 F.3d 1376 (Fed. Cir. 1998).

Each patent claim element or limitation is considered material and essential. *London v. Carson Pirie Scott & Co.*, 946 F.2d 1534, 1538 (Fed. Cir. 1991).²¹ Literal infringement of a claim occurs when every limitation recited in the claim appears in the accused device, *i.e.*, when the properly construed claim reads on the accused device exactly. *Amhil Enters., Ltd. v. Wawa, Inc.*, 81 F.3d 1554, 1562 (Fed. Cir. 1996); *Southwall Tech. v. Cardinal IG Co.*, 54 F.3d 1570, 1575 (Fed Cir. 1995).

If the accused product does not literally infringe the patent claim, infringement might be found under the doctrine of equivalents. The Supreme Court has described the essential inquiry of the doctrine of equivalents analysis in terms of whether the accused product or process

²¹ Thus, if an accused device lacks a limitation of an independent claim, the device cannot infringe a dependent claim. See *Wahpeton Canvas Co. v. Frontier, Inc.*, 870 F.2d 1546, 1552 n.9 (Fed. Cir. 1989).

contains elements identical or equivalent to each claimed element of the patented invention.

Warner-Jenkinson Co., Inc. v. Hilton Davis Chemical Co., 520 U.S. 17, 40 (1997).

Under the doctrine of equivalents, infringement may be found if the accused product or process performs substantially the same function in substantially the same way to obtain substantially the same result. *Valmont Indus., Inc. v. Reinke Mfg. Co.*, 983 F.2d 1039, 1043 (Fed. Cir. 1993). The doctrine of equivalents does not allow claim limitations to be ignored. Evidence must be presented on a limitation-by-limitation basis, and not for the invention as a whole. *Warner-Jenkinson*, 520 U.S. at 29; *Hughes Aircraft Co. v. U.S.*, 86 F.3d 1566 (Fed. Cir. 1996). Thus, if an element is missing or not satisfied, infringement cannot be found under the doctrine of equivalents as a matter of law. *See, e.g., Wright Medical*, 122 F.3d 1440, 1444 (Fed. Cir. 1997); *Dolly, Inc. v. Spalding & Evenflo Cos., Inc.*, 16 F.3d 394, 398 (Fed. Cir. 1994); *London*, 946 F.2d at 1538-39; *Becton Dickinson and Co. v. C.R. Bard, Inc.*, 922 F.2d 792, 798 (Fed. Cir. 1990).

The concept of equivalency cannot embrace a structure that is specifically excluded from the scope of the claims. *Athletic Alternatives v. Prince Mfg., Inc.*, 73 F.3d 1573, 1581 (Fed. Cir. 1996). In applying the doctrine of equivalents, the Commission must be informed by the fundamental principle that a patent's claims define the limits of its protection. *See Charles Greiner & Co. v. Mari-Med. Mfg., Inc.*, 92 F.2d 1031, 1036 (Fed. Cir. 1992). As the Supreme Court has affirmed:

Each element contained in a patent claim is deemed material to defining the scope of the patented invention, and thus the doctrine of equivalents must be applied to individual elements of the claim, not to the invention as a whole. It is important to ensure that the application of the doctrine, even as to an individual element, is not

allowed such broad play as to effectively eliminate that element in its entirety.

Warner-Jenkinson, 520 U.S. at 29.

Prosecution history estoppel may bar the patentee from asserting equivalents if the scope of the claims has been narrowed by amendment during prosecution. A narrowing amendment may occur when either a preexisting claim limitation is narrowed by amendment, or a new claim limitation is added by amendment. These decisions make no distinction between the narrowing of a preexisting limitation and the addition of a new limitation. Either amendment will give rise to a presumptive estoppel if made for a reason related to patentability. *Honeywell Int'l Inc. v. Hamilton Sundstrand Corp.*, 370 F.3d 1131, 1139-41 (Fed. Cir. 2004), *cert. denied*, 545 U.S. 1127 (2005) (citing *Warner-Jenkinson*, 520 U.S. at 22, 33-34; and *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722, 733-34, 741 (2002)).

The presumption of estoppel may be rebutted if the patentee can demonstrate that: (1) the alleged equivalent would have been unforeseeable at the time the narrowing amendment was made; (2) the rationale underlying the narrowing amendment bore no more than a tangential relation to the equivalent at issue; or (3) there was some other reason suggesting that the patentee could not reasonably have been expected to have described the alleged equivalent. *Honeywell*, 370 F.3d at 1140 (citing, *inter alia*, *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 344 F.3d 1359 (Fed. Cir. 2003) (*en banc*)).

As noted, one claim limitation at issue in this investigation is alleged to be in means-plus-function format. “Literal infringement of a § 112, ¶ 6 limitation requires that the relevant structure in the accused device perform the identical function recited in the claim and be

identical or equivalent” to the structure identified in the written description as corresponding to the recited function. *JVW Enter. v. Interact Accessories, Inc.*, 424 F.3d 1324, 1333 (Fed. Cir. 2005) (citing *Odetics, Inc. v. Storage Tech. Corp.*, 185 F.3d 1259, 1267 (Fed. Cir. 1999)). For the relevant structure in the accused device to be equivalent to the structure in the written description, differences between the two must be insubstantial. For example, the structure in the accused device must perform the claimed function in substantially the same way to achieve substantially the same result as the structure in the written description. *JVW*, 424 F.3d at 1333.

“The primary difference between structural equivalents under section 112, paragraph 6 and the doctrine of equivalents is a question of timing.” *Frank’s Casing, Crew & Rental Tools, Inc. v. Weatherford Int’l, Inc.*, 389 F.3d 1370, 1379 (Fed. Cir. 2004) (citing *Al-Site Corp. v. VSI Int’l, Inc.*, 174 F.3d 1308, 1321 n.2 (Fed. Cir. 1999)). As the Federal Circuit has explained, “[a] proposed equivalent must have arisen at a definite period in time, i.e., either before or after [patent filing]. If before, a § 112, ¶ 6 structural equivalents analysis applies and any analysis for equivalent structure under the doctrine of equivalents collapses into the § 112, ¶ 6 analysis. If after, a non-textual infringement analysis proceeds under the doctrine of equivalents.” *Id.*

C. Validity

One cannot be held liable for practicing an invalid patent claim. See *Pandrol USA, LP v. AirBoss Railway Prods., Inc.*, 320 F.3d 1354, 1365 (Fed. Cir. 2003). However, the claims of a patent are presumed to be valid. 35 U.S.C. § 282; *DMI Inc. v. Deere & Co.*, 802 F.2d 421 (Fed. Cir. 1986). Although a complainant has the burden of proving a violation of section 337, it can rely on this presumption of validity. A respondent that has raised patent invalidity as an affirmative defense must overcome the presumption by “clear and convincing” evidence of

invalidity. *Checkpoint Systems, Inc. v. United States Int'l Trade Comm'n*, 54 F.3d 756, 761 (Fed. Cir. 1995).

1. Obviousness

Obviousness is grounded in 35 U.S.C. § 103, which provides, *inter alia*, that:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

35 U.S.C. § 103(a).

An allegation of obviousness is evaluated under the so-called *Graham* factors: (1) the scope and content of the prior art; (2) the differences between the prior art and the claims at issue; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness, the so-called “secondary considerations,” *e.g.*, commercial success, long felt need, and failure of others. *See Graham v. John Deere Co.*, 383 U.S. 1, 13-17 (1966); *Dystar Textilfarben GmbH v. C.H. Patrick Co.*, 464 F.3d 1356, 1361 (Fed. Cir. 2006).²²

“[E]vidence arising out of the so-called ‘secondary considerations’ must always when present be considered en route to a determination of obviousness.” *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538 (Fed. Cir. 1983). Secondary considerations, such as commercial success, will not always dislodge a determination of obviousness based on analysis of the prior

²² “Before answering *Graham*’s ‘content’ inquiry, it must be known whether a patent or publication is in the prior art under 35 U.S.C. § 102 – a legal question.” *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1568 (Fed. Cir. 1987).

art. See *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 426 (2007) (commercial success did not alter conclusion of obviousness).

“One of the ways in which a patent’s subject matter can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent’s claims.” *KSR*, 550 U.S. at 419-20. “[A]ny need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.” *Id.*

Specific teachings, suggestions, or motivations to combine prior art may provide helpful insights into the state of the art at the time of the alleged invention. *Id.* at 1741. Nevertheless, “an obviousness analysis cannot be confined by a formalistic conception of the words teaching, suggestion, and motivation, or by overemphasis on the importance of published articles and the explicit content of issued patents. The diversity of inventive pursuits and of modern technology counsels against limiting the analysis in this way.” *Id.* “Under the correct analysis, any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.” *Id.* at 420. A “person of ordinary skill is also a person of ordinary creativity” *Id.* at 421.

The Federal Circuit has harmonized the *KSR* opinion with many prior circuit court opinions by holding that when a patent challenger contends that a patent is invalid for obviousness based on a combination of prior art references, “the burden falls on the patent challenger to show by clear and convincing evidence that a person of ordinary skill in the art would have had reason to attempt to make the composition or device, or carry out the claimed process, and would have had a reasonable expectation of success in doing so.” *PharmaStem*

Therapeutics, Inc. v. ViaCell, Inc., 491 F.3d 1342, 1360 (Fed. Cir. 2007) (citing *Medichem S.A. v. Rolabo S.L.*, 437 F.3d 1175, 1164 (Fed. Cir. 2006)); see *KSR*, 550 U.S. at 416 (a combination of elements must do more than yield a predictable result; combining elements that work together in an unexpected and fruitful manner would not have been obvious).²³

The ultimate determination of whether an invention would have been obvious is a legal conclusion based on underlying findings of fact. *In re Dembiczak*, 175 F.3d 994, 998 (Fed. Cir. 1999).

2. The Written Description Requirement of Section 112

The first paragraph of Section 112 of the Patent Act provides:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

35 U.S.C. § 112, ¶ 1.

To satisfy the written description requirement, the applicant must “convey with reasonable clarity to those skilled in the art that, as of the filing date sought, he or she was in possession of the invention.” *Carnegie Mellon Univ. v. Hoffman-La Roche Inc.*, 541 F.3d 1115, 1122 (Fed. Cir. 2008). Nevertheless, a patent specification may contain a written description of a broadly claimed invention without describing all species that a claim encompasses. *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1563 n.6 (Fed. Cir. 1991).

²³ Further, “when the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be nonobvious.” *KSR*, 550 U.S. at 416 (citing *United States v. Adams*, 383 U.S. 39, 52 (1966)).

3. The Enablement Requirement of Section 112

A patent is enabled if its disclosure is sufficient to enable a person of ordinary skill in the art, after reading the specification, to make and use the claimed invention without undue experimentation. *In re Wands*, 858 F.2d 731, 736-37 (Fed. Cir. 1988); *Johns Hopkins Univ. v. Cellpro, Inc.*, 152 F.3d 1342, 1360 (Fed. Cir. 1998) (It is imperative when attempting to prove lack of enablement to show that one of ordinary skill in the art would be unable to make the claimed invention without undue experimentation.). A number of factors may be considered in determining whether a disclosure would require undue experimentation, including: (1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims. *Wands*, 858 F.2d at 737.

4. The Definiteness Requirement of Section 112

The definiteness requirement of 35 U.S.C. § 112 ensures that the patent claims particularly point out and distinctly claim the subject matter that the patentee regards to be the invention. See 35 U.S.C. § 112, ¶ 2; *Metabolite Labs., Inc. v. Laboratory Corp. of America Holdings*, 370 F.3d 1354, 1366 (Fed. Cir. 2004). If a claim's legal scope is not clear enough so that a person of ordinary skill in the art could determine whether or not a particular product infringes, the claim is indefinite, and is, therefore, invalid. *Geneva Pharm., Inc. v. GlaxoSmithKline PLC*, 349 F.3d 1373, 1384 (Fed. Cir. 2003). Thus, it has been found that:

When a proposed construction requires that an artisan make a separate infringement determination for every set of circumstances in which the composition may be used, and when such determinations are likely to result in differing outcomes

(sometimes infringing and sometimes not), that construction is likely to be indefinite.

Halliburton Energy Servs. v. M-I LLC, 514 F.3d 1244, 1255 (Fed. Cir. 2008).

5. The Best Mode Requirement of Section 112

As quoted above, the first paragraph of section 112 of the Patent Act places a best mode requirement on patentees. The Federal Circuit has set out a two-pronged test for determining whether an inventor has met the best mode requirement.

“First, the factfinder must determine whether, at the time of filing the application, the inventor possessed a best mode for practicing the invention.” *Eli Lilly and Co. v. Barr Labs., Inc.*, 251 F.3d 955, 963 (Fed. Cir. 2001) (citing *Chemcast Corp. v. Arco Indus. Corp.*, 913 F.2d 923, 927-28 (Fed. Cir.1990)). This involves a subjective inquiry whereby the factfinder focuses on the inventor's state of mind at the time of filing. *Id.*

“Second, if the inventor possessed a best mode, the factfinder must determine whether the written description disclosed the best mode such that one reasonably skilled in the art could practice it.” *Id.* This involves an objective inquiry focused on the scope of the claimed invention and the level of skill in the art. *Id.*

D. Inequitable Conduct

Applicants for patents have a duty to prosecute patents in the U.S. Patent and Trademark Office (“PTO”) with candor and good faith, which includes a duty to disclose information known to the applicants to be material to patentability. *Pharmacia Corp. v. Par Pharm, Inc.*, 417 F.3d 1369, 373 (Fed. Cir. 2005). A breach of this duty may render the patent that issues unenforceable for inequitable conduct. *Cargill, Inc. v. Canbra Foods, Ltd.*, 476 F.3d 1359, 1363 (Fed. Cir. 2007). Thus, a patent is unenforceable if the patentee withheld material information with an

intent to deceive or mislead the PTO. *See Purdue Pharma L.P. v. Endo Pharms., Inc.*, 438 F.3d 1123, 1128 (Fed. Cir. 2006).

The Federal Circuit has rejected a “but for” standard of materiality (*i.e.*, the patent would not have issued but for the omission of art from the prosecution). *Merck & Co. v. Danbury Pharmacal, Inc.*, 873 F.2d 1418, 1421 (Fed. Cir. 1989). Instead, information is deemed material “if there is a substantial likelihood that a reasonable examiner would consider it important in deciding whether to allow the application to issue as a patent.” *Brasseler, U.S.A. L.L.P. v. Stryker Sales Corp.*, 267 F.3d 1370, 1380 (Fed. Cir. 2001).

Intent is a subjective inquiry based on all the evidence, including evidence of good faith. *See Kingsdown Med. Consultants, Ltd. v. Hollister, Inc.*, 863 F.2d 867, 876 (Fed. Cir. 1988) (*en banc* in relevant part). A finding of deceptive intent requires clear and convincing evidence. *See Northern Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 939 (Fed. Cir. 1990). “[G]eneralized allegations lack the particularity required to meet the threshold level of deceptive intent necessary for a finding of inequitable conduct.” *Sanofi-Synthelabo v. Apotex, Inc.* 470 F.3d 1368, 1381 (Fed. Cir. 2006). Indeed, an intent to deceive, “cannot be ‘inferred solely from the fact that information was not disclosed; there must be a factual basis for a finding of deceptive intent.’” *Purdue Pharma, L.P.*, 438 F.3d at 1134 (quoting *Hebert v. Lisle Corp.*, 99 F.3d 1109, 1116 (Fed. Cir. 1996)).

In determining whether there has been inequitable conduct, a court (1) determines whether the withheld information meets a threshold level of materiality and whether the applicant’s conduct at issue meets a threshold level of intent to deceive, and (2) weighs the materiality and intent in light of the circumstances to determine whether the applicant’s conduct

is so culpable that the patent should be held unenforceable. *Cargill*, 476 F.3d at 1363.

IV. United States Patent No. 5,083,039

A. Claim Construction

The specification of the '039 patent states that the claimed invention "relates generally to wind turbines that operate at variable speed under varying wind conditions, and relates more particularly to a power converter for converting wind energy into AC electrical power at a controlled power factor and for controlling the torque generated by the wind turbine." CX-1 ('039 patent) at col. 1, lines 11-16 (Field of the Invention). Independent claim 121, the only claim of the '039 patent asserted by GE, is directed to a variable speed wind turbine, and provides, as follows:

121. A variable speed wind turbine comprising:

a turbine rotor including at least one blade mounted to a rotatable shaft;

a multiphase induction generator having a rotor coupled to the turbine shaft for rotation therewith;

a power converter for converting variable frequency electricity generated by the generator into fixed frequency electricity, the power converter including an inverter for supplying output electricity, wherein the inverter has active switches; and

inverter controller means coupled to the inverter and responsive to a power factor control signal for controlling the active switches to supply electricity at a desired angle between voltage and current.

Id. at col. 41, lines 35-48.

There is no dispute among the parties concerning the meaning of the claim preamble and the first claim element. There are, however, disputes concerning the construction of the

remaining claim elements, which are discussed in the following four categories: induction generator, power converter, inverter for supplying output electricity, and inverter controller means.

“induction generator”

GE argues that the induction generator required by the second element of claim 121 does not require a special construction, and that one of ordinary skill in the art would understand that the term refers to a generator with either a squirrel cage or a DFIG configuration.²⁴ GE Br. at 51-53. Mitsubishi argues that the language of claim 121, and the explicit statements of the specification, make it clear that the induction generator is limited to a squirrel cage induction generator, and cannot read on a doubly-fed generator such as a DFIG. Mitsubishi Br. at 11-12. The Staff argues that the term “induction generator” should be construed to mean “squirrel cage generator.” Staff Br. at 16-18.

The plain language of claim 121 does not expressly require that the induction generator have a squirrel cage design, or any other specific design.²⁵ Nor is there any claim language that expressly excludes a doubly-fed induction generator, or any other specific configuration of an induction generator.

Indeed, Mitsubishi and the Staff argue that the limitation they propose for the claim is evident, not through the term “induction generator,” *per se*, but rather by reading and considering

²⁴ The terms “squirrel cage” and “DFIG” are basic to the art, and are not in dispute. Both terms are discussed, *supra*, in Section I.B.1. (Technological Background).

²⁵ The claim does require a “multiphase” induction generator, but that term is not in dispute. Further, the fact that the claimed generator must be multiphase (which refers to the phases, or timing, of current) does not relate to the squirrel cage generator versus doubly-fed generator question raised by Mitsubishi and the Staff.

the language of “claim 121 as a whole and the explicit statements of the ‘039 patent specification.” *See* Mitsubishi Br. at 11; Staff Br. at 16-17. In particular, Mitsubishi points out that another limitation of claim 121 requires a converter (which is depicted in the specification’s Figure 2) to convert variable frequency energy into fixed frequency energy. It is argued that the requirement of such a converter makes sense only in the context of a squirrel cage generator because the energy flowing from a squirrel cage generator needs that type of conversion. In contrast, the stator of a doubly-fed generator (such as a DFIG) is connected directly to the grid, and does not require any conversion. Thus, Mitsubishi argues, a doubly-fed generator cannot be included in the term “induction generator.” The Staff uses similar reasoning with respect to the “inverter controller means,” arguing that it cannot work with a DFIG, only with a squirrel cage generator. *See* Staff Br. at 17-18.²⁶

The constructions proposed by Mitsubishi and the Staff cannot be reconciled with the claim language, the specification, and applicable law.

An induction generator is a class of machines called induction machines. The word “induction” is used because voltage is induced in the rotor of the machine as it moves relative to a magnetic field. *See* Kirtley Tr. 417-418. The term “induction generator” is used in the art to refer to both a squirrel cage generator and a doubly-fed generator (such as a DFIG) because they both induce voltages according to the same basic principle. That was the case when the application for the ‘039 patent was filed in 1991, when the patent issued, and has remained the case. *See* Habetler Tr. 1236; Kirtley Tr. 419.

²⁶ The terms “power converter” and “inverter controller means” are disputed, and are thus construed separately.

It is undisputed that the embodiment disclosed in the specification has a squirrel cage generator, and the power converter and inverter controller means, as described in the specification, are configured to interact with it. However, the particular examples or embodiments discussed in a specification generally are not to be read into the claims as limitations. *See Markman*, 52 F.3d at 979. Additionally, the '039 specification does not clearly manifest an intention to limit the claims to a particular embodiment. *See Innova/Pure Water*, 381 F.3d at 1117. In fact, while the specification indicates that the claimed invention should not be restricted to the embodiments disclosed therein, it goes well beyond any boilerplate statement, and provides, as follows:

From the above description, it will be apparent that the invention disclosed herein provides a novel and advantageous variable speed wind turbine. The foregoing discussion discloses and describes merely exemplary methods and embodiments of the present invention. As will be understood by those familiar with the art, the invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. For example, some aspects of the current controller can be performed in various ways equivalent to those disclosed herein, including using hysteresis control or forced oscillation with triangular intersection. ***The generator need not be a three-phase squirrel-cage induction generator, but may be any multiphase generator, including a synchronous generator.*** Certain aspects of the generator control could be performed open-loop, instead of the closed loop control disclosed herein. Also, the power converter could have a DC current link, or could be a cyclo-converter instead of a DC voltage link. In addition, the torque monitor could directly measure torque with a transducer, instead of inferring torque from the measured stator currents. Accordingly, the disclosure of the present invention is intended to be illustrative, but not limiting, of the scope of the invention, which is set forth in the following claims.

CX-1 ('039 patent), col. 19, lines 1-26 (emphasis added).

Thus, rather than seeking to confine the claimed invention to a turbine with a squirrel cage generator, the specification is consistent with the broad language of the claim, which literally reads on any multiphase induction generator.

Consequently, the term “induction generator” is construed to mean an induction generator. The induction generator need not be a squirrel cage induction generator.

“power converter”

GE argues that the term “power converter” in claim 121 should be accorded its plain and ordinary meaning as understood by one of ordinary skill in the art, and thus no formal claim construction should be required. GE argues that Mitsubishi’s proposed construction is an effort to limit claim 121 to the preferred embodiment of the specification. GE further argues that “if ‘power converter’ must be construed, the construction should be no narrower than ‘an AC-DC-AC power converter.’” GE Br. at 54-55.

Mitsubishi argues that “the ‘power converter’ of claim 121 should be construed as a power converter with a rectifier connected to the stator of the generator and with an inverter connected to the grid, wherein the power converter acts to convert the variable frequency generated by the generator into fixed frequency electricity.” Mitsubishi Br. at 8-11.²⁷

The Staff argues that “‘power converter’ means ‘an AC/DC/AC full power converter *with an inverter.*’” Staff Br. at 19 (emphasis by Staff). It is argued that GE’s construction of “power converter” is too broad, and is based on a construction that addresses the term in isolation without consideration of claim 121 as a whole. The Staff argues that the “induction generator”

²⁷ See Habetler Tr. 1132-1134 (with reference to a squirrel cage embodiment as disclosed in the ‘039 patent specification: “The rectifier has active switches in a bridge configuration that control the currents and while the inverter has active switches in a bridge configuration that control the currents at the line side of the power converter.”).

must be a squirrel-cage generator, and thus all of the power from the turbine must go through the power converter before reaching the grid (in contrast to a DFIG, in which case some of the power goes directly from the generator to the grid without passing through the power converter). *Id.* at 19-20.

The constructions proposed by Mitsubishi (and to a lesser extent, the Staff) would add limitations not found in the claim language, including the requirement that the power converter be a full power converter. Claim 121 contains no requirement that the power converter be fully rated. Indeed, it need not be fully rated if a generator other than a squirrel cage generator is used. Further, claim 121 never mentions the stator at all, let alone in connection with the power converter. *See Kirtley Tr. 437-439.*²⁸

Mitsubishi and the Staff base their proposed constructions on the requirements of a squirrel cage generator whose induced output is destined for the utility grid. *See Habetler Tr. 1127-1128* (testimony of Mitsubishi expert based on a squirrel cage generator). Yet, as discussed above, there is no requirement that the “multiphase induction generator” of claim 121 be so limited.

Consequently, the “power converter” is construed to mean a power converter that may be used in connection with the multiphase induction generator required in the preceding claim element (which need not be a squirrel cage generator). Further, there is no dispute that the power converter is an AC-DC-AC power converter, and, as expressed in the claim language, it includes an inverter.

²⁸ In contrast, claim 130 mentions the stator, and specifically a rectifier that includes “a pair of active switches for each phase of the generator coupled between the DC voltage link and a stator power tap.” *See CX-1* (‘039 patent), col. 14, lines 30-43.

“inverter for supplying output electricity”

GE argues that the term “inverter for supplying output electricity” should be construed to mean “[a]n inverter whose operation allows electricity to be supplied to the grid.” GE Br. at 56. It contends that claim 121 does not require the inverter to be connected directly to the grid (*i.e.*, through a direct or “copper-to-copper” connection), but that other components may be located between the inverter and the grid. GE further contends that Mitsubishi has not only impermissibly imported limitations from the specification concerning the location of the inverter, but also limitations concerning the inverter’s function (such as a requirement that the inverter supply both real and reactive power). *Id.* at 56-57.

Mitsubishi argues that the “inverter for supplying output electricity” must be construed to be a grid-side inverter connected to the grid that supplies both real and reactive power to the grid. It submits that such a construction is consistent with the term “inverter” as it is used in the specification and claims, and with the understanding of one of ordinary skill that an “inverter for supplying output electricity” is a grid-side inverter in a full power AC-DC-AC power converter. Mitsubishi Br. at 8-10. Mitsubishi states that, in fact, the ‘039 specification “explicitly defines the term ‘inverter’ as used in claim 121 to be the line-side or grid-side portion of the power converter.” *Id.* at 9 (citing CX-1 (‘039 patent), col. 2, lines 44-49).

The Staff argues that “inverter for supplying output electricity” is unambiguous and should be given its plain and ordinary meaning, which is “an inverter connected to the grid that can supply both real and reactive power to the grid.” Staff Br. at 21. The Staff “does not object to the scope of Complainant’s construction *per se*,” but argues that it is vague and could be misleading because the point of the entire system is to make sure that power gets from the

generator to the grid. *Id.* at 20-21.

The only limitations that the plain language of claim 121 expressly places on the inverter are: (1) that it must supply output electricity, and (2) that it must have active switches. Further, the specification passages relied upon by Mitsubishi to argue that the specification requires a line-side (*i.e.*, grid-side) inverter refer to a preferred embodiment, including the statement found within the “Summary of the Invention” portion of the specification.²⁹ The Summary portion of the specification is written in terms of “one illustrated embodiment,” and how it is “preferably” configured. *See* CX-1 (‘039 patent), col. 1, line 64; col. 2, lines 43, 63; col. 3, line 9. Thus, even the statement in the Summary portion of the specification, which places the inverter on the line side, cannot be read to define the inverter limitation for all embodiments of the claimed invention and all claims of the patent.³⁰

Accordingly, there is no limitation in the claim or the specification that requires the inverter to be located on the grid or line side; and no limitation should be placed on the inverter other than those required by the plain claim language.

“inverter controller means”

GE argues that while “this term uses the word ‘means’ (though that word is dropped in dependent claim 122), the claim itself easily recites sufficient structure such that it does not meet

²⁹ *See* CX-1 (‘039 patent), col. 2, lines 44-49 (“The rectifier has active switches in a bridge configuration that control the currents and voltages at the generator side of the power converter, while the inverter has active switches in a bridge configuration that control the currents at the line side of the power converter.”).

³⁰ Mitsubishi’s arguments are based in large part on portions of the specification that relate specifically to squirrel cage generators, and which, according to Mitsubishi, preclude claim 121 from reading on a “doubly-fed system.” *See* Mitsubishi Br. at 9. As stated, *supra*, in connection with other claim construction issues, it is not found that the “multiphase induction generator” required by claim 121 is limited to a squirrel cage generator.

the statutory requirements for construction under 35 U.S.C. § 112, ¶ 6.” GE Br. at 58-59 (citing, *inter alia*, *Mass. Inst. of Tech. v. Abacus Software*, 462 F.3d 1344, 1356 (Fed. Cir. 2006)).³¹

GE further argues that the inverter controller is not a general-purpose computer, and that the patent provides an example of a specialized part (identified by part number) that one of ordinary skill would be able to buy or build and then program to perform the desired functions set forth in claim 121, *i.e.*, controlling the active switches to supply electricity at a desired angle between voltage and current. GE argues that claim 121 also specifies that the inverter controller must be responsive to a power factor control signal that establishes the desired angle. *Id.* at 59-60.

Mitsubishi argues that GE has failed to rebut the presumption that the “inverter controller means” is a means-plus-function element, and further that the specification and prosecution history confirm the understanding that it is such an element. Indeed, the Mitsubishi respondents contend that the algorithms or structure necessary to accomplish control of the inverter are not disclosed within claim 121. As a result, the “inverter controller means” must be construed according section 112, paragraph 6, as a mean-plus-function element. In addition, Mitsubishi argues that the structure for the inverter controller means is shown in the specification to be “a power controller 54 connected to the grid-side inverter control unit 88 shown in Figure 2, where the required structure for the inverter control unit 88 is given in Figure 13.” Mitsubishi Br. at 5-8.³²

³¹ GE elaborates on its claim comparison argument by comparing the language of claims 121, 122, and 124, and stating that the fact that the terms “inverter controller” and “inverter controller means” are used interchangeably further evidences that “inverter controller means” is not a means-plus-function term. *See* GE Br. at 60-61.

³² In view of its contention that the “inverter controller means” is not a means-plus-function element, GE argues that Mitsubishi’s reference to a “grid-side” inverter
(continued...)

The Staff argues that the “inverter controller means” is a means-plus-function element as provided for in 35 U.S.C. § 112, ¶6. It further argues that the function is “controlling the inverter switches to supply electricity at a desired angle between the voltage and current,” and the corresponding structure is “a power factor controller connected to the line-side inverter control unit shown in Figure 2; and the inverter control unit that operates by controlling the power factor angle shown in Figure 13, and equivalents thereof.” Staff Br. at 11-15 (citing, *inter alia*, CX-1 (‘039 patent), col. 5, lines 43-46, col. 18, lines 44-58 & Figs. 2, 13).³³

By arguing that the “inverter controller means” is a means-plus-function limitation, Mitsubishi and the Staff refer to the embodiment of the specification not only to supply a structure for the limitation, but also to read into claim 121 the specific requirements of a system based on a squirrel cage generator. It would be remarkable if a squirrel cage limitation were to be read into claim 121 in this manner, inasmuch as other claim limitations, discussed above, are not limited by the claim language or the specification to a squirrel cage system.³⁴

³²(...continued)
impermissibly imports a limitation into the claim. See GE Br. at 61-62; GE Reply at 29.

³³ GE argues that the power factor controller cannot be part of the inverter controller means because Figure 1 of the ‘039 patent shows two inverter controllers (items 50 and 52) yet only one power factor controller (item 54). Thus, it is argued, the Staff’s proposed construction would read out a disclosed embodiment, and such constructions are rarely, if ever, correct. See GE Br. at 62 (citing *Vitronics*, 90 F.3d at 1583). In response, the Staff argues that the claim itself provides that the inverter controller means must be responsive to a power factor control signal, and that Figure 13 shows that the only device responsive to the power factor control signal is the power factor controller. Thus, the Staff argues, regardless of whether or not the “inverter controller means” is ultimately construed to be a means-plus-function element, in any event, “it must include the power factor controller in order to cover the patent’s preferred embodiment.” See Staff Br. at 3 (citing *Vitronics*, 90 F.3d at 1583).

³⁴ Mitsubishi makes a passing reference to a remark made by the examiner during a reexamination proceeding to the effect that claim 121 is a means-plus-function claim. See
(continued...)

In any event, before looking to the preferred embodiment to define the structure of the inverter controller means, one must first decide whether or not the inverter controller means is in fact a means-plus-function limitation. *See Net MoneyIn, Inc. v. Verisign, Inc.*, 545 F.3d 1359, 1366 (Fed. Cir. 2008).

There can be no dispute that the word “means” appears in the claim limitation at issue. GE points out, however, that other claims refer to an inverter controller, including dependent claim 124 (which refers to “the inverter controller means”), but also dependent claim 122 (which refers to the “inverter controller” without the word “means”). GE Br. at 60. That argument is entitled to some weight, but the fact remains that claim 121 does refer to a particular “means” whose function, according to the claim, is “controlling the active switches to supply electricity at a desired angle between voltage and current.” The question is whether or not the claim language itself discloses a structure that is sufficient to perform the required function in its entirety. *See Altiris*, 318 F.3d at 1375.

If one looks to claim 121 for a detailed structure, or an algorithm (as suggested by Mitsubishi), one will find nothing. Indeed, the only structure in the claim identified by GE for the “inverter controller means” are the words “inverter controller” themselves. *See* GE Br. at 59. At first, this argument may seem circular, *i.e.*, that the structure for the claimed inverter controller means is the inverter controller. However, the specification confirms that an “inverter

³⁴(...continued)
Mitsubishi Br. at 6-7 (citing RX-76 at GEWT00006127)). Without citing hearing testimony to put the remark in context, or providing a thorough quotation of the remark and discussion of its meaning, it is not possible to give the statement much weight. Moreover, it is the statements of the applicant during the prosecution of the patent, rather than those of the examiner, that are usually accorded weight when narrowing the interpretation of claim terms. *See Southwall* 54 F.3d at 1576.

controller” as contained in the language of the claim is in fact the required structure. In particular, the specification provides:

Turning now to the inverter side of the wind turbine system, the details of the inverter control unit 88 are shown in FIGS. 13-15. Like the generator control unit 76, ***the inverter control unit is preferably implemented with a digital signal processor, a Texas Instruments model TMS320C25.*** Computer code for implementing the inverter control function in a DSP is disclosed in the microfiche appendix.

CX-1, col. 16, lines 48-55 (emphasis added).

Thus, the specification shows that the inverter control unit is simply an inverter controller which, in the case of the preferred embodiment, is implemented in the form of a digital processor, specifically a TI TMS320C35, programmed to function according to the algorithms or other detailed information provided in the Figures. The disclosure of the specification is consistent with the knowledge of one of ordinary skill in the art, who would recognize an inverter controller as a piece of equipment or a component, and also would be able to buy a processor. The claim instructs one where to locate the controller, *i.e.*, “coupled to the inverter.” Further, one of ordinary skill would already know how to program such a processor. One would need only to know what the processor should be programmed to do, but that information is explicitly provided by the claim language, *i.e.*, respond “to a power factor control signal for controlling the active switches to supply electricity at a desired angle between voltage and current.” *See* Kirtley Tr. 483-483, 659-661.

According to the specification, the information disclosed in connection with inverter control unit 88, and depicted in Figures 13-15, is an example of how the digital processor should be programmed in the preferred embodiment. Those examples are not to be confused with a

structure needed to complete a means-plus-function claim limitation. Nor has any reason been shown to restrict the claim to the preferred embodiment by reading that particular information from the specification into the claim.³⁵

Accordingly, the “inverter controller means” is not a means-plus-function limitation. It is an inverter controller, *i.e.*, a piece of equipment that may be implemented in the form of a digital processor. Further, the inverter controller means and its operations are not restricted to the examples, algorithms or other programming information contained in the specification for the preferred embodiment. However, as required by the plain language of claim 121, the inverter controller means must control the active switches to supply electricity at a desired angle between voltage and current.

B. Infringement Determination

GE accuses Mitsubishi’s MWT of literal infringement of claim 121 of the ‘039 patent. GE Br. at 51-68. Further, GE argues that if claim 121 were limited to the specification’s preferred embodiment (which is the way that GE characterizes Mitsubishi’s proposed claim construction), the MWT would infringe under the doctrine of equivalents. *Id.* at 68-69.

Mitsubishi argues that the MWT does not infringe claim 121 either literally, or under the doctrine of equivalents. Mitsubishi Br. at 18-26. The Staff also argues that the MWT does not infringe either literally, or under the doctrine of equivalents. Staff Br. at 27-34.

³⁵ Even in the case of a means-plus-function limitation covering a computer or controller, the algorithm itself is not the structure. Rather, the structure is a special computer or controller that has been programmed to perform the disclosed algorithm. *See MoneyIn*, 545 F.3d at 1367 (quoting *Aristocrat Techs. Austl. Pty Ltd. v. Int’l Game Tech.*, 521 F.3d 1328, 1333 (Fed. Cir. 2008)).

The dispute concerning the question of infringement centers around the following four limitations (which were also areas of dispute with respect to claim construction): induction generator, power converter, inverter for supplying output electricity, and inverter controller means. Each disputed element is discussed below.

1. Literal Infringement

“induction generator”

As noted, no party disputes the fact that the MWT uses an induction generator, specifically, a multiphase induction generator. In fact, the MWT uses a doubly-fed induction generator, or DFIG, that produces three-phase electricity. *See* Kirtley Tr. 387-388, 430-432. The noninfringement arguments of Mitsubishi and the Staff with respect to this limitation are based on their proposed claim constructions that would limit the “induction generator” to a squirrel cage generator. As discussed above in connection with claim construction, those proposals were rejected in favor of a construction that allows squirrel cage and other generators (in particular DFIGs) to meet this claim limitation.

Accordingly, it is found that the MWT practices the “induction generator” limitation literally.

“power converter”

The evidence shows that the DFIG of the accused MWT directly converts variable frequency electricity from the generator into fixed electricity. In fact, the MWT has an AC-DC-AC power converter with an inverter. *See* Kirtley Tr. 441-445, 699-700; Habetler Tr. 1195-1196, 1241-1242.

Thus, the MWT practices this claim limitation literally.

“inverter for supplying output electricity”

As discussed above in connection with claim construction, the stator of a doubly-fed generator (such as a DFIG) is connected directly to the grid. Thus, the path of output electricity from a DFIG differs from that of the squirrel cage generator to which Mitsubishi and the Staff would limit claim 121. However, as also discussed above, the claim is not so limited. Further, there is no limitation in the claim language (or in the specification) that requires the inverter to be located on the grid (*i.e.*, line) side.

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Accordingly, the MWT practices this claim limitation literally.

“inverter controller means”

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³⁶ [

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According to the express claim language, the inverter controller must be “responsive to a power factor control signal for controlling the active switches to supply electricity at a desired angle between voltage and current.” [

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Accordingly, the MWT practices this claim limitation literally.

2. Doctrine of Equivalents

Because the MWT practices each limitation of claim 121 literally, there is no need to conduct an analysis under the doctrine of equivalents to determine whether or not the MWT practices the claim. In any event, based on the sparse analysis presented by GE on this issue, it is unclear whether infringement could be found under the doctrine of equivalents on a limitation-by-limitation basis. *See* GE Br. at 68-69.

3. Summary Concerning Infringement of Claim 121

It is found by a preponderance of the evidence that the accused MWT practices claim 121 of the '039 patent literally. It has not been found that the MWT would practice claim 121 under the doctrine of equivalents.

C. Domestic Industry

As detailed in Section I.A., it already has been found in an unreviewed initial determination that the economic prong of the domestic industry requirement is satisfied with respect to each asserted patent. Further, as detailed in Section I.B.5., GE relies on the GE Turbine to argue that the technical prong has been satisfied with respect to each asserted patent. GE Br. at 69-71 (arguing that the GE Turbine literally practices claim 121 of the '039 patent, as well as under the doctrine of equivalents, if the claim were limited to a squirrel cage configuration).³⁷

³⁷ In its brief, GE advances a two-paragraph, alternative argument concerning domestic industry. It is argued that licensing of the asserted patents establishes a domestic industry, apparently with respect to each patent-in-suit. GE also argues that the undersigned erroneously sustained Mitsubishi's objection during the hearing to the testimony of GE witness McGinness concerning licensing. In arguing that the ruling at the hearing was "improper," GE criticizes the "extra-statutory distinction between 'technical' and 'economic' prongs" of the domestic industry requirement. *See* GE Br. at 97-98.

GE's latest argument concerning the testimony of Mr. McGinness (who did testify on other subjects) is remarkable because during the hearing, it was GE that insisted, on more than one occasion, that there was indeed a distinction between the technical and economic prongs of the domestic industry requirement, and further that somehow the admission of the disputed testimony on licensing would assist GE in establishing the "technical prong" of the domestic industry requirement. *See* Tr. 315 ("For the purposes of Mr. McGinness's testimony, we're soliciting domestic industry information for application to the technical prong."), Tr. 375-376 ("We were offering it solely for the technical prong and for secondary considerations, which he will testify to during our rebuttal case."), Tr. 1817 ("our ill-fated campaign of last week regarding the technical prong"). *See also* Staff Br. at 20-21 (arguing waiver because GE had failed in a timely fashion to plead domestic industry based on licensing).

At the hearing, GE's response to Mitsubishi's objection, in which GE attempted to link
(continued...)

Mitsubishi, in an abbreviated argument, takes the position that the GE Turbine does not practice any asserted patent, including the '039 patent. Mitsubishi Br. at 27-28. Similarly, the Staff argues that GE has not satisfied the technical prong of the domestic industry requirement with respect to any asserted patent, including the '039 patent. Staff Br. at 70.

Both Mitsubishi and the Staff argue that the GE Turbine fails to practice claim 121 for the same reasons set forth with respect to the MWT. They argue that, like the MWT, the GE Turbine lacks the required “induction generator,” “power converter,” “inverter for supplying output electricity,” and “inverter controller means.” Mitsubishi Br. at 27-28 (“Thus, for at least the same reasons the Mitsubishi Wind Turbine does not infringe, the GE wind turbine does not practice claim 121.”); Staff Br. 71 (“In sum, the GE wind turbine is more similar to the accused MHI Wind Turbine than it is to the patent. Thus, for the reasons that the MHI Wind Turbine does not infringe, the GE wind turbine does not practice the '039 patent.”).

Yet, as discussed previously, the proposed claim constructions of Mitsubishi and the Staff were not adopted, and the MWT was found to infringe claim 121 of the '039 patent. For example, the GE Turbine, like the MWT, [

³⁷(...continued)
licensing to the technical prong, was unclear. In view of GE’s new statements (in its post-hearing brief) concerning the technical prong of the domestic industry requirement, GE’s arguments made at the hearing appear to be abandoned.

In any event, GE has not established a domestic industry based on licensing for the '039 patent, or any other patent asserted in this investigation for that matter.

] is an induction generator and supplies multiphase power, thus satisfying the “multiphase induction generator” limitation of the claim. *See* Kirtley Tr. 544-545.

The record evidence shows that the GE Turbine practices each of the additional limitations of claim 121, including the disputed limitations. [

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Accordingly, it is found that the GE Turbine literally practices claim 121, and thus the technical prong of the domestic industry requirement is met with respect to the ‘039 patent.³⁸

1. **Summary Concerning Domestic Industry Under the ‘039 Patent**

GE has demonstrated by a preponderance of the evidence that the domestic industry requirement is satisfied with respect to the ‘039 patent.

D. Validity Determination

Mitsubishi argues that if GE’s proposed claim constructions are adopted, claim 121 of the ‘039 patent should be found invalid on three grounds: lack of enablement; lack of adequate written description; and obviousness. Mitsubishi Br. at 12-18, 28-35; Mitsubishi Reply at 35-42. GE argues that Mitsubishi has failed to establish that the asserted claim is invalid due to obviousness, lack of enablement, or lack of written description. GE Br. at 71-81; GE Reply at

³⁸ GE’s brief does not offer a thorough doctrine of equivalents analysis, and is generally based on the arguments made in connection with the MWT. *See* GE Br. at 71.

36-42. The Staff disagrees with Mitsubishi as to certain prior art raised in connection with alleged obviousness; and further argues that if claim 121 is construed to contain a means-plus-function element, the invalidity defenses need not be reached. Staff Br. at 35-36.

1. Enablement

Mitsubishi argues that if GE's proposed claim constructions were adopted, claim 121 of the '039 patent would be invalid for lack of enablement. In particular, it is argued that GE's own expert, Dr. Kirtley, admitted that to the extent there is any novelty in claim 121, it is found within the inverter control unit shown in Figure 13, and how that element uses the power factor angle, ϕ , to control the power factor. [

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GE argues that Mitsubishi has failed to meet its burden of proving by clear and convincing evidence that claim 121 lacks enablement. GE Br. at 80-81.

As discussed above, the Staff does not reach the enablement defense under its proposed claim construction. Staff Br. 35-36.

Mitsubishi's argument rests on a faulty characterization of Dr. Kirtley's testimony. He did not testify that any novelty in claim 121 is found within the particular inverter control unit shown in Figure 13. Rather, Dr. Kirtley testified that Figure 13 illustrates only one embodiment of an inverter controller. *See* Kirtley Tr. 658 ("I guess I would have to say this is a description of an embodiment of an embodiment. This is one way of doing the -- that inverter controller."). Dr. Kirtley further testified: "It's a combination of elements that makes up the novelty of this invention. * * * I think the novelty in this invention is in the combination of elements, including the notion of operating a machine at a -- a desired power factor angle." Kirtley Tr. 657. Additionally, it has not otherwise been shown that the novelty of claim 121 lies only in Figure 13.

Thus, Mitsubishi's argument that other embodiments cannot be enabled simply because they are not disclosed in the specification, *i.e.*, Figure 13, must fail. Moreover, the use of inverters to control DFIGs and squirrel cage generators was well known in the art. With the teachings of the '039 patent, one of ordinary skill would have been able to implement the inverter controller aspects of claim 121. *See* Kirtley Tr. 659-661, 2333.³⁹ Indeed, in GE's rebuttal case, Dr. Kirtley reviewed the state of the art when the application was filed to support his testimony

³⁹ Relying on *Auto. Techs. Int'l, Inc. v. BMW*, 501 F.3d 1274, (Fed. Cir. 2007), Mitsubishi places little or no value on the knowledge of one of ordinary skill. *See* Mitsubishi Br. at 14-15. In its *Auto. Techs.* opinion, the Federal Circuit stated that "[i]t is the specification, not the knowledge of one skilled in the art, that must supply the novel aspects of an invention in order to constitute adequate enablement." 501 F.3d at 1283. However, as discussed, *supra*, Mitsubishi's characterization of the claimed invention, and of the related testimony of GE's expert, is erroneous. It has not been established that the only possible point of novelty of claim 121 resides solely in the implementation of an inverter controller shown in Figure 13. Thus, the particular aspect of the *Auto. Techs.* opinion relied upon by Mitsubishi is inapplicable here. It is also noted that even in the *Auto. Techs.* analysis, "the knowledge of one skilled in the art is indeed relevant." *Id.*

that doubly-fed induction generators were one of only two types of induction generators used in variable-speed wind turbines. *See* Habetler Tr. 1236; Kirtley Tr. 419. Indeed, DFIGs were well known in the art prior to the filing of the application for the '039 patent. The use of inverters to control DFIGs, as well as squirrel cage generators, likewise was well known in the art. Literature concerning the use and control of DFIGs was widely available (a fact that Mitsubishi argues, *infra*, in connection with alleged obviousness). *See* Kirtley Tr. 419-423; Habetler Tr. 1236, 1273.

A patentee is not required to describe all species encompassed by a claim. *See Cordis Corp. v. Medtronic AVE, Inc.*, 339 F.3d 1352, 1365 (Fed. Cir. 2003). In this instance, there is no indication that the patentees were required to discuss (or illustrate) a DFIG embodiment in order to inform a person of ordinary skill that they were in possession of the claimed invention, including an invention that may be implemented with a DFIG.

Accordingly, it has not been shown by clear and convincing evidence that claim 121 is invalid due to a failure to provide an adequate written description.

3. Obviousness

Mitsubishi does not argue that claim 121 should necessarily be found invalid due to obviousness. Rather, Mitsubishi argues that “under the expansive claim constructions argued by GE, claim 121 would also be invalid as obvious in light of the dissertation of Arsudis, ‘Double-Fed Three-Phase Generator with Voltage Link Converter in the Rotor Circuit’ (1989) [(Arsudis) (RX-323; RX-324 (translation))], either alone, or in combination with the other prior art cited at the hearing.” Mitsubishi Br. at 28. The other prior art items specifically cited by Mitsubishi are: Warneke, Otto, “Use of a Double-Fed Induction Machine in the Growian Large

Wind Energy Converter,” Siemens Power Engineering, Vol. VI, No. 1, pp. 56-59 (Jan./Feb. 1984) (“Warneke”) (RX-39); Mohan et al., “Power Electronics, Converters, Applications, and Design,” John Wiley & Sons (1989) (“Mohan”) (RX-85); and Ooi et al., “A Three-Phase Controlled Current PWM Converter with Leading Power Factor,” IEEE Transactions on Industry Applications, Vol. 1A-23 (Jan./Feb. 1987) (“Ooi”) (RX-86).⁴¹ *Id.* at 32-35.

GE argues that Mitsubishi has failed to prove by clear and convincing evidence that claim 121 is obvious. GE Br. at 71-79. The Staff does not join with Mitsubishi as to certain prior art and argues that Mitsubishi’s invalidity arguments need not be reached because, in its view, claim 121 should not be construed in the manner proposed by GE. Staff Br. at 35-36.

As discussed in the claim construction section above, it has not been found that claim 121 must contain the limitations proposed by Mitsubishi, such as requirements that the claim read only on a wind turbine with a squirrel cage generator, only on a turbine with a fully rated power converter, and only on the inverter controller means disclosed in the specification. Thus, it is necessary to consider Mitsubishi’s alternate arguments relating to alleged obviousness, including the prior art upon which Mitsubishi relies.

A theme common to the ‘039 patent and much of the prior art in question is the ability to supply electricity at a desired angle between voltage and current. In general, the ability to control the angle between voltage and current is important to many applications, including the management of reactive power. The record shows that power plants must manage reactive power because it significantly affects voltage on the grid. *See* Lyons Tr. 238. With so-called “weak

⁴¹ The Staff does not dispute the private parties’ stipulation that Arsudis, Warneke, Mohan and Ooi qualify as prior art to the ‘039 patent under 35 U.S.C. § 102(b). *See* Joint Submission and Stipulation Regarding Prior Art (“Prior Art Stips.”), ¶ 1 (May 7, 2009).

grids” (such as remote locations where wind turbines tend to be located), reactive power management helps prevent rapid and random fluctuations in the grid voltage, known as “voltage flicker.” Voltage flicker may, among other things, cause bulbs to flicker. Lyons Tr. 219-220, 238-240.

Specifically with respect to the ‘039 patent, GE’s expert, Dr. Kirtley, described in his direct hearing testimony how, in 1991 (when the patent application was filed), conventional power plants used reactive power (represented as Q^* , in contrast to real power P^*) to obtain a steady voltage at the point of interconnection to the grid. Dr. Kirtley testified as follows:

A. Yes. There really were two methods that were used in large power plants. One was a voltage regulator, which was simply a feedback loop that measured output voltage and readjusted field currents to achieve the right terminal voltage.

And another method that was sometimes used was to operate the plant to a defined level of reactive power; that is, the system operator would ask the power plant to generate to a specific level of reactive power.

Kirtley Tr. 2338.

Furthermore, according to Dr. Kirtley, the ‘039 patent offered something new:

Q. What about controlling to a constant power factor where P and Q would move up and down together?

A. I don’t believe that -- I had -- I have never heard of that being done before -- before this was invented for wind turbines.

Q. Okay. Do you think that one of ordinary skill in the art in 1991 would have been motivated to try this fixed power factor control for a wind turbine?

A. I don’t think -- I think that was really an inventive thing. I think one of ordinary skill in the art would probably have thought about the two methods that had already been used for other kinds

of power plants.

Kirtley Tr. 2338-2339.

Indeed, in hindsight, the use of fixed power control for wind turbines is a useful innovation. It is practiced by both Mitsubishi and GE, as discussed above in connection with the infringement and domestic industry issues. However, in analyzing the prior art, one must avoid using hindsight knowledge to determine whether or not a patent claim is obvious. *See Graham*, 383 U.S. at 36; *Sanofi-Synthelabo v. Apotex, Inc.*, 550 F.3d 1075, 1088 (Fed. Cir. 2008).

In arguing that claim 121 is obvious, Mitsubishi relies primarily upon the Arsudis dissertation because, as explained by GE's expert during cross-examination at the hearing, it contains all the elements and limitations of claim 121, except the final element, *i.e.*, "inverter controller means coupled to the inverter and responsive to a power factor control signal for controlling the active switches to supply electricity at a desired angle between voltage and current." *See* Kirtley Tr. 2375-2376.

Mitsubishi does not raise invalidity under 35 U.S.C. § 102 (anticipation), but it does argue that Arsudis alone, as read by one of ordinary skill, would render claim 121 obvious under section 103. Further, Mitsubishi argues that the inverter controller limitation would have been supplied by a number of other prior art teachings as reflected in the documents identified above, *i.e.*, Warneke, Mohan, and Ooi.

For the reasons discussed below, it has not been shown that any single prior art item, or combination of prior art, identified by Mitsubishi renders claim 121 obvious.⁴²

⁴² The record also contains some evidence relating to secondary considerations that, although not of great weight, supports the validity of the claim 121. Most significantly, the '039
(continued...)

Arsudis

Arsudis (RX-323; RX-324 (translation)) does not disclose an “inverter controller means coupled to the inverter and responsive to a power factor control signal,” or “controlling the active switches to supply electricity at a desired angle between voltage and current,” which are both required by claim 121. *See* Kirtley Tr. 2376. In fact, no power factor control signal is disclosed in the Arsudis dissertation, so the output electricity is not controlled to a desired angle between voltage and current. Kirtley Tr. 2391.

Mitsubishi’s obviousness arguments are built primarily upon supposed admissions by GE’s Dr. Kirtley to the effect that (quoting Mitsubishi’s brief): “the ability to control the power factor of the electricity output to the grid using a power factor control was what was new in the ‘039 patent and a significant departure from the independent control of real and reactive power used in conventional power plants.” Mitsubishi Br. at 30 (citing Kirtley Tr. 2338). The portion of Dr. Kirtley’s testimony at issue is quoted at length above.

In no portion of his testimony did Dr. Kirtley opine that the mere ability to control the power factor was an inventive concept. As already discussed in connection with the enablement defense, Dr. Kirtley testified that “novelty in this invention is in the combination of elements, including the notion of operating a machine at a -- a desired power factor angle.” *See* Kirtley Tr. 657. According to the actual testimony of Dr. Kirtley, a key element of claim 121 is “controlling to a constant power factor where P and Q would move up and down together.” *See*

⁴²(...continued)
patent is the subject of 10 licenses. The licenses cover more than the ‘039 patent, but eight of them specifically enumerate the patent. Additionally, according to a GE witness involved in license negotiations, inclusion of the ‘039 patent is requested by potential licensees. *See* McGinness Tr. 2269-2277, 2290.

Kirtley Tr. 2338, 2342-2343.

Yet, Arsudis discloses P output from the turbine that changes with the wind, but Q does not do so. Thus, P and Q do not move up and down together. Indeed, no power factor control signal is disclosed in the Arsudis dissertation inasmuch as power factor control like that claimed by the '039 patent is not taught in the dissertation. *See* Kirtley Tr. 2340-2341, 2391. It has not been shown that Arsudis alone, as read by one of ordinary skill, discloses the required power factor control.

Thus, it has not been shown that to one of ordinary skill, claim 121 would have been obvious in view of the Arsudis dissertation alone. Nor, as discussed below, has it been established that the other prior art relied upon by Mitsubishi supplies the claim limitations missing from Arsudis, let alone that one of ordinary skill would combine the art in the manner argued by Mitsubishi.

Warneke

The Warneke article (RX-39) discusses the use of a specific doubly-fed induction generator in the "Growian large wind energy converter" built in Germany. As in the case of other doubly-fed induction generators discussed herein, "[t]he stator of the induction generator is connected to the system." *See* RX-39 (Warneke) at MHI4002403. Warneke states that "[t]he rotor is fed via sliprings from a cycloconverter that controls the frequency, amplitude and phase angle of the rotor currents. The frequency is controlled so that the sum of the rotor rotational frequency and rotor current frequency is always equal to the system frequency. By changing the phase angle between the cycloconverter output voltage and rotor current, the active and reactive power of the double-fed induction machine can be controlled independently." *Id.* While some

aspects of this description are similar to the DFIG technology already discussed, and also include some limitations of claim 121, it is noted that a cycloconverter, unlike the power converter of claim 121, does not contain an inverter. *See* Kirtley Tr. 2356.

Moreover, Warneke does not teach control to a desired angle between voltage and current or responsiveness to a power factor control signal. *See* Kirtley Tr. 2354- 2357. There is vague reference to “power factor control” in the Warneke text and accompanying figure, but there is no disclosure of the power factor control signal required by claim 121. *See* Kirtley Tr. 2356-2358.

While it might be tempting to assume that Warneke’s mention of power factor control must refer to power factor control as disclosed in the ‘039 patent (as Mitsubishi has done), such would be an exercise of impermissible hindsight. Additionally, even assuming that Warneke’s reference to power factor control refers to something similar to the power factor control claimed by the ‘039 patent, Warneke would fail to disclose to one of ordinary skill how to put it to use, specifically to obtain fixed power-factor control for a variable-speed wind turbine. *See* Kirtley Tr. 2354, 2356-2359.

Mohan

Mitsubishi argues that “the purportedly ‘new’ power factor control of claim 121 was being taught to college students in textbooks,” as in the Mohan text (RX-85) that Mitsubishi relies upon in this investigation. Mitsubishi Br. at 34. Mohan was already before PTO during the reexamination of the ‘039 patent, during which the patentability of the claim was confirmed. *See* CX-1 (includes reexamination certificate); RX-76 (patent prosecution) at GEWT00006095. In fact, the applicant for reexamination made some of the same arguments concerning Mohan that Mitsubishi’s expert made during the hearing in this investigation. *See* Habetler Tr. 1212-

1213.

Further, although Mitsubishi argues that Mohan discloses the “purportedly ‘new’ power factor control of claim 121,” as already discussed twice, Mitsubishi has a narrow and incorrect view of GE’s argument concerning the novelty of claim 121. Thus, Mitsubishi’s argument concerning Mohan, and a combination of Arsudis and Mohan, is based on a faulty characterization of GE’s argument.

While Mohan, within its many hundred of pages, does contain a section relating to wind power and the grid, that section does not mention power factor. Moreover, even the figure in that section would not work with a multiphase induction generator due to its lack of active switches to excite the generator. *See* Kirtley Tr. 2345-2346; Habetler Tr. 1133, 1212-1213. The section of Mohan upon which Mitsubishi principally relies discusses utility interfaces and electric locomotives, and specifically refers to a single-phase circuit, rather than adapting its teachings to a multiphase induction generator. It is unclear whether one of ordinary skill could modify Mohan’s teaching for use with a multiphase generator, as required by claim 121. *See* Kirtley Tr. 2345-2347; Habetler Tr. 1193; RX-85 (Mohan) MHI0000437 (Mohan, pp. 424-25).

Finally, the section of Mohan (in chapter 17) that Mitsubishi relies upon for disclosures relating to power factor, discusses how to produce power only at a unity power factor, but does not show control to other desired angles between voltage and current. Nor does it disclose control in response to a power factor control signal, which is also required by claim 121. *See* Kirtley Tr. 2347-2348.

Thus, not only has Mitsubishi selectively pieced together portions of the Mohan text based on the teachings of the ‘039 patent, Mitsubishi has not managed to assemble together all of

the limitations of claim 121 that are absent from the Arsudis dissertation.

Ooi

Finally, Mitsubishi also relies upon Ooi (RX-86) in combination Arsudis, or Arsudis and Mohan, in connection with its obviousness defense. Mitsubishi Br. at 33-35. Ooi, along with Mohan, was before the PTO during reexamination of the '039 patent. The patentability of all claims of the '039 patent was confirmed. *See* CX-1 (includes reexamination certificate); RX-76 (patent prosecution) at GEWT00006095; Habetler Tr. 1212-1213.

Ooi describes the results of an experiment to teach how to use an inverter to make reactive power. Ooi taught “that you could actually inject current into the power system with both real and reactive power being controllable.” Kirtley Tr. 2352. However, Ooi does not address considerations particular to wind turbines and how they connect to the grid, especially not to one of ordinary skill. Moreover, Ooi does not suggest the control of output electricity to a desired power factor angle in response to a power factor control signal, which is required by claim 121, and which similarly is absent from the Arsudis dissertation (with which Mitsubishi would combine Ooi). *See* Kirtley Tr. 2353-2354.

4. Summary on Obviousness

It has not been established by clear and convincing evidence that any single prior art item, or any combination of prior art, identified by Mitsubishi renders claim 121 obvious.

E. Summary as to Claim 121

It has been shown by at least a preponderance of the evidence that claim 121 of the '039 patent is infringed by the MWT, and is practiced by the GE Turbine. The domestic industry requirement is satisfied with respect to the '039 patent. It has not been shown by clear and

convincing evidence that claim 121 is invalid. Accordingly, a violation of section 337 has occurred with respect to the '039 patent.

V. United States Patent No. 7,321,221

A. Claim Construction

The entire specification of the '221 patent occurs under the heading "CROSS REFERENCE TO OTHER APPLICATIONS," and begins by stating, "The present application is a continuation of German Patent Application No. 102 32 423.9, filed Jul. 17, 2002." CX-9 ('221 patent), col. 1, lines 5-9.

The specification provides, in part, that:

With the increasing use of regenerative sources of energy, e.g. wind power plants, for electric power production, the problem arises that the duration of supply voltage drops substantially increases since not enough power can be provided to quickly stabilize the supply voltage after voltage drops caused, e.g., by a short-circuit.

In view of these problems in the prior art, it is an object of the invention to provide an improvement of the known methods for operating a wind power plant, which improvement can be used for stabilizing the supply voltage after voltage drops without jeopardizing the electrical components of the wind power plant, as well as to provide a wind power plant capable of executing such methods.

Regarding the method aspect, this object is solved by an improvement of the known methods for operating a wind power plant which is substantially characterized in that the feeding of the rotor current is resumed after the decoupling of the feed-in unit caused by the variation of the supply voltage amplitude as soon as the currents created in the rotor windings by this variation have dropped to a predetermined value.

Id. at col. 2, lines 20-41.

Independent claim 5, and dependent claims 7 and 8, are the only claims of the '221 patent asserted by GE. They claim a wind turbine, and provide, as follows:

5. A wind turbine, comprising:

a rotor with at least one rotor blade, the rotor being rotatably arranged with regard to a substantially horizontal rotor axis;

an induction generator whose rotor windings are coupled to the rotor and whose stator coils can be coupled to a voltage grid;

a feed-in unit for feeding currents into the rotor windings;

a control unit for controlling the frequency of the fed-in currents depending on the rotor rotation frequency, and

an emergency unit which can be operated to electrically decouple the feed-in unit from the rotor windings in case of variations of the grid voltage amplitude, wherein the emergency unit comprises a release arrangement for releasing the rotor current feed-in after decoupling, when the currents generated in the rotor windings by variation of the grid voltage amplitude triggering the decoupling are declined to a predetermined value.

* * *

7. The wind turbine according to claim 5, wherein the feed-in unit comprises a converter coupled to the grid voltage.

8. The wind turbine according to claim 7, wherein the converter is an intermediate DC voltage converter with a rotor-sided rotor current converter and a grid-sided grid converter.

Id. at col. 5, line 58 - col. 6, line 16; col. 6, lines 18-25.

There is no dispute among the parties with respect to any element contained in the asserted claims, except for the final, “emergency unit” element of claim 1. Even with respect to that element, there is no dispute that in the claimed wind turbine, a feed-in unit normally supplies, or feeds, current to the turbine’s rotor winding. As stated in the patent specification,

this concept was commonly known in the prior art. *See* CX-9 ('221 patent), col. 1, lines 36-43.⁴³ Nor is there a dispute that in an emergency caused by an unsafe variation in the amplitude of the grid voltage, the feed-in unit is decoupled from the rotor windings, according to the plain language of the “emergency unit” claim element. According to the specification, such decoupling was also known in the prior art. *See Id.* at col. 1, line 61 - col. 2, line 2. Further, there is also no dispute that such decoupling may be achieved by the use of a crowbar circuit that was generally known in the prior art, and is mentioned in the specification. *Id.* at col. 3, lines 46-49.

The parties’ dispute stems from the limitation that requires “releasing” the rotor current feed-in after the decoupling has taken place. It is not surprising that the dispute is centered on this limitation because, according to the specification, one object of the claimed invention is an improvement in the way that a turbine resumes the feeding of rotor current. *Id.* at col. 2, line 26 - col. 3, line 6.

GE’s brief does not present a comprehensive and independent statement of how it proposes that the “emergency unit” element should be construed. Instead, GE intertwines its claim construction arguments with its infringement arguments, and does so mostly as a critique of the non-infringement arguments set forth by Mitsubishi’s expert, Dr. Toliyat. The closest that GE comes to offering a proposed construction for this element is found on page 38 of its brief where GE (mostly quoting from the claim language) takes the position that “(i) the ‘emergency unit’ limitation’ . . . requires an ‘emergency unit,’ or crowbar, that can be operated to ‘electrically decouple’ the ‘feed-in unit’ from the rotor windings ‘in case of variations of the grid voltage

⁴³ *See* Section I.B.1. (Technological Background).

amplitude,’ and (ii) the ‘releasing limitation’ . . . requires an arrangement for releasing the crowbar and resuming the rotor current feed-in ‘when the currents generated in the rotor windings by variation of the grid voltage amplitude triggering the decoupling are declined to a predetermined value.’” GE Br. at 38 (citing Toliyat Tr. 1438, 1445).

In GE’s more detailed discussion of specific claim construction and infringement issues, GE proposes that, although the crowbar “can be operated” in response to grid voltage changes, claim 5 does not require measurement of grid voltage, or at least not direct measurement. Rather, GE argues that the specification shows that the claim is broad enough to allow grid voltage to be monitored indirectly [] Further, it argues that although claim 5 refers to the release of the decoupling (or crowbar) circuit when the currents generated in the rotor windings by variation of the grid voltage amplitude have declined to a “predetermined value,” the specification shows that in practice, [] []

Mitsubishi briefed the issue of claim construction separately from the issue of infringement. Yet, like GE, its claim construction arguments consist almost entirely of an explanation of what is allegedly wrong with the arguments made at the hearing by the other side (in this case, GE), and the error that would come from adopting the other side’s interpretation. Nevertheless, it is clear that Mitsubishi takes the position that “predetermined value” refers to a value fixed prior to operation of the turbine, and not to a more open-ended construction such as “any value that prevents damage.” Further, Mitsubishi argues that to be consistent with the specification and prosecution history, the emergency unit must turn off, and the driving of rotor currents must resume, “when” (*i.e.*, immediately or as soon as) current created in the rotor

windings drops “to” (*i.e.*, as soon as they drop to) a predetermined value. Mitsubishi Br. at 36-42. Mitsubishi argues that one of ordinary skill would understand the words of claim 5 to mean what they say, “and nothing more.” *Id.* at 42.

The Staff also argues that the “emergency unit” element is unambiguous and should be construed according to the express meaning of the claim language. The Staff argues that the feeding of rotor current should resume when (*i.e.*, as soon as) the currents created by the current variation have dropped to a predetermined value, and not when all fluctuations have ceased. Further, the Staff argues that a “predetermined value” is one set in advance, and not necessarily “to or below” a value that prevents damage to the electrical components of the wind turbine. Staff Br. at 50-54. Indeed, the Staff, relying on a portion of the ‘221 patent’s prosecution history, argues that “any predetermined value – even if riskier than the value prescribed by Rebsdorf [a prior art patent⁴⁴] – is allowed by the claims.” *Id.* at 54 (emphasis by Staff).

Thus, there are claim construction questions as to: (1) whether grid voltage amplitude must be directly measured, or whether one may measure other values that relate to grid voltage; (2) the meaning of “a predetermined value;” and in view of the claim terms “when” and “to,” whether the release of the rotor current feed-in must occur as soon as the predetermined decline has occurred.

⁴⁴ The private parties have stipulated that United States Patent No. 6,566,764, entitled “Variable Speed Wind Turbine Having a Matrix Converter,” which issued to Rebsdorf et al. on May 20, 2003 (“Rebsdorf”), is prior art to the asserted ‘221 patent, under 35 U.S.C. § 102(b). *See* Prior Art Stips., ¶ 2.A.; Staff Br. at 54 n.30 (the Staff does not contest the stipulations of the private parties); RX-19 (Rebsdorf).

measurement of grid voltage amplitude

Nowhere in the plain language of claim 121, including the language of the “emergency unit” element, is there an explicit requirement that grid voltage amplitude be measured directly. Indeed, it is widely known in the art that there is a relationship between variations in grid voltage and []

[.]

Moreover, the ‘221 patent specification shows that grid voltage variations can be monitored indirectly [] Specifically, in one embodiment, the specification teaches that due to high rotor currents, “intermediate circuit voltage in converter **50** exceeds a predetermined value,” thus firing the crowbar circuit. *See* CX-9 (‘221 patent), col. 5, lines 8-14; *see also Id.* at col. 5, lines 11-16 (“When the intermediate circuit voltage in converter **50** exceeds a predetermined value due to exceedingly high rotor currents, the crow bar formed as a B6 bridge is fired. Then, the same procedure as in the case of a short-circuit of the grid is executed.”).

When Mitsubishi’s expert was questioned at the hearing concerning the fact that the ‘221 patent specification provides an embodiment in which the crowbar is turned on (*i.e.*, decoupling occurs) as a result of the value of voltage on the DC bus capacitor (rather than as a result of directly monitoring grid voltage), he admitted that fact but was unable to reconcile it with his proposed construction of claim 5. Thus, he testified that he would exclude the preferred embodiment from the claim based upon his understanding of how one of ordinary skill would read the claim. *See* Toliyat Tr. 1765-1768. Yet, any claim construction that excludes an embodiment disclosed in a specification rarely, if ever, is correct. *See Vitronics*, 90 F.3d at 1583.

In this instance, there is nothing in the claim language, the specification, or extrinsic evidence to require a claim construction that excludes [] to determine when the emergency unit must be activated.

Consequently, the emergency unit of claim 5 need not operate only as a result of the direct measurement of grid voltage amplitude. Rather, electric decoupling may occur as a result of indirect measurement, []

a predetermined value; whether the release of the rotor current feed-in must occur as soon as the predetermined decline has occurred

There is no doubt, based upon the plain meaning of the term “predetermined,” that the value in question must be determined prior to the decoupling of the feed-in unit. Thus, to paraphrase the claim language, when “variation of the grid voltage amplitude trigger[s] the decoupling” one has already “predetermined” the value at which decoupling will be reversed, and the feed-in unit will be released. Further, release of the feed-in will occur “when” (*i.e.*, not “before,” or “after,” but rather “when”) the currents that triggered the decoupling in the first place “are declined to” a predetermined value.

The plain language of the claim is supported by the specification, which states that an object of the claimed invention is to help stabilize the power supply after a voltage drop. To that end, the specification discusses the fact that “the feeding of the rotor current is resumed after the decoupling of the feed-in unit caused by the variation of the supply voltage amplitude *as soon as* the currents created in the rotor windings by this variation have dropped to a predetermined value.” CX-9 (‘221patent), col. 2, lines 26-41 (emphasis added).⁴⁵

⁴⁵ Nevertheless, this is an art in which the frequency of current is measured in cycles per (continued...)

Thus, it is crucial to know what the predetermined value is so that feed-in can resume as soon as the currents in the rotor windings caused by variation in the supply voltage have declined sufficiently. Interestingly, claim 5 characterizes these events within the context of an “emergency,” and presumably, operation will return to normal as soon as the emergency has passed. Indeed, the specification discusses the harm that can come to a wind turbine during a low voltage event. *See* CX-9 (‘221 patent), col. 1, lines 53-61 (destruction of the rotor power converter). Further, the specification states: “In view of these problems in the prior art, it is an object of the invention to provide an improvement of the known methods for operating a wind power plant, which improvement can be used for stabilizing the supply voltage after voltage drops *without jeopardizing the electrical components of the wind power plant*, as well as to provide a wind power plant capable of executing such methods.” *Id.* at col. 2, lines 27-33 (emphasis added). Thus, one must find the predetermined value at which the release referred to in the claim will not jeopardize the electrical components of the turbine.

The specification provides at least one answer as to how one may derive the predetermined value. The specification states that, “[b]asically, resuming the feeding of rotor current can be accomplished under consideration of a predetermined time constant.” *Id.* at col. 3, lines 4-6. The constants in question are expressed in the specification in terms of a time range,

⁴⁵(...continued)
second, and voltage fluctuation is measured in milliseconds. Thus, one of ordinary skill would know that even a term such as “as soon as” carries with it a connotation of engineering practicality. *See* Collins Tr. 922-923. Even the specification of the ‘221 patent, when addressing voltage drop and the resumption of the feed-in, indicates ranges of time, albeit measured in milliseconds, but nonetheless ranges that account for factors such as resistance. *See* CX-9 (‘221 patent), col. 2, lines 42-49, col. 3, lines 37-38, 54-56; *see also* Holley Tr. 354 (variables to consider with respect to turning off the crowbar circuit, such as the phases of the generated current).

measured in milliseconds. In fact, the specification teaches that “[w]hen the amplitude of the rotor current has dropped sufficiently after 100 to 200 msec, the feeding of the rotor current can be resumed on recurrence of the supply voltage within the framework of the method according to the invention.” *Id.* at col. 3, lines 35-40. The specification explains that exact times depend upon resistance in the system. *See* CX-9 (‘221 patent), col. 3, lines 53-56; *see also* Collins Tr. 906 (The resistance probably can be calculated, but “in a complex system like this, it would be modeled or simulated.”).

In summary, an examination of the plain language of the claim and the specification shows that the “emergency unit” of claim 5 is construed to require releasing the rotor current feed-in as soon as the currents generated in the rotor windings by variation of the grid voltage amplitude triggering the decoupling are declined to a predetermined value. Further, the predetermined value is to be determined before operation of the emergency unit, and the value should be determined so as not to jeopardize the electrical components of the turbine. A time constant, in the form of a specific time range, may be considered when determining that predetermined value.

B. Infringement Determination

GE accuses Mitsubishi’s MWT of literal infringement of claims 5, 7, and 8 of the ‘221 patent. GE Br. at 38-44. GE also argues that the evidence presented at the hearing would support a finding of infringement under the doctrine of equivalents with respect to the “emergency unit” and “releasing” limitations. *Id.* at 44-45.

Mitsubishi argues that its turbines do not literally infringe independent claim 5 because they do not decouple the feed-in unit “in case of variations of grid voltage amplitude,” and nor do

they release rotor current feed-in “when [rotor currents] . . . are declined to a predetermined value.” Mitsubishi Br. at 42-50. Further, Mitsubishi argues that GE narrowed claim 5 during prosecution of the ‘221 patent such that it surrendered the equivalents it now seeks to assert. Thus, it is argued, the turbines cannot infringe under the doctrine of equivalents. *See Id.* at 50-51. Additionally, Mitsubishi argues that inasmuch as its turbines do not infringe independent claim 5, they cannot infringe dependent claims 7 and 8. Mitsubishi does not, however, set forth any other defense to GE’s argument that the accused turbines infringe claims 7 and 8. *Id.* at 50.

The Staff argues that Mitsubishi’s turbines fail to satisfy two limitations of claim 5, either literally or under the doctrine of equivalents: (1) “emergency unit which can be operated to electrically decouple the feed-in unit from the rotor windings in case of variations of the grid voltage” and (2) “releasing the rotor current feed-in after decoupling, when the currents generated in the rotor windings by variation of the grid voltage amplitude triggering the decoupling are declined to a predetermined value.” Staff Br. at 54-58. Further, the Staff argues that dependent claim 7 and 8 cannot be infringed inasmuch as independent claim 5 is not infringed. *Id.* at 58.

1. Claim 5

Literal Infringement

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Accordingly, the MWT practices claim 5 of the '221 patent literally.

Doctrine of Equivalents

The evidence shows that even if the MWT did not practice claim 5 literally, it would practice claim 5 under the doctrine of equivalents. In that regard, the MWT has the required “emergency unit” because, for the reasons discussed above regarding claim construction,

[

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Further, at the very least, when comparing the MWT to claim 5, one finds that the MWT (1) performs the same function, *i.e.*, releasing the rotor current feed-in; (2) in the same way, *i.e.*, resuming the feed-in of current into the rotor windings after the rotor currents have declined to a safe level; and (3) achieves the same result, *i.e.*, resuming normal rotor current feed-in operation, while avoiding damage to the power converter from excess rotor currents. *See* Collins Tr. 955-959.

Mitsubishi argues that GE is precluded from arguing that [] is substantially similar to the claimed “release arrangement” because, during prosecution of the ‘221 patent, the applicants distinguished the claimed invention over the prior art Rebsdorf patent (cited above). In particular, Mitsubishi argues that the applicants told the examiner that although Rebsdorf resumes control of the generator when the grid disturbance disappears, and allows the generator to be operated immediately after a disturbance has ended, Rebsdorf does not disclose resuming the driving of the rotor when the rotor currents have declined to a predetermined value (as claimed by the ‘221 patent). *See* Mitsubishi Br. 50-51 (citing RX-10 (prosecution history) at MHI4019510).

The statement relied upon by Mitsubishi, however, simply repeats the claim language, and is in no way a disclaimer of any equivalent thereof. In fact, [] [] is entirely consistent with the distinction made by applicants between the disclosure of the Rebsdorf patent and the claimed invention of the '221 patent with its use of a predetermined value. Accordingly, GE would not be precluded from arguing that the MWT infringes under the doctrine of equivalents.

Thus, infringement of claim 5 by the MWT could be found under the doctrine of equivalents.

2. Claims 7 and 8

Specific disputes have not arisen concerning the MWT's practice of the limitations added by dependent claims 7 and 8. *See* Mitsubishi Br. at 50. In addition, the record contains evidence concerning the MWT's practice of those limitations. *See* GE PFF 8.10 & 8.11; Collins Tr. 926-927. Consequently, it is found that the MWT practices claims 7 and 8 of the '221 patent literally.

3. Summary Concerning Infringement of Claims 5, 7, and 8 of the '221 Patent

It is found by a preponderance of the evidence that the MWT practices claims 5, 7, and 8 of the '221 patent literally. Further, if it were not found that the MWT literally practices claim 5, it would be found that the MWT practices claim 5 under the doctrine of equivalents.

C. Domestic Industry

As detailed in Section I.A., an unreviewed initial determination has already found that the economic prong of the domestic industry requirement is satisfied with respect to each asserted patent. Further, as detailed in Section I.B.5., GE relies on the GE Turbine to establish that the

technical prong has been satisfied with respect to each asserted patent. With respect to the GE patent, GE argues that its turbines practice the same claims that it asserts against Mitsubishi. *See* GE Br. at 45-48 (arguing that the GE Turbine practices claims 5, 7, and 8 of the ‘221 patent).

Mitsubishi argues that the GE Turbine does not practice any asserted patent, including independent claim 5 of the ‘221 patent, either literally or under the doctrine of equivalents. Mitsubishi’s argument concerning dependent claim 7 and 8 is that they cannot be practiced because the GE Turbine does not practice claim 5. Mitsubishi Br. at 52-59.

The Staff argues that GE has not satisfied the technical prong of the domestic industry requirement with respect to any asserted patent, including the ‘221 patent. Staff Br. at 70, 74-78.

1. Claim 5

The issue of whether or not the GE Turbine practices claim 5 pertains to four terms or limitations contained in the “emergency unit” element of the claim. These four limitations are discussed below.

a. Whether GE Turbine operates “to electrically decouple the feed-in unit from the rotor windings”

Mitsubishi and the Staff argue that the GE Turbine fails “to electrically decouple the feed-in unit from the rotor windings,” as required by claim 5. GE admits many of the allegations made by the other parties, such as the fact that [

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The term “crowbar,” while used in the ‘221 patent in connection with the preferred embodiment, is not defined therein. The specification, however, states:

As has been explained above, it has been shown within the framework of the invention to be particularly advantageous that the rotor windings are short-circuited for decoupling from the feed-in or supply unit so that the currents induced in the rotor windings can diminish particularly rapidly. Therefore, a so-called “crow bar” can be used which short-circuits the rotor windings via a resistor of low impedance, particularly an impedance, and reduces the excitation of the engine.

CX-9 (‘221 patent), col. 3, lines 41-48.

Thus, the specification states that creating a short circuit is one way of implementing the claimed invention, and a crowbar, which creates a short circuit, is one way of accomplishing that. The specification in no way requires any particular circuitry for accomplishing the task of decoupling. In fact, the plain language of claim 5 does not claim a particular circuit, and places very little limitation on the necessary electrical decoupling, except to require that the feed-in unit be decoupled from the rotor winding during an emergency.⁴⁶

The critical allegation by Mitsubishi and the Staff is that even when the short circuit, or crowbar, is activated, “rotor currents continue to flow through switching elements in the rotor-side converter.” Mitsubishi Br. at 52; Staff Br. at 76. GE’s expert, Dr. Collins, admitted that is the case. Collins Tr. 1029-1030. However, that is only because some components within the rotor-side converter do more than act as part of the feed-in unit.

In the GE Turbine, [

⁴⁶ *But see* CX-9, col. 6, lines 26-28 (non-asserted, dependent claim 9) (“The wind turbine according to claim 5, wherein the emergency unit comprises a crow bar for short-circuiting the rotor windings.”).

] and the GE Turbine literally practices the decoupling limitation of claim 5.

b. Whether activation of the short-circuit mode (or crowbar) in the GE Turbine is based on grid voltage amplitude variations

There is no dispute that the GE Turbine [

] Mitsubishi's argument that the GE Turbine cannot practice claim 5 is based on its claim construction and noninfringement arguments concerning direct measurement of grid voltage, which were rejected above. Claim 5, as correctly construed in light of the specification, does not require that grid voltage be directly monitored. Further, the record shows that the GE Turbine [

c. Whether the GE Turbine releases rotor current feed-in “when the currents generated in the rotor windings by variation of the grid voltage amplitude triggering the decoupling are declined to a predetermined value”

(i) The parties’ arguments

Although GE makes a broad statement that the GE Wind Turbine literally satisfies the “emergency unit” and “releasing limitations,” it provides little analysis relating to literal practice. In that regard, GE argues that Mitsubishi’s expert proposes an incorrect construction of the claim. GE also cites to a portion of the ‘221 patent specification that, as characterized by GE, “explicitly discloses an embodiment of an emergency unit [] which, like the GE crowbar, is *triggered* by a rise in the DC bus voltage.” GE Br. at 46 (emphasis added) (citing CX-9 (‘221 patent), col. 5, lines 11-14).

GE, however, does argue that its turbine satisfies the “releasing” limitation of claim 5 under the doctrine of equivalents and it provides a brief analysis. *See* GE. Br. at 46. As discussed below, GE has failed to show that the GE Turbine practices claim 5 even under the doctrine of equivalents, let alone literally.

GE admits that [

]

Neither Mitsubishi, nor the Staff, accept GE's argument that DC bus voltage can be used to determine rotor current, or that release occurs in the GE Turbine when rotor current has declined to 1300 amps. Mitsubishi Br. at 56-58; Staff Reply Br. 12-14.

In addition, as a threshold issue, Mitsubishi argues that GE cannot rely on the doctrine of equivalents for the "release arrangement" because during prosecution of the '985 patent, the applicants relied on this feature to distinguish claim 5 and thereby overcome the prior art Rebsdorf patent cited by the examiner. Citing *Cordis Corp. v. Medtronic AVE, Inc.*, 511 F.3d 1157, 1177 (Fed. Cir. 2008), Mitsubishi argues that the applicants clearly and unmistakably surrendered any equivalent structures for the release arrangement. Mitsubishi Br. 58-59. This argument is similar to one advanced by Mitsubishi in connection with infringement.

(ii) Whether GE disavowed all equivalents for the "release arrangement" during patent prosecution

In the Federal Circuit's *Cordis* opinion, relied upon by Mitsubishi, the Court succinctly

reviewed the relevant law concerning the disavowal of equivalents that an applicant may make during patent prosecution. The Court stated:

[A]n applicant can make a binding disavowal of claim scope in the course of prosecuting the patent, through arguments made to distinguish prior art references. Such argument-based disavowals will be found, however, only if they constitute clear and unmistakable surrenders of subject matter. *Conoco, Inc. v. Energy & Envtl. Int'l, L.C.*, 460 F.3d 1349, 1364 (Fed. Cir.2006); *Pharmacia & Upjohn Co. v. Mylan Pharms., Inc.*, 170 F.3d 1373, 1376 (Fed. Cir. 1999); *Litton Sys., Inc. [v. Honeywell, Inc.]*, 140 F.3d [1449,] 1458 [(Fed. Cir. 1998)]. Moreover, the scope of such a disavowal will depend on the nature of the argument made by the patentee. As the court explained in *Omega [Engineering, Inc. v. Raytek Corp.]*, 334 F.3d 1314,] 1324 [(Fed. Cir. 2003)], even in the case of an unequivocal disavowal of claim scope, the court must construe the claim “congruent with the scope of the surrender.” In order to constitute binding surrenders of claim scope, the statements in question must be such that “a competitor would reasonably believe that the applicant had surrendered the relevant subject matter.” *Cybor Corp. v. FAS Techs., Inc.*, 138 F.3d 1448, 1457 (Fed. Cir. 1998) (en banc). If the court finds that the patentee made a clear disavowal of the subject matter that is subsequently asserted to be equivalent to the limitation in question, it will preclude the patentee from asserting equivalency as to that subject matter. *See Bayer AG v. Elan Pharm. Res. Corp.*, 212 F.3d 1241, 1252 (Fed. Cir. 2000).

511 F.3d at 1176.

In this instance, Mitsubishi has established only that the applicants argued that the emergency unit and release arrangement were novel, and patentable over the prior art, such as Rebsdorf. *See Mitsubishi Br.* at 59-60 (citing RX-10 (prosecution history) at MHI4019511). Indeed, this is all that is shown by the prosecution history relevant to this point. The applicants, tracking claim language very closely in their Remarks, argued that the emergency unit with its release limitation can be distinguished from the prior art, but they did not make any argument to

narrow the scope of claim 5, or its equivalents, beyond the limitations imposed by the claim when read in view of the specification. Indeed, the applicants drew a distinction between the claimed invention and Rebsdorf based on the fact that the claimed invention electrically decouples the feed-in unit. See RX-10 (prosecution history) at MHI4019511.⁴⁷ The arguments made to the PTO are entirely consistent with the arguments that GE makes in this investigation concerning decoupling, as well as the use of rotor current, or proxy values for rotor current, in connection with the release of rotor current feed-in.

Moreover, no disavowal was made during prosecution of the '221 patent that is relevant to the specific arguments that GE makes in this investigation concerning the "release

⁴⁷ The substance of the applicants' argument is contained in two paragraphs, as follows:

Applicant respectfully submits that claim 5 requires an emergency unit which can be operated to electrically decouple the feed-in unit from the rotor windings in case of variations of the grid voltage amplitude, and that includes a release arrangement for releasing the rotor current feed-in after decoupling, when the currents generated in the rotor windings by variation of the grid voltage amplitude triggering the decoupling are declined to a predetermined value. Rebsdorf fails to disclose at least this limitation of the claim.

As described above, Rebsdorf is directed to a variable speed wind turbine that includes a matrix converter, a control unit, and a protection unit. See Rebsdorf, Abstract. Rebsdorf, however, does not disclose that the protection unit of Rebsdorf *electrically decouples* a feed-in unit, which provides feeding currents into the rotor windings, in case of in case of [sic] variations of the grid voltage amplitude. In addition, Rebsdorf does not disclose that the protection unit includes a release arrangement for releasing the rotor current feed-in after decoupling, when the currents generated in the rotor windings by variation of the grid voltage amplitude triggering the decoupling are declined to a predetermined value.

RX-10 (prosecution history) at MHI4019511 (emphasis in original).

arrangement” in its own turbines and whether they practice claim 5 under the doctrine of equivalents. *See* RX-10 at MHI4019510-511. Consequently, GE’s arguments concerning its alleged practice of claim 5 under the doctrine of equivalents will be considered.

(iii) It has not been established that the GE Turbine practices the “release arrangement” limitation under the doctrine of equivalents

GE argues that just as DC bus voltage determines when its “crowbar” circuitry should be activated, DC bus voltage also determines when deactivation should occur and the feed-in should be released. Indeed, during the hearing, Dr. Holley, GE’s chief consulting engineer for wind systems (*see* Holley Tr. 333), described how the “crowbar” circuitry is deactivated, as follows:

Q. How does the converter control unit know when to turn the crowbar circuit off?

A. [

]

Q. Was the rotor current taken into account in designing the control logic for this crowbar circuit?

A. []

Q. []

A. [

]

Q. Can you explain that a little further, sir.

A. Yes. [

]

Q. And is there any particular value of rotor current that was

considered in the design of the crowbar circuit?

A. []

Q. []

A. []

Holley Tr. 346-347.

[

].⁴⁸

⁴⁸ Dr. Holley testified:

Q. [

A

]

Q. And by acceptable level, what do you mean?

(continued...)

[

⁴⁸(...continued)

A. []

Holley Tr. 355-356.

Consequently, the evidence of record fails to show that the GE Turbine practices the “release arrangement” limitation of claim 5, either literally or under the doctrine of equivalents.

d. Summary Concerning the GE Turbine and Claim 5

The GE Turbine does not practice all of the limitations of claim 5, and thus does not practice that claim.

2. Claims 7 and 8

There is no requirement that the domestic industry be based on the same claim or claims alleged to be infringed. Nor is there a requirement that a domestic industry practice more than one claim of an asserted patent. 19 U.S.C. § 1337(a)(2). Nevertheless, with respect to the domestic industry requirement, GE relies on dependent claims 7 and 8, in addition to independent claim 5. GE Br. at 45.

Mitsubishi and the Staff do not dispute that the GE Turbine practices the specific limitations added by claims 7 and 8, but rather hinge their arguments solely on their position that GE does not practice claim 5. Mitsubishi Br. at 59; Staff Br. at 75 n.46. Thus, GE’s practice of claims 7 and 8 is undisputed, provided that GE’s practice of claim 5 has been established. GE cannot prevail on claims 7 or 8, however, if it does not practice claim 5 inasmuch as claims 7 and 8 include the limitations of claim 5. *See Wahpeton*, 870 F.2d at 1552 n.9.

As discussed above, it has not been shown that the GE Turbine practices claim 5 of the ‘221 patent. Accordingly, it has not been shown that the GE Turbine practices claim 7 or claim 8 of the ‘221 patent.

3. Summary Concerning Domestic Industry Under the ‘221 Patent

It has not been established that GE practices a claim of the ‘221 patent. Thus, it has not

been established that the technical prong of the domestic industry requirement is met.

Accordingly, it has not been shown that the domestic industry requirement is satisfied with respect to the '221 patent.

D. Validity Determination

Mitsubishi argues that the asserted claims of the '221 patent are obvious in view of the prior art. Mitsubishi Br. at 59-63. With respect to independent claim 5, it asserts that the structural elements of the claim, as well as the use of crowbar circuits, were well known in the art. Indeed, Mitsubishi argues that when the PTO examiner rejected the claim during prosecution over Rebsdorf (stipulated prior art, cited above in connection with claim construction), the applicants responded that only the emergency unit and release arrangement were novel.

Mitsubishi further argues that decoupling and the release arrangement recited in claim 5 were taught by published Japanese Patent Application No. 07-194196 ("JP-196") (RX-223) and United States Patent No. 5,734,256 to Larsen et al. ("Larsen") (RX-44).⁴⁹ Thus, Mitsubishi submits that the combination of JP-196 or Larsen with prior art such as Rebsdorf or Kühn⁵⁰ would render claim 5 obvious to one of ordinary skill in the art. *Id.* at 60-63. In addition, it is argued that the limitations added by dependent claims 7 and 8 were well known in the art, and thus those claims are also obvious over the combination of prior art as exemplified by Rebsdorf or Kühn in combination with JP-196 or Larsen. *Id.* at 63.

GE asserts that Mitsubishi has failed to prove that claims 5, 7, and 8 are obvious,

⁴⁹ JP-196 and Larsen are stipulated prior art to the '221 patent. *See* Prior Art Stips., ¶ 2.

⁵⁰ Mitsubishi describes Kühn (RX-580) as an article whose structural features were well known in the art. *See* Mitsubishi Br. at 62.

especially in view of the heavy burden of proving invalidity by clear and convincing evidence. GE Br. at 48-50. First, as a threshold matter, it submits that Mitsubishi failed to prove that Kühn is prior art to the '221 patent because Kühn is undated. Furthermore, Mitsubishi's expert had no personal knowledge of this paper, did not attend the conference where the paper was allegedly presented and disseminated, and had not seen any physical evidence showing when the paper was published. *Id.* at 48-49.

Second, GE argues that JP-196 (which requires a "chopper circuit" that stays on until *after* grid voltage has stabilized) and Larsen (which has nothing to do with generators or rotor currents, and discloses a "series compensator" that injects voltage into a load during a grid voltage drop) actually teach away from the "emergency unit" and "releasing" limitations of claim 5. GE additionally contends that Mitsubishi failed to explain at the hearing why someone skilled in the art, without benefit of hindsight, would be motivated to combine two references that teach away from the claimed invention. *Id.* at 49-50.

The Staff argues that Mitsubishi has failed to show by clear and convincing evidence that the prior art discloses the "releasing arrangement" of claim 5, specifically, releasing the rotor current feed-in when currents in the generator windings are declined to a predetermined value. Staff Br. at 59-62. Further, the Staff argues that Mitsubishi has failed to establish Kühn as prior art. *Id.* at 59-60 (citing Toliyat Tr. 1536-1538).

1. Kühn

It is Mitsubishi's burden to prove that the art relied upon should be considered prior art, as that term is used in the Patent Act, in order to evaluate the validity of a particular patent claim. *See Loral Fairchild Corp., v. Matsushita Elec. Indus. Co.*, 266 F.3d 1358, 1361 (Fed. Cir. 2001).

In that regard, a question has been raised as to whether or not Kühn (RX-580) should be considered prior art to the '221 patent.

Kühn is an article or paper that was allegedly published in April 2002, *i.e.*, more than one year prior to July 17, 2003, which is the priority date of the '221 patent. However, the article itself bears no date, and a publication date for the article was not established on the record. An attempt was made to establish Kühn's publication through its presentation at a conference, but Mitsubishi was not able to present any witness who had personal knowledge of Kühn's publication or presentation at the conference. Nor did Mitsubishi offer a document that established the fact that Kühn was actually presented on a certain date. *See* Toliyat Tr. 1536-1541, 1687-1691.

Thus, it has not been established that Kühn is prior art to the '221 patent. In any event, it appears from the parties' arguments (including those of Mitsubishi), that even if Kühn were accepted as prior art, the decoupling and release arrangement limitations of claim 5 would still have to be supplied by JP-196 or Larsen for the claim to be found invalid as obvious.

2. Claim 5

JP-196 (RX-223) discloses a so-called chopper circuit, not a crowbar or other circuit suitable for use in the claimed invention of the '221 patent. In particular, the chopper circuit in JP-196 does not electrically decouple the feed-in unit from the rotor windings. *See* RX-223 (JP-196) at 8-9; *see also* Toliyat Tr. 1799. Further, JP-196 requires the chopper circuit to remain on until after grid voltage has stabilized. *See* Toliyat Tr. 1801; Collins Tr. 2301. Thus, JP-196 not only fails to disclose the limitations at issue of claim 5 of the '221 patent, but it teaches away from the "releasing" limitation of claim 5 which permits the crowbar to be released before grid

stabilization so that feed-in can be resumed and the wind turbine can contribute to grid recovery. *See* CX-9 ('221 patent), col. 2, lines 52-67.

Larsen (RX-44) also fails to disclose the limitations of claim 5, and teaches away from the invention claimed in the '221 patent. Larsen discloses a "series compensation device" connected to a load such as a factory or piece of equipment. The series compensation device in Larsen is not involved in power generation, and one of ordinary skill in the art relevant to the '221 patent would not look to the disclosure in Larsen for application in a wind turbine. *See* Collins Tr. 2301-2305.

The series compensator in Larsen is designed to inject voltage into the load during a grid voltage drop so that the voltage to the load stays steady. *See* Toliyat Tr. 1787, 1791. There is a crowbar circuit in Larsen, but it is not designed to activate when the grid voltage drops (and, of course, has nothing to do with rotor currents). It is instead activated when there is a fault between the load and the series compensation device which could cause damage to it. *See* Collins Tr. 2302-2303; Toliyat Tr. 1793-1794; RX-44 (Larsen) at Fig. 1.

Mitsubishi failed to present evidence at hearing to establish that one skilled in the art, without benefit of hindsight, would combine JP-196 or Larsen with Rebsdorf or similar prior art. In any event, neither JP-196 nor Larsen supplies the claim limitation related to decoupling and the release arrangement of claim 5 of the '221 patent.

Accordingly, it has not been established by clear and convincing evidence that claim 5 of the '221 patent is invalid due to obviousness.

3. Claims 7 and 8

Mitsubishi argues that the added limitations of claims 7 and 8 were well known in the art

and thus those claims are also invalid over the combination of prior art such as Rebsdorf or Kühn, with JP-196 and Larsen. Mitsubishi Br. at 63.⁵¹ GE has not set forth arguments and evidence specifically with respect to the validity of claims 7 and 8. See GE Br. at 78-51; GE Reply at 26-27. Nevertheless, neither claim 7 nor claim 8 is found to be invalid for at least the reasons indicated above with respect to the limitation of claim 5.

4. Summary on Validity

It has not been established by clear and convincing evidence that claim 5, 7, or 8 of the '221 patent is invalid due to obviousness. No other basis for invalidity has been argued with respect to these claims.

E. Summary

It has been shown by at least a preponderance of the evidence that claims 5, 7, and 8 are infringed by the MWT.

It has not been established that GE practices any claim of the '221 patent. Thus, it has

⁵¹ The Patent Act provides, in part:

A patent shall be presumed valid. Each claim of a patent (whether in independent, dependent, or multiple dependent form) shall be presumed valid independently of the validity of other claims; dependent or multiple dependent claims shall be presumed valid even though dependent upon an invalid claim.

35 U.S.C. § 282.

With respect to this provision, the Federal Circuit has stated: "Such an independent evaluation is necessary because dependent claims necessarily add limitations to the claims from which they depend and may therefore not be subject to the same asserted grounds of invalidity." *Dana Corp. v. American Axle & Mfg., Inc.*, 279 F.3d 1372, 1376 (Fed. Cir. 2002). In this instance, independent claim 5 has not been shown to be invalid. Yet, even if claim 5 were found invalid, dependent claims 7 and 8 would have to be analyzed independently to determine whether they had also been shown to be invalid.

not been established that the technical prong of the domestic industry requirement is met. Consequently, it has not been shown that the domestic industry requirement is satisfied with respect to the '221 patent.

It has not been shown by clear and convincing evidence that claim 5, 7, or 8 of the '221 patent is invalid.

Accordingly, due to a failure by GE to establish that the domestic industry requirement has been satisfied, it has not been found that a violation of section 337 has occurred with respect to the '221 patent.

VI. United States Patent No. 6,921,985

A. Claim Construction

The specification of the '985 patent states that the claimed invention relates to wind turbine generators. "More particularly, the invention relates to supporting low voltage ride through for wind turbine generators coupled with a power distribution grid." CX-6 ('985 patent), col. 1, lines 6-9.

The specification explains that although "[h]istorically, wind turbines have been very small contributors to overall power generation to supply electrical grids," modern wind turbine generators have ratings of 1.5 MW or more, and may be installed on a farm with one hundred or more such generators. Such a farm provides a "block" of power comparable to the output of a modern gas turbine generator. *See* CX-6 ('985 patent), col. 1, lines 12-22. Thus, wind turbines are no longer permitted to trip offline during a low voltage event, but must satisfy low voltage ride-through (LVRT) requirements. *See Id.* at col. 1, lines 41-56. According to the specification (filed in 2003):

Currently, wind turbine generators specifications can require connection and synchronization with the power grid down to levels of 70% of rated voltage. These requirements can be accommodated through, for example, increased capacity in various components (motors, generators, converters, etc.) and by use of uninterruptible power supplies (UPSs) for sensitive control circuits. However, more severe voltage fluctuations, for example, voltages at 15% of rated voltage cannot be accommodated using these techniques.

Id. at col. 1, lines 58-67.

According to the “Detailed Description” of the specification, the techniques described therein allow a wind turbine to provide one or more of the following features:

1) to remain synchronized to the power grid during severe voltage fluctuations, 2) to maintain functioning of the blade pitch system in spite of lack of voltage at the generator terminals, 3) to protect the power converter and generator from high voltages and currents during the voltage fluctuation, and 4) to temporarily shut down non-vital subsystems that could be damaged by exposure to low voltages or could be tripped by either circuit breaker action or fuse operation.

Id. at col. 2, lines 24-34.

Independent claim 15 of the ‘985 patent, the only claim asserted by GE, provides for a wind turbine, as follows:

15. A wind turbine generator comprising:

a generator;

a power converter coupled with the generator, the power converter having an inverter coupled to receive power from the generator, a converter controller coupled with the inverter to monitor a current flow in the inverter wherein the converter controller is coupled to receive power from an uninterruptible power supply during a low voltage event, and a circuit coupled with the input of the inverter and with the converter controller to shunt current from the inverter and generator rotor in response to a control signal from the

converter controller.

Id. at col. 7, line 58 - col. 8, line 3.

GE's brief provides a proposed claim construction for the term "uninterruptible power supply." Based on the testimony of its expert, Dr. Kirtley, GE argues that the uninterruptible power supply (or "UPS") is a device that can provide an alternate source of short term power during a grid voltage drop so that the load can continue to function without interruption.

Although GE does not devote a specific portion of its brief to the phrase "shunt current from the inverter and generator rotor," GE does argue that "the 'shunting' limitation should be construed according to its plain meaning to require a circuit that diverts rotor current that would otherwise flow through and potentially damage the power converter." GE rejects any construction of claim 15 that would require a separate crowbar circuit located outside the inverter. GE Br. at 21-33.

Mitsubishi's brief offers specific proposed constructions for the phrases "uninterruptible power supply" and "during a low voltage event." Mitsubishi argues that an uninterruptible power supply is "a power storage system, such as a battery, capacitors, or a photovoltaic system, that provides an alternate source of power." Based on the specification and the prosecution history of another patent⁵² (which, upon a rejection by the PTO, distinguished the later-filed application from the '985 patent), Mitsubishi argues that the UPS of the '985 patent does not encompass anything other than a power storage system, []

Mitsubishi Br. at 63-68. Mitsubishi argues that "during a low voltage event" means "throughout

⁵² The other patent referred to by Mitsubishi issued as United States Patent No. 7,218,012 ('012 patent), entitled "Emergency Pitch Drive Power Supply." See Mitsubishi Br. at 65-66 (quoting RX-59 ('012 patent prosecution history)).

a period when there is a low voltage event.” *Id.* at 66-67.

In its reply, Mitsubishi notes the portion in GE’s main brief in which it states that the shunting limitation “requires merely that the shunt circuit divert the current that would otherwise flow through the inverter.” Mitsubishi argues, however, that the plain language of claim 15 requires shunting current from both “the inverter and the generator rotor.” Mitsubishi Reply at 1-3.

The Staff’s brief offers proposed constructions for the terms “uninterruptible power supply” (*i.e.*, “a power storage system that supplies alternative power during a drop in grid voltage and cannot be interrupted during such drops”) and “during a low voltage event” (“throughout a period when there is a low voltage event”). Staff Br. at 37-40. In its reply, the Staff argues that “the claimed ‘inverter’ must correspond to the rotor-side converter because the claimed circuit must protect both the rotor and grid-side converters. To accomplish this, the claim and the specification disclose that the circuit between the rotor and the rotor-side converter protects the entire converter.” *Id.* at 37, 41-43; Staff Reply at 11.

The words “uninterruptible power supply” and “during a low voltage event” flow together in the patent claim, and the arguments concerning the latter cluster of words are closely related to the UPS. Accordingly, the following two phrases are construed below: (1) “uninterruptible power supply during a low voltage event,” and (2) “shunt current from the inverter and generator rotor.”

“uninterruptible power supply during a low voltage event”

There should be no dispute that the required “uninterruptible power supply” provides an alternate source of power, at least in the sense that it is available “during a low voltage event,” as

opposed to normal grid conditions. Indeed, claim 15 refers to the UPS only in the context of “a low voltage event.”

Furthermore, the plain language of the claim requires the UPS to supply power “during a low voltage event,” and not merely at the outset of the event, or at some later point. In fact, the specification explains that a modern low voltage ride-through utility standard “typically requires that a power generation unit must remain connected and synchronized to the grid when the voltage at the terminals of the generation unit fall to prescribed levels.” CX-6 (‘985 patent), col. 1, lines 29-33. There is no contemplation in the claim language or the specification of a UPS that works during only part of a low voltage event – rather, as specified by the claim, it supplies power “during a low voltage event.”⁵³

With respect to how such a UPS must be implemented, claim 15 contains no express limitation to indicate that it must be restricted to storage system, such as battery system, capacitors, or a photovoltaic system (although it is clearly undisputed by the parties that batteries, capacitors and photovoltaic can satisfy the UPS limitation). []
[]
[]. While much has been made of the testimony of GE’s expert, Dr. Kirtley, on this point in which he stated that uninterruptible power supplies *include* energy storage, he did not testify that they consist entirely of energy storage. See Kirtley Tr. at 776.

In arguing that an uninterruptible power supply must be a storage system, Mitsubishi and

⁵³ The phrase “during a low voltage event,” must be understood within the proper context. As indicated several times already, in this art, low voltage events typically last for only a few seconds or less. Thus, it is not contemplated that a UPS will work indefinitely. Further, at some point, even a battery-based UPS (such as that proposed by Mitsubishi and the Staff) will run out of stored energy. See Toliyat Tr. 1656, 1707.

the Staff turn to the specification, which states, in pertinent part:

In one embodiment, LVDP 320 provides 24 V DC power to turbine controller 340 through uninterruptible power supply (UPS) 330. UPS 330 provides power to turbine controller 340 in the event that LVDP 320 is unable to provide necessary power to turbine controller 340. UPS 330 can be any type of uninterruptible power supply known in the art, for example, a battery system, a photovoltaic system or any other power storage system known in the art. In one embodiment, UPS 330 does not have sufficient capacity to energize all of the electrical loads served by LVDP 320.

CX-6 ('985 patent), col. 3, line 60 - col. 4, line 2.

The specification portion quoted above clearly pertains only to particular embodiments of the claimed invention, and thus does not exclude [] from any possible embodiment of claim 15. Indeed, as GE's expert was quick to point out during the hearing, photovoltaic systems are not actually energy storage systems. *See Kirtley Tr. 776*. Rather, photovoltaic systems generate electricity. Further, even for that particular embodiment the specification suggests a power storage system by way of example, stating that the UPS in that embodiment "can be any type of uninterruptible power supply known in the art."⁵⁴

Accordingly, the "uninterruptible power supply" is not restricted to a power storage system. Further, an uninterruptible power supply must operate during a low voltage event, and

⁵⁴ Additionally, Mitsubishi points out that the '985 patent was raised during prosecution of the '012 patent (which is not asserted here). Yet, there is no suggestion that the '012 patent prosecution history is intrinsic to the '985 patent. Indeed, there is no formal relationship or incorporation of one patent into the other. Thus, it would be error to narrow a claim of the '985 patent based on the prosecution of the '012 patent. *See Goldberg v. CytoGen, Inc.*, 373 F.3d 1158, 1167-68 (Fed. Cir. 2004); *Abbott Labs. v. Dey, L.P.*, 287 F.3d 1097, 1105 (Fed. Cir. 2002) (a common assignee and one shared inventor insufficient to create a "formal relationship").

In any event, Mitsubishi's arguments concerning the prosecution of the '012 patent would not be persuasive. Mitsubishi's brief refers to instances in which GE told the examiner that a battery system is an "example" of an uninterruptible power supply. *See Mitsubishi Br.* at 66.

not for only a portion of the event.

“shunt current from the inverter and generator rotor”

As indicated above, although the shunting limitation was addressed by the parties with respect to the infringement and domestic industry aspects of the investigation, the claim construction aspect of their dispute did not take shape until the reply round of briefing. The claim construction dispute ultimately centers around the issue of where the shunting of current occurs (and thus where, according to the claim, the shunt circuit must be located), and relatedly, from which components the current is shunted.

On its face, the claim language addresses both issues. Claim 15 expressly provides for “a circuit coupled with the input of the inverter and with the converter controller,” and also that the circuit is “to shunt current from the inverter and generator rotor.” Thus, as far as the location of the circuit is concerned, it must be coupled with the input of the inverter and the converter controller. Further, current must be shunted “from the inverter and generator rotor.”

As indicated above, GE argues against any construction that would require a crowbar circuit outside the inverter. While such a limitation is not apparent from the claim language, whether a particular shunting circuit located within the inverter (as opposed to outside it) meets the claim limitation will depend upon whether it is found to be “coupled with the input of the inverter and the converter controller,” as required by the claim.

Also as indicated above, the Staff clearly articulates the argument that the “inverter” in question must correspond to the rotor-side converter because the claimed circuit must protect both the rotor-side and grid-side converters. Further, the Staff argues, the claim and the specification disclose that placing a crowbar circuit between the rotor and the rotor-side

converter protects the entire converter. Staff Reply at 11. While the claim does not expressly require the design referred to by the Staff, the specification does show how one can meet the claim limitations in the manner described by the Staff. In that regard, the specification provides as follows:

FIG. 4 is a block diagram of one embodiment of a power converter having functionality to respond to a low voltage event. In one embodiment, power converter 400 includes inverters 410 and 420, converter controller 430 and crowbar circuit 440. Other components can also be included in power converter 400.

Inverter 410 is coupled with the generator (not illustrated in FIG. 4) and to inverter 420 which is coupled with the power grid. ***Crowbar circuit 440 is coupled with the output of the generator rotor.*** Converter controller 430 is coupled to receive data indicating the current flowing in inverter 410 and to control crowbar circuit 440. In one embodiment, converter controller 430 selectively activates and deactivates crowbar circuit 440 to maintain the current in inverter 410 within an acceptable range.

CX-6 ('985 patent), col. 4, lines 44-58 (emphasis added).

Clearly, the specification provides this example in connection with one embodiment of the claimed invention. It cannot require a crowbar (or other shunting circuit) between the rotor and the rotor-side converter, as though that were a claim limitation. Whether another design that differs from the embodiment of the specification practices claim 15 will depend upon whether or not such a design meets all the other claim limitations while also being able (in the words of the claim) "to shunt current from the inverter and generator rotor."

B. Infringement Determination

GE argues that both the original and EPSS versions of the MWT infringe claim 15 of the '985 patent. The argument in GE's main brief is based only on literal infringement. GE Br. at

21-30. GE raises the doctrine of equivalents in its reply, with reference to the “uninterruptible power supply” limitation. GE Reply at 6-7.

The only claim limitations disputed by Mitsubishi are “uninterruptible power supply for use during a low voltage event” and “circuit coupled with the input of the inverter . . . to shunt current from the inverter and the generator rotor.” Mitsubishi Br. at 68, 70; *see* Toliyat Tr. 1571-1572 (concerning limitations practiced by the MWT).

With respect to the shunt limitation, Mitsubishi argues that its products do not have a circuit coupled to the input inverter to shunt current from the inverter and generator rotor. Mitsubishi Br. at 68-70. [

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The Staff argues that the evidence shows the original version of the MWT to infringe claim 15, but that the EPSS version does not infringe. Staff Br. at 41-46. With respect to the EPSS version, the Staff argues [

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The “uninterruptible power supply” and “shunt current from the inverter and generator rotor” limitations are discussed below.

1. **“uninterruptible power supply”**

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Accordingly, it is found that both the original and EPSS versions of the MWT practice this limitation literally.

As indicated above, GE argues in its reply that the EPSS version could also be found to practice this limitation under the doctrine of equivalents. However, GE's argument is not sufficiently supported by its rather brief analysis (relying on the testimony of Mitsubishi's expert). Its doctrine of equivalents argument must therefore fail.

2. **"shunt current from the inverter and generator rotor"**

Mitsubishi argues that the MWT (in both its original and EPSS versions) do not practice

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this limitation [

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Accordingly the MWT practices the shunt limitation of claim 15 literally.

3. Summary Concerning Infringement of Claim 15 of the '985 Patent

It is found by a preponderance of the evidence that both the original and EPSS versions of the MWT infringe claim 15 of the '985 patent literally. It is not found that the EPSS version would practice the "uninterruptible power supply" limitation under the doctrine of equivalents.

C. Domestic Industry

1. Background

As detailed in Section I.A., an unreviewed initial determination has already found that the economic prong of the domestic industry requirement is satisfied with respect to each asserted patent. Further, as detailed in Section I.B.5., GE relies on the GE Turbine to establish that the technical prong has been satisfied with respect to each asserted patent. *See* GE Br. at 30-33 (arguing that the GE wind turbine practices claim 15 of the '985 patent).

The basic structure relied upon by GE to satisfy the limitations of claim 15 corresponds to the [

⁶⁰ [].

].

Mitsubishi argues that the GE Turbine does not practice claim 15 of the '985 patent. Mitsubishi Br. at 78-83. In particular, Mitsubishi argues that claim 15 requires a circuit, “separate and apart from the inverter,” to be coupled to the input of the inverter. [

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Further, Mitsubishi argues that the GE Turbine does not shunt current as required by claim 15. A significant portion of Mitsubishi’s argument relies on the same interpretation of “shunt current from the inverter and generator rotor” that was disputed by GE and Staff, and was rejected herein. Nevertheless, Mitsubishi argues that even if its understanding of the claim is not adopted, the GE Turbine cannot practice claim 15 because [

.]

The Staff argues that GE has not satisfied the technical prong of the domestic industry requirement with respect to any asserted patent, including the '985 patent. It argues that the GE Turbine does not practice claim 15 literally or under the doctrine of equivalents. The Staff, like Mitsubishi, argues that the GE Turbine [

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2. Discussion

As discussed above in connection with claim construction, there is no requirement that the shunting circuit be located outside the inverter. Indeed, there is no express limitation in the plain language of claim 15 that requires the circuit “coupled with the input of the inverter and with the converter controller” to be “separate and apart” from the inverter (as argued by Mitsubishi) or located outside the inverter at all. Nor has any party cited a portion of the evidence intrinsic to the ‘985 patent that would require such a configuration.

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⁶² See Kirtley Tr. 623 (“[A]ll of these things are connected together. The inverter has two inputs, if you will. It’s got the AC input and the DC input. And the shunt circuit that we’re describing here, made up of the devices, the active switches of the rotor side converter, is coupled through the DC link to the DC input of the grid side converter – inverter.”).

Power converters contain inverters. Thus, the ‘985 patent, and the witnesses, have used the terms interchangeably, even though the claim refers specifically to inverters. See Kirtley Tr. 623-624; Toliyat Tr. 1597.

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Consequently, the GE Turbine literally practices claim 15 of the '985 patent.

In addition, if it were found that claim 15 literally requires a circuit outside the inverter to shunt current, the GE Turbine could nonetheless be found to practice this limitation of claim 15 under the doctrine of equivalents inasmuch as the GE Turbine would not differ substantially from the express limitations of the claim. In particular, [

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3. Summary Concerning Domestic Industry Under the '985 Patent

GE has demonstrated that the domestic industry requirement is met with respect to the '985 patent.

D. Validity and Enforceability Determinations

Mitsubishi argues that claim 15 is invalid as obvious over the prior art. Mitsubishi also argues that claim 15 is invalid due to a failure to disclose the best mode for the claimed invention, as subjectively contemplated by one of the five named inventors (all of whom reside in Germany), even though there was no genuine invention. *See* Mitsubishi Br. at 83-89. Further, Mitsubishi argues that the '985 patent is unenforceable due to inequitable conduct "in failing to disclose Thomas Wilkins's inventive contributions to the PTO," even though it is Mitsubishi's contentions that there is no invention at all. *Id.* at 89-90.⁶³ The Staff argues that while claim 15 is not invalid, it is unenforceable. Staff Br. at 46-49, 63-69. GE rejects all of the invalidity and unenforceability arguments. GE Br. at 71-97.

As discussed below, it is not found that claim 15 of the '985 patent is invalid. Further, it has not been shown that the name of Thomas Wilkins was removed from the application for the

⁶³ No party raised inventorship as an independent issue.

'985 patent with an intent to deceive the PTO. Thus, it has not been established that the '985 patent is unenforceable.

1. Validity

Mitsubishi argues that claim 15 of the '985 patent is invalid due to obviousness and failure to disclose the best mode. *See* Mitsubishi Br. at 83-89. GE argues that Mitsubishi failed to prove by clear and convincing evidence that claim 15 is obvious, or invalid for failure to disclose a best mode. GE Br. at 33-38. The Staff also argues that Mitsubishi has failed to prove either obviousness or failure to disclose a best mode. *See* Staff Br. at 46-49.

a. Obviousness

Mitsubishi argues that two prior art publications that were not considered by the PTO during prosecution of the '985 patent “teach or suggest all the limitations of claim 15, including the use of an uninterruptible power supply to provide power to a converter controller during a low voltage event.” The publications are Hofmann et al., “Control of a Double-Fed Induction Generator for Wind-Power Plants,” PCIM 1998, Nuremberg, Power Quality Proceedings (1998) (“Hofmann”) (RX-40) and Dittrich, Hofmann et al., “Design and Control of a Wind Power Station with Double Fed Induction Generator,” EPE '97 (Sept. 1997) (“Dittrich & Hofmann”) (RX-46).⁶⁴ Mitsubishi Br. at 83-88.

GE argues, among other things, that while Hofmann and Dittrich & Hofmann generally disclose a wind turbine with a DFIG generator, neither makes mention of a low voltage event, low voltage ride-through, or how to achieve LVRT “with a crowbar circuit coupled to a converter

⁶⁴ The parties have stipulated that Hofmann and Dittrich & Hofmann are prior art to the '985 patent. *See* Prior Art Stips., ¶ 3; Staff Br. at 46.

controller that is itself coupled to an uninterruptible power supply.” It is argued by GE that Mitsubishi has failed to prove obviousness by clear and convincing evidence. GE Br. at 33-37.

The Staff argues that Mitsubishi has failed to demonstrate that a combination of Hofmann and Dittrich & Hofmann provides all required limitations of claim 15. Staff Br. at 46-47.

Hofmann and Dittrich & Hofmann (collectively, the “Hofmann articles”) disclose a wind turbine with a DFIG generator. *See* Toliyat Tr. 1731-1732. They also disclose a crowbar circuit. Kirtley Tr. 2403. However, GE has never argued that the invention of claim 15 lies in the use of a DFIG in a wind turbine, or even the use of a crowbar (or similar) circuit. Rather, as discussed above in the section on claim construction, claim 15 is specifically limited, among other things, to an uninterruptible power supply, as well as a circuit, such as a crowbar, to shunt current during a low voltage event. Yet, neither article concerns a low voltage event, and, in contrast to the requirements of the claim 15, the crowbar circuit is not used to shunt current from the inverter and generator rotor in response to a control signal from the converter controller in connection with a low voltage event. Kirtley Tr. 2400-2407. This was admitted by Mitsubishi’s expert who testified that there is no mention of low voltage ride-through in the articles. Toliyat Tr. 1742-1743.⁶⁵

Thus, the Hofmann articles do not disclose a crowbar circuit responsive to a control signal from the CCU. GE’s expert, Dr. Kirtley, testified that Figure 11 of the Hofmann references (which was raised by Mitsubishi to satisfy the control signal limitation) shows that the crowbar circuit is not in fact controlled by a CCU, but rather by signals from voltage and current

⁶⁵ Indeed, Mitsubishi’s expert never relied on the Hofmann references alone for any of the obviousness opinions expressed in his expert reports. *See* Toliyat Tr. 1741-1742.

sensors. Kirtley Tr. 2403-2404 (concerning Fig. 11 of Hofmann (RX-40)). The controller disclosed in the Hofmann articles, even assuming it is a “converter controller,” is not coupled to both the inverter and the circuit that shunts current. Kirtley Tr. 2402-2404 (Figure 11 shows that the crowbar circuit is not coupled to anything that controls the inverter).

In contrast, the testimony of Mitsubishi’s expert on this point is unpersuasive because rather than establishing that Figure 11 and other portions of the Hofmann articles actually disclosed the limitations of claim 15 in the prior art, his testimony amounts merely to conjecture as to how certain limitations of claim 15 might be referenced in the Hofmann articles if one set out in hindsight to find some representation of them in the prior art. *See* Toliyat Tr. 1409-1410, 1732-1733, 1745-1747.

In addition, Hofmann does not disclose the required uninterruptible power supply, or a UPS connected to a CCU. *See* Kirtley Tr. 2401; Toliyat Tr. 1410 (converter controller is powered by the grid). Hofmann & Dittrich refers to “short-time energy storage,” without any description of the purpose of that storage, or how to implement it. Toliyat Tr. 1412-1413 (discussing RX-46), 1747-1749. During cross-examination, Mitsubishi’s expert pointed to “large DC bus capacitors” that are illustrated in a figure and testified that they are “probably” used for short-term storage. Toliyat Tr. 1750-1751.

Consequently, it has not been shown by clear and convincing evidence that the Hofmann articles, either alone or in combination, render claim 15 invalid as obvious.

b. Best Mode

Mitsubishi argues that claim 15 is invalid because “Henning Lütze, one of the inventors named on the ‘985 patent, subjectively contemplated a best mode for practicing the shunt circuit

of claim 15, namely, a specific crowbar design that was described in the '221 patent specification. The '985 patent, however, contains no disclosure of this specific crowbar design for implementing the shunt circuit" of the claim. Mitsubishi Br. at 88-89.

GE argues that Mr. Lütze did not testify as to a crowbar preference for the '985 patent, whose application was filed six months after the priority application for the '221 patent. It is argued that there is no evidence that Lütze or any other inventor believed that the crowbar they described in the '221 patent was the best mode for practicing claim 15. GE Br. at 37. In fact, GE argues that the testimony of Dr. Fogarty, who drafted the disclosure and assisted in preparing the application for the '985 patent, is consistent with the statement contained in the specification to the effect that "any appropriate (e.g., a circuit having sufficient power ratings) crowbar circuit can be used." *Id.* at 38 (quoting CX-6 ('985 patent) at col. 4, lines 59-61).

The Staff argues that Mitsubishi has failed to prove that claim 15 is invalid for failure to disclose a best mode. Staff Br. at 48-49.

Henning Lütze lives in Germany and did not testify at the hearing in this investigation. All of his testimony was presented through the parties' deposition designations. *See* Lütze Dep. (JX-10) Tr. 7. He was an employee of Enron Wind, which in 2002, was acquired by GE. *See* Lütze Dep. (JX-10) Tr. 13. He is a named inventor on both the '221 and '985 patents. *See* CX-6 ('985 patent); CX-9 ('221 patent).

Lütze testified that in 2002, he thought that the crowbar shown in Figure 3 of the '221 patent should be used in GE's 1.5 MW wind turbines because "[b]y this crowbar design, it is

possible to control the currents in the rotor circuit.” *See* Lütze Dep. (JX-10) Tr. 101-104.⁶⁶

Although Lütze testified about the crowbar design disclosed in the ‘221 patent, and GE turbines in general, he was not asked whether the design disclosed in the ‘221 patent is best for the invention claimed in the ‘985 patent, specifically with respect to claim 15. Mitsubishi simply infers that the illustrated crowbar in the ‘221 patent must be the best mode for the ‘985 patent.

Mitsubishi’s reasoning, however, comes up short of providing the proof necessary to show that claim 15 of the ‘985 patent is invalid. Even assuming that the crowbar design in question is the best mode for the claims of the ‘221 patent, the fact remains that the ‘985 patent, and claim 15 in particular, concern a different invention. Thus it is not clear that an embodiment from the ‘221 patent necessarily constitutes the best mode for claim 15, even in the opinion of Mr. Lütze.⁶⁷

Accordingly, it is not found by clear and convincing evidence that claim 15 of the ‘985 patent is invalid for a failure to disclose the best mode.

2. Enforceability

Mitsubishi argues that the ‘985 patent is unenforceable due to inequitable conduct before

⁶⁶ During his deposition, Lütze was not sure whether the crowbar design of the ‘221 patent was actually implemented in GE 1.5 MW turbines installed in the spring of 2003. In fact, he pointed out that while the principle of the crowbar used in Figure 3 of the ‘221 patent would have been used in GE’s turbines, the exact design would have to be modified due to the design of other components. *See* Lütze Dep. (JX-10) Tr. 101-104.

⁶⁷ In connection with one embodiment disclosed in the ‘985 patent, the specification states: “Crowbar circuits are known in the art and any appropriate (e.g., a circuit having sufficient power ratings) crowbar circuit can be used.” CX-6, col. 4, lines 59-61. Indeed, Dr. Fogarty, who participated in drafting the application for the ‘985 patent, testified that another named inventor, Wilhelm Janssen, provided him with alternate crowbar designs but never singled out one as preferred over the others. *See* Fogarty Tr. 2038-2039.

the PTO. In particular, [

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Mitsubishi argues that [

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Thus, the identity of each inventor is material to the prosecution of a patent. Indeed, “[i]n practice, patent examiners do not normally engage in determination of the respective contributions of the individual members of an inventive entity as part of making an *ex parte*

examination; rather, it is the responsibility of the applicants and their attorneys to ensure that the inventors named in a patent application are the only true inventors.” *Board of Educ. v. American Bioscience, Inc.*, 333 F.3d 1330, 1344 (Fed. Cir. 2003) (footnote omitted).

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3. Conclusion on Unenforceability

It has not been established by clear and convincing evidence that the '985 patent is

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unenforceable due to inequitable conduct.

E. Summary

It is found by at least a preponderance of the evidence that the MWT infringes claim 15 of the '985 patent, and that the GE Turbine practices the claim. The domestic industry requirement has been satisfied with respect to the '985 patent. It has not been established by clear and convincing evidence that claim 15 is invalid. Accordingly, a violation of section 337 has occurred with respect to the '985 patent.

VII. Conclusions of Law

1. The Commission has personal jurisdiction over the parties, and subject-matter jurisdiction over the investigation.
2. The importation or sale requirement of section 337 has been met with respect to the accused products.
3. Respondents MHI and MPSA have sold for importation, imported and, or, sold after importation into the United States, the accused products.
4. It has not been established that respondent MHIA has directly or indirectly imported or sold an accused product. Consequently, it cannot be found that MHIA is in violation of section 337.
5. It has not been shown by clear and convincing evidence that claim 121 of the '039 patent is invalid.
6. It has been shown by at least a preponderance of the evidence that the accused Mitsubishi turbines infringe claim 121 of the '039 patent.
7. It has been established that the domestic industry requirement is satisfied with respect

to the '039 patent.

8. A violation of section 337 has occurred with respect to the '039 patent.

9. It has not been shown by clear and convincing evidence that claim 5, 7, or 8 of the '221 patent is invalid.

10. It has been shown by at least a preponderance of the evidence that the accused Mitsubishi turbines infringe claim 5, 7, and 8 of the '221 patent.

11. It has not been established that GE practices any claim of the '221 patent. It has not been established that the domestic industry requirement is satisfied with respect to the '221 patent.

12. It has not been shown that a violation of section 337 has occurred with respect to the '221 patent.

13. It has not been shown by clear and convincing evidence that claim 15 of the '985 patent is invalid.

15. It has not been established by clear and convincing evidence that the '985 patent is unenforceable due to inequitable conduct.

16. It has been shown by at least a preponderance of the evidence that the accused Mitsubishi turbines (both the original and EPSS versions) infringe claim 15 of the '985 patent.

17. It has been established that the domestic industry requirement is satisfied with respect to the '985 patent.

18. A violation of section 337 has occurred with respect to the '985 patent.

VIII. Initial Determination and Order

Based on the foregoing, it is the INITIAL DETERMINATION ("ID") of the undersigned that a violation of section 337 of the Tariff Act of 1930, as amended, has occurred in the importation into the United States, the sale for importation, or the sale within the United States after importation of certain variable speed wind turbines and components thereof by reason of infringement of claim 121 of United States Patent No. 5,083,039 and claim 15 of United States Patent No. 6,921,985.

Further, this ID, together with the record of the hearing in this investigation consisting of:

- (1) the transcript of the hearing, with appropriate corrections as may hereafter be ordered, and
- (2) the exhibits received into evidence in this investigation, as listed in the attached exhibit lists, is CERTIFIED to the Commission.

In accordance with 19 C.F.R. § 210.39(c), all material found to be confidential by the undersigned under 19 C.F.R. § 210.5 is to be given *in camera* treatment.

The Secretary shall serve a public version of this ID upon all parties of record and the confidential version upon counsel who are signatories to the Protective Order (Order No. 1) issued in this investigation, and upon the Commission investigative attorney.

To expedite service of the public version, each party is hereby ORDERED to file with the Commission Secretary by no later than August 14, 2009, a copy of this ID with brackets that show any portion considered by the party (or its suppliers of information) to be confidential, accompanied by a list indicating each page on which such a bracket is to be found. At least one copy of such a filing shall be served upon the Administrative Law Judge, and the brackets shall

be marked in red. If a party (and its suppliers of information) considers nothing in the ID to be confidential, and thus makes no request that any portion be redacted from the public version of this ID, then a statement to that effect shall be filed in lieu of a document with brackets.

Pursuant to 19 C.F.R. § 210.42(h), this Initial Determination shall become the determination of the Commission unless a party files a petition for review pursuant to § 210.43(a) or the Commission, pursuant to § 210.44, orders on its own motion a review of the ID or certain issues herein.

A handwritten signature in cursive script, reading "Carl C. Chameski".

Carl C. Chameski
Administrative Law Judge

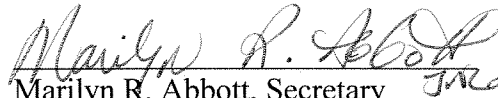
Issued: August 7, 2009

CERTAIN VARIABLE SPEED WIND TURBINES AND COMPONENTS THEREOF
INV. NO. 337-TA-641

PUBLIC CERTIFICATE OF SERVICE

I, Marilyn R. Abbott, hereby certify that the attached **INITIAL DETERMINATION** has been served upon the Commission Investigative Attorney, Erin D. Joffre, Esq., and the following parties as indicated, on

OCT 21 2009



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CERTAIN VARIABLE SPEED WIND TURBINES AND COMPONENTS THEREOF
INV. NO. 337-TA-641

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