A system for powering a compressor. The system may include a power generation unit adapted to generate AC power. An electric motor may be coupled to the power generation unit and adapted to turn at a rate proportionate to a frequency of the AC power. A compressor may be coupled to the electric motor, and an output pressure of the compressor may be directly dependent on the rate that the electric motor turns. A control system may be coupled to the power generation unit and to the compressor, and the control system may be adapted to vary the frequency of the AC power generated by the power generation unit, thereby varying the output pressure of the compressor.
VARY A SPEED OF AN ENGINE WITH A CONTROL SYSTEM COUPLED TO THE ENGINE

VARY A FREQUENCY OF AC POWER GENERATED BY AN ELECTRIC GENERATOR COUPLED TO THE ENGINE, THE FREQUENCY OF THE AC POWER BEING DIRECTLY DEPENDENT ON THE SPEED OF THE ENGINE

VARY A SPEED OF AN ELECTRIC MOTOR COUPLED TO THE ELECTRIC GENERATOR, THE SPEED OF THE ELECTRIC MOTOR BEING DIRECTLY DEPENDENT ON THE FREQUENCY OF THE AC POWER GENERATED BY THE ELECTRIC GENERATOR

VARY A SPEED OF A COMPRESSOR COUPLED TO THE ELECTRIC MOTOR, THE SPEED OF THE COMPRESSOR BEING DIRECTLY DEPENDENT ON THE SPEED OF THE ELECTRIC


FIG. 2
VARIABLE SPEED HIGH EFFICIENCY GAS COMPRESSOR SYSTEM

BACKGROUND

[0001] This application claims priority to U.S. Patent Application Ser. No. 61/355,658, which was filed Jun. 17, 2010. This priority application is hereby incorporated by reference in its entirety into the present application, to the extent that it is not inconsistent with the present application.

[0002] The present disclosure relates to systems and methods for varying the output pressure of a compressor.

[0003] Conventional compressor station systems include gas pipeline compressors driven by simple cycle gas turbines. Often, the output pressure of the compressors needs to be varied to match downstream demand. Gas turbines are typically capable of varying their speed in order to vary the speed of the compressors, which in turn, varies the output pressure of the compressors to match demand. However, gas turbines have a peak load efficiency between about 15% and 35% and a half load efficiency between about 8% and 20%. Due to their relatively poor efficiency, operating costs for gas turbine driven compressor station systems may be undesirably high, particularly at partial load.

[0004] Other configurations use variable speed electric motors to drive the pipeline compressors. The variable speed electric motors may be connected to an electrical grid through a variable frequency drive that converts the standard frequency power from the electrical grid (50 Hz or 60 Hz) to a frequency that will enable the electric motors to drive the compressors at a speed which will produce the desired output pressure. However, the installation and operating costs for compressor station systems using this type of configuration may be undesirably high and therefore unattractive.

[0005] There is a need, therefore, for improved systems and methods for efficiently varying the output pressure of a gas compressor.

SUMMARY

[0006] Embodiments of the disclosure may provide a system for powering a compressor. The system may include a power generation unit adapted to generate AC power. An electric motor may be coupled to the power generation unit and adapted to turn at a rate proportionate to a frequency of the AC power. A compressor may be coupled to the electric motor, and an output pressure of the compressor may be directly dependent on the rate of the electric motor turns. A control system may be coupled to the power generation unit and to the compressor, and the control system may be adapted to vary the frequency of the AC power generated by the power generation unit, thereby varying the output pressure of the compressor.

[0007] Embodiments of the disclosure may further provide a method for powering a compressor. The method may include varying a speed of an engine with a control system coupled to the engine. The method may also include varying a frequency of AC power generated by an electric generator coupled to the engine, and the frequency of the AC power may be directly dependent on the speed of the engine. The method may also include varying a speed of an electric motor coupled to the electric generator, and the speed of the electric motor may be directly dependent on the frequency of the AC power generated by the electric generator. The method may also include varying a speed of a compressor coupled to the electric motor, and the speed of the compressor may be directly dependent on the speed of the electric motor. The method may also include varying an output pressure of the compressor, and the output pressure of the compressor may be directly dependent on the speed of the compressor.

[0008] Embodiments of the disclosure may further provide a system for powering a compressor. The system may include an engine adapted to run at variable speeds. An electric generator may be coupled to the engine and adapted to generate AC power, and a frequency of the AC power may be directly dependent on the speed of the engine. A busbar may be coupled to the electric generator and adapted to receive and conduct the AC power generated by the electric generator. An electric motor may be coupled to the busbar, and a speed of the electric motor may be directly dependent on the frequency of the AC power generated by the electric generator. A compressor may be coupled to the electric motor, and a speed of the compressor may be directly dependent on the speed of the electric motor. The compressor may produce an output pressure that is directly dependent on the speed of the compressor. A control system may be coupled to the engine and to the compressor, and the control system may be adapted to sense the output pressure of the compressor and to send control signals to the engine. The control signals may be adapted to direct the engine to vary the speed of the engine until the compressor produces a predetermined output pressure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The present disclosure is best understood from the following detailed description when read with the accompanying Figures. It is emphasized that, in accordance with the standard practice in the industry, various features are not drawn to scale. In fact, the dimensions of the various features may be arbitrarily increased or reduced for clarity of discussion.

[0010] FIG. 1 depicts a block diagram of an illustrative compressor station system, according to one or more embodiments described.

[0011] FIG. 2 depicts an exemplary method of varying the output pressure of a compressor.

DETAILED DESCRIPTION

[0012] It is to be understood that the following disclosure describes several exemplary embodiments for implementing different features, structures, or functions of the invention. Exemplary embodiments of components, arrangements, and configurations are described below to simplify the present disclosure; however, these exemplary embodiments are provided merely as examples and are not intended to limit the scope of the invention. Additionally, the present disclosure may repeat reference numerals and/or letters in the various exemplary embodiments and across the Figures provided herein. This repetition is for the purpose of simplicity and clarity and does not in itself dictate a relationship between the various exemplary embodiments and/or configurations discussed in the various Figures. Moreover, the formation of a first feature over or on a second feature in the description that follows may include embodiments in which the first and second features are formed in direct contact, and may also include embodiments in which additional features may be formed interposing the first and second features, such that the first and second features may not be in direct contact. Finally, the exemplary embodiments presented below may be com-
combined in any combination of ways, i.e., any element from one exemplary embodiment may be used in any other exemplary embodiment, without departing from the scope of the disclosure.

[0013] Additionally, certain terms are used throughout the following description and claims to refer to particular components. As one skilled in the art will appreciate, various entities may refer to the same component by different names, and as such, the naming convention for the elements described herein is not intended to limit the scope of the invention, unless otherwise specifically defined herein. Further, the naming convention used herein is not intended to distinguish between components that differ in name but not function. Further, in the following discussion and in the claims, the terms “including” and “comprising” are used in an open-ended fashion, and thus should be interpreted to mean “including, but not limited to.” All numerical values in this disclosure may be exact or approximate values unless otherwise specifically stated. Accordingly, various embodiments of the disclosure may deviate from the numbers, values, and ranges disclosed herein without departing from the intended scope. Furthermore, as it is used in the claims or specification, the term “or” is intended to encompass both exclusive and inclusive cases, i.e., “A or B” is intended to be synonymous with “at least one of A and B,” unless otherwise expressly specified herein.

[0014] FIG. 1 depicts a block diagram of an illustrative compressor station system 100, according to one or more embodiments described. The compressor station system 100 may include one or more power generation units 110 (three are shown) connected to a common busbar 120. One or more electric motors 130 (two are shown) may also be connected to the busbar 120. The electric motors 130 may be connected to one or more compressors 140 (two are shown).

[0015] In exemplary operation, the power generation units 110 may be adapted to supply power to the electric motors 130 through the common busbar 120, and the electric motors 130 may drive the compressors 140. As illustrated, there may be three power generation units 110 included in the compressor station system 100. As can be appreciated, however, any number of power generation units 110 may be used to meet the needs of varying applications, without departing from the scope of the disclosure. In exemplary embodiments, there may be at least one additional power generation unit 110 installed than is actually required to operate the compressor station system 100 at full load. In other embodiments, a minimum of three power generation units 110 may be used in the compressor station system 100. With a full load, the power output from each power generation unit 110 may range from a low of about 10 kilowatts, about 100 kilowatts, or about 1 megawatt, to a high of about 10 megawatts, about 20 megawatts, or about 30 megawatts. In at least one embodiment, the power output from each power generation unit 110 may be about 5 megawatts. The power generation units 110 may be synchronous units or asynchronous units.

[0016] Each power generation unit 110 may include an electric generator 114 coupled to the shaft 113 of an engine 112. The engine 112 may be a reciprocating engine and run on gasoline, diesel, natural gas, propane, bio-diesel, hydrogen, combinations thereof, or the like. As can be appreciated, however, other fuel sources are also contemplated herein without departing from the scope of the disclosure. The gas engine 112 may be more efficient than a gas turbine. The efficiency of the power generation unit 110 using a gas engine 112, for example, may be in excess of 40% at full load and only 2-3% lower at half load. As a result, efficiencies in excess of 25% may be achieved over compressor station systems that use gas turbines to drive the compressors, and thus, operating costs may be significantly lower. However, gas turbines continue to improve in efficiency, particularly if operated in a recuperated or combined cycle system. These “improved” gas turbines (not shown) may be coupled directly to and drive the compressors 140.

[0017] The speed of the engine 112 may be varied and/or regulated, such as with a throttle, thereby adjusting the rotational speed of the shaft 113. The electric generator 114 includes an armature winding and a field winding, one of which is coupled to the shaft 113 and one of which is stationary. As the shaft 113 rotates, the field winding moves with respect to the armature winding, thereby generating AC power. As known in the art, the frequency of the AC power is directly dependent on the speed at which the field winding moves through the armature winding. Thus, the frequency of the AC power generated by the electric generator 114 is directly dependent on the speed of the engine 112. In at least one embodiment, the frequency of the AC power may be varied between about 25 Hz and about 60 Hz.

[0018] In at least one embodiment, the common busbar 120 is a variable frequency busbar. The variable frequency busbar 120 is configured to direct the variable frequency AC power from the power generation units 110 to the electric motors 130. In at least one embodiment, the electric motors 130 are variable speed motors whose speed may be directly dependent on the frequency of the AC power generated by the power generation units 110. In other words, the electric motors 130 may be adapted to turn at a rate proportionate to the frequency of the AC power supplied to them.

[0019] The electric motors 130 may have an efficiency ranging from a low of about 85%, about 88%, or about 91% to a high of about 97%, about 99%, or about 99.9%. The electric motors 130 may be synchronous motors, asynchronous motors (e.g., induction motors or squirrel cage motors), permanent magnet motors, or any other type of variable speed electric motor. In at least one embodiment, the electric motors 130 may be configured to replace gas turbines in an existing compressor station system, or the electric motors 130 may be installed in new compressor station systems 100, as generally described herein.

[0020] Each electric motor 130 may be adapted to drive a shaft 132 coupled to one or more compressors 140, and the speed of each compressor 140 may be directly dependent on the speed of the electric motor 130 driving it. The output pressure of each compressor 140 is, therefore, directly dependent on the speed of the compressor 140. In one or more embodiments, the compressors 140 may be centrifugal compressors, reciprocating compressors, rotary compressors, axial compressors, or combinations thereof. In at least one embodiment, the compressors 140 may be employed as gas pipeline compressors.

[0021] The control system 150 may utilize a power line communication or power line carrier (PLC) system to send control signals. PLC systems transmit data on conductors that are also used for electric power transmission. The control system 150 may be linked to a SCADA system (not shown) or operated and monitored from a remote station (not shown) equipped with appropriate hardware and software including communications systems.
As illustrated, the control system 150 may be connected to the compressors 140 and to the engines 112. The control system 150 may be adapted to sense the output pressure of the compressors 140 and to send control signals to the engines 112. For example, when downstream demand requires the compressors 140 to have a specified output pressure, the control system 150 may be used to increase, maintain, or reduce the output pressure of the compressors 140 to match the downstream demand. To accomplish this, the control system 150 may direct the engines 112 to maintain or vary their speed. The frequency of the AC power generated by the electric generators 114 may be directly dependent on the speed of the engines 112, and the speed of the electric motors 130 may be directly dependent on the frequency of the AC power generated by the electric generators 114. The speed and pressure output of the compressors 140 may be directly dependent on the speed of the electric motors 130. Thus, the control system 150 may control the output pressure of the compressors 140 by controlling the speed of the engines 112.

By way of example, if the downstream demand requires an increased output pressure from the compressors 140, the control system 150 may react by increasing the speed of the engines 112. As the engines 112 increase in speed, the frequency of the AC power output from the electric generators 114 is proportionally increased. This, in turn, increases the speed of the electric motors 130 that drive the compressors 140. As speed of the electric motors 130 increases, the output pressure of the compressors 140 increases until a predetermined pressure is achieved. As can be appreciated, if maximum pressure output from the compressors 140 is desired, the control system 150 may send a signal directing the engines 112 to run at maximum speed.

Moreover, the control system 150 may be capable of sending control signals to each engine 112 independently. Thus, as output pressure demands vary, the control system 150 may be configured to direct one or more engines 112 to start and stop accordingly, thereby efficiently matching fluctuating power demands. For example, a compressor 140 operating at full power may require power from two or more power generation units 110. As the power required by the compressor 140 decreases, there will come point where one less power generation unit 110 will be needed. At this point, the control system 150 may stop one power generation unit 110.

One power generation unit 110 may produce a different amount of power than another power generation unit 110. However, the frequency of AC power produced by each power generation unit 110 will be the same. Likewise, one electric motor 130 may receive a different amount of power than another electric motor 130, yet the speed of each electric motor 130 will be the same.

The power generation units 110 may output waste heat in line 116 as a byproduct of the AC power that is generated. In an exemplary embodiment, the power generation units 110 may operate as a combined heat and power (CHP) system, and the thermal energy derived from the waste heat in line 116 may be used in other applications. For example, the waste heat may be used to produce hot water and/or steam for heating or to power an absorption chiller or similar device for cooling.

In other embodiments, the power generation units 110 may operate as a combined cycle system, and the thermal energy from the waste heat in line 116 may be used to generate additional AC power. For example, the waste heat in line 116 may be used to generate steam to power a turbine 117, such as a steam turbine or an organic Rankine cycle (ORC) turbine. The turbine 117 may drive an electric generator 118. In at least one embodiment, the electric generator 118 driven by the turbine 117 may be the same as the electric generators 114 driven by the engines 112, or it may be different. The electric generator 118 may generate additional AC power that may be supplied to the variable frequency busbar 120. A variable frequency drive (VFD) 119 may be located between the electric generator 118 and the variable frequency busbar 120 to vary the frequency of the AC power generated by the electric generator 119 to match the frequency of the power generated by the electric generators 114.

In one or more embodiments, the power generation units 110 may allow power to be generated on site without the need for a connection to an electrical grid 160, such as a national power grid. This allows the compressor station systems 100 to be placed in remote locations where connection to the electrical grid 160 is impractical or cannot be established. In other embodiments, however, the variable frequency busbar 120 may be connected to the electrical grid 160, and a VFD 162 may be located between the variable frequency busbar 120 of the compressor station system 100 and the electrical grid 160. The electrical grid 160 may conduct standard frequency AC power (generally 50 Hz or 60 Hz standard frequency). The variable frequency busbar 120 may conduct AC power with frequency ranging between about 25 Hz and about 60 Hz. The VFD 162 may be located between the electrical grid 160 and the variable frequency busbar 120 to facilitate power transfer between the two. In at least one embodiment, the control system 150 may be connected to the VFD 162 to control the power transfer.

In certain situations, it may be cost efficient to supplement the power generated by the power generation units 110 by importing power from the electrical grid 160. For example, rather than start up another engine 112 to match the power requirements of the electric motors 130, it may be less expensive to supplement the generated power with power from the electrical grid 160. In other situations, the power generation units 110 may not be able to supply enough power to match the power requirements of the electrical motors 130, and the electrical grid 160 may supplement the generated power to match demand. For example, one or more power generation units 110 may be disconnected from the variable frequency busbar 120, or an additional compressor 140 may be added to the compressor station system 100. When the electrical grid 160 is supplying power to the electrical motors 130 through the variable frequency busbar 120, the VFD 162 may convert the standard frequency AC power from the electrical grid 160 to the frequency required by the electric motors 130.

In certain situations, the power generation units 110 may produce more power than is required by the electric motors 130. The excess power generated by the power generation units 110 may be exported to the electrical grid 160 for a profit. In the event that excess power is being exported to the electrical grid 160, the control system 150 may send a control signal to the VFD 162 indicating the amount of power to be exported. When the power generation units 110 are exporting excess power to the electrical grid 160 through the variable frequency busbar 120, the VFD 162 may convert the frequency of the power generated by the power generation units 110 to standard frequency AC power as required by the electrical grid 160.
In one or more embodiments, a transformer 164 may be located between the variable frequency busbar 120 and the electrical grid 160. As shown in FIG. 1, the transformer 164 is located between the VFD 162 and the electrical grid 160 such that the VFD 162 operates at the voltage generated by the power generation units 110. The transformer 164 may also be located between the variable frequency busbar 120 and the VFD 162 (not shown) such that the VFD 162 operates at the voltage of the electrical grid 160.

In one or more embodiments, one or more auxiliary loads 170 (two are shown) may also be connected to the variable frequency busbar 120. Auxiliary loads 170 include loads using standard frequency power, such as lighting, air conditioning, cooling systems, ventilation systems, oil systems, control systems, small power systems, and other loads in or around the compressor station system 100. A VFD 172 may be located between the variable frequency busbar 120 and the auxiliary loads 170 to convert the frequency of the power generated by the power generation units 110 to standard frequency AC power for the auxiliary loads 170.

A transformer 174 may be located between the variable frequency busbar 120 and the auxiliary loads 170. As shown in FIG. 1, the transformer 174 is located between the VFD 172 and the auxiliary loads 170 such that the VFD 172 operates at the voltage generated by the power generation units 110. The transformer 174 may also be located between the variable frequency busbar 120 and the VFD 172 (not shown) such that the VFD 172 operates at the stepped-down voltage used to power the auxiliary loads 170.

In another embodiment, the compressor station system 100 may be a variable voltage DC system. The power generation units 110 may be DC generators, the common busbar 120 may be a DC busbar, and the electric motors 130 may be DC motors. The power generation units 110 may supply DC power to the electric motors 130 through the busbar 120, and the speed of the electric motors 130 may vary directly with the DC voltage supplied to them.

In a variable voltage DC system, an electrical inverter and/or an electrical rectifier (not shown) may be located between the variable voltage DC busbar 120 and the VFD 162. When power is exported from the compressor station system 100 to the electrical grid 160, the electrical inverter may convert the DC power generated by the power generation units 110 to AC power. The VFD 162 may then convert the AC power to standard frequency before the power is exported to the electrical grid 160.

When the electrical grid 160 supplies power to the compressor station system 100, the electrical rectifier may convert the AC power conducted by the electrical grid 160 to DC power. A DC-to-DC converter (not shown) may be located between the electrical rectifier and the variable voltage DC busbar 120. The DC-to-DC converter may convert the DC voltage supplied by the electrical rectifier to the voltage required by the electrical motors 130.

A second electrical inverter (not shown) may be located between the variable voltage DC busbar 120 and the VFD 172 to convert the DC power generated by the power generation units 110 to AC power. The second VFD 172 may then convert the AC power to standard frequency for the auxiliary loads 170.

FIG. 2 depicts an exemplary method 200 of varying the output pressure of a compressor. The method 200 includes varying a speed of an engine with a control system coupled to the engine, as shown at 202. The method 200 also includes varying a frequency of AC power generated by an electric generator coupled to the engine, the frequency of the AC power being directly dependent on the speed of the engine, as shown at 204. The method 200 also includes varying a speed of an electric motor coupled to the electric generator, the speed of the electric motor being directly dependent on the frequency of the AC power generated by the electric generator, as shown at 206. The method 200 also includes varying a speed of a compressor coupled to the electric motor, the speed of the compressor being directly dependent on the speed of the electric motor, as shown at 208. The method 200 also includes varying an output pressure of the compressor, the output pressure of the compressor being directly dependent on the speed of the compressor, as shown at 210.

The foregoing has outlined features of several embodiments so that those skilled in the art may better understand the present disclosure. Those skilled in the art should appreciate that they may readily use the present disclosure as a basis for designing or modifying other processes and structures for carrying out the same purposes and/or achieving the same advantages of the embodiments introduced herein. Those skilled in the art should also realize that such equivalent constructions do not depart from the spirit and scope of the present disclosure, and that they may make various changes, substitutions and alterations herein without departing from the spirit and scope of the present disclosure.

1. A system for powering a compressor, comprising:
   a power generation unit adapted to generate AC power;
   an electric motor coupled to the power generation unit, the electric motor adapted to turn at a rate proportionate to a frequency of the generated AC power;
   a compressor coupled to the electric motor, an output pressure of the compressor being directly dependent on the rate that the electric motor turns;
   and a control system coupled to the power generation unit and to the compressor, the control system being adapted to vary the frequency of the AC power generated by the power generation unit, thereby varying the output pressure of the compressor.

2. The system of claim 1, wherein the power generation unit further comprises:
   an engine adapted to run at variable speeds; and
   an electric generator coupled to the engine and adapted to generate the AC power, the frequency of the AC power being directly dependent on the speed of the engine.

3. The system of claim 1, wherein the power generation unit comprises a plurality of power generation units, and wherein the control system is adapted to regulate each power generation unit independently to match a power demand of the electric motor.

4. The system of claim 1, further comprising a busbar, wherein the power generation unit and the electric motor are each coupled to the busbar such that the busbar conducts the AC power from the power generation unit to the electric motor.

5. The system of claim 4, further comprising:
   a variable frequency drive coupled to the busbar; and
   an electrical grid coupled to the variable frequency drive.

6. The system of claim 5, wherein at least a portion of the AC power is exported from the busbar to the electrical grid, and wherein the variable frequency drive is adapted to convert the frequency of the exported AC power to standard frequency AC power.
7. The system of claim 5, wherein standard frequency AC power is imported from the electrical grid, and wherein the variable frequency drive is adapted to convert the standard frequency AC power to the frequency of the AC power required by the electric motor.

8. The system of claim 4, further comprising:
   a variable frequency drive coupled to the busbar; and
   an auxiliary load coupled to the variable frequency drive.

9. The system of claim 8, wherein the AC power generated by the power generation unit is supplied to the auxiliary load, and wherein the variable frequency drive is adapted to convert the frequency of the AC power generated by the power generation unit to standard frequency AC power.

10. The system of claim 4, further comprising:
    a turbine coupled to the power generation unit, the turbine adapted to receive steam produced from waste heat from the power generation unit; and
    an electric generator coupled to the turbine and to the busbar, the electric generator being driven by the turbine and generating additional AC power that is supplied to the busbar.

11. A method for powering a compressor, comprising:
    varying a speed of an engine with a control system coupled to the engine;
    varying a frequency of AC power generated by an electric generator coupled to the engine, the frequency of the AC power being directly dependent on the speed of the engine;
    varying a speed of an electric motor coupled to the electric generator, the speed of the electric motor being directly dependent on the frequency of the AC power generated by the electric generator;
    varying a speed of a compressor coupled to the electric motor, the speed of the compressor being directly dependent on the speed of the electric motor; and
    varying an output pressure of the compressor, the output pressure of the compressor being directly dependent on the speed of the compressor.

12. The method of claim 11, further comprising:
    sensing the output pressure of the compressor with the control system; and
    sending a signal from the control system to the engine directing the engine to vary the speed of the engine in response to the output pressure.

13. The method of claim 11, wherein the engine comprises a first engine and a second engine, and wherein the electric generator comprises a first electric generator and a second electric generator, the first electric generator being coupled to the first engine and the second electric generator being coupled to the second engine.

14. The method of claim 13, further comprising regulating the first and second engines independently to efficiently match a power demand of the electric motor.

15. The method of claim 11, further comprising supplying the AC power generated by the electric generator to the electric motor through a busbar.

16. The method of claim 15, further comprising:
    exporting at least a portion of the AC power from the busbar to an electrical grid; and converting the frequency of the exported AC power generated by the electric generator to standard frequency AC power with a variable frequency drive.

17. The method of claim 15, further comprising:
    importing standard frequency AC power from an electrical grid to the busbar; and converting the standard frequency AC power to the frequency of the AC power required by the electric motor.

18. The method of claim 11, further comprising:
    producing steam with waste heat from the engine;
    powering a turbine with the steam;
    driving a separate electric generator with the turbine; and
    generating additional AC power with the separate electric generator.

19. A system for powering a compressor, comprising:
    an engine adapted to run at variable speeds;
    an electric generator coupled to the engine and adapted to generate AC power, a frequency of the AC power being directly dependent on the speed of the engine;
    a busbar coupled to the electric generator and adapted to receive and conduct the AC power generated by the electric generator;
    an electric motor coupled to the busbar, a speed of the electric motor being directly dependent on the frequency of the AC power generated by the electric generator;
    a compressor coupled to the electric motor, a speed of the compressor being directly dependent on the speed of the electric motor, the compressor producing an output pressure that is directly dependent on the speed of the compressor; and
    a control system coupled to the engine and to the compressor, the control system being adapted to sense the output pressure of the compressor and to send control signals to the engine, wherein the control signals direct the engine to vary the speed of the engine until the compressor produces a predetermined output pressure.

20. The system of claim 19, wherein the engine comprises a first engine and a second engine, the electric generator comprises a first electric generator and a second electric generator, the first engine being coupled to the first electric generator, and the second engine being coupled to the second electric generator, and wherein the control system is adapted to regulate the first and second engines independently to efficiently match a power demand of the electric motor.