Summary of the Invention

[0007] There is disclosed a rotor for a hydro-powered electricity generator, the rotor including:

a hub with a circular cross sectional shape and a longitudinal rotational axis,

a plurality of blades, each having a proximal root and a distal tip, each of the blade roots being mounted to the hub at the widest part thereof,

wherein the ratio between the diameter of the tips of the blades to the diameter of the widest part of the hub is less than about 2:1.

[0008] Preferably, the ratio between the diameter of the tips of the blades to the diameter of the widest part of the hub is between about 1.2:1 and 2:1.

[0009] Preferably, the ratio between the diameter of the tips of the blades to the diameter of the widest part of the hub is about 1.5:1 or 1.6:1.

[0010] In one embodiment, the diameter of the tips of the blades is between 3.6 and 4.8 metres and the diameter of the widest part of the hub is 2.4 metres.

[0011] In another embodiment, the diameter of the tips of the blades is between 30 and 32 metres and the diameter of the widest part of the hub is 20 metres.

[0012] The profile radius of the hub surface, in the region where each of the blade roots are mounted to the hub, is preferably between 1/6th of and equal to the radius of the widest part of the hub.

[0013a] In an aspect, the present invention provides a rotor for a hydro-powered electricity generator suitable for installation in a free stream, the rotor including:

a hub formed of a shape with a circular cross section and a longitudinal rotational axis, the hub shape adapted to cause pressure in fluid flowing local to the hub to decrease relative to pressure of a balance of fluid in the free stream, and

a plurality of blades, each having a proximal root and a distal tip, each of the blade roots being mounted to the hub at the widest part thereof,

wherein the mounted position of the blade roots is configured so that energy in the free stream of the fluid is concentrated in a region of the blades.

[0013b] In some embodiments, the relative pressure decrease in the fluid flowing local to the hub results from an increase in velocity of that fluid relative to velocity of the balance of fluid in the free stream.

[0013c] In some preferred embodiments, the relative pressure decrease in the fluid flowing local to the hub leads to the concentration of the energy in the free stream being in a region of the blades.

[0013d] Preferably, the hub shape is further adapted to accelerate fluid flow reducing turbulence in the region of the blades.

[0013e] In some embodiments, the rotor is suitable for installation in fluid flows with high levels of turbulence.

[0013f] In some alternative embodiments, the rotor has an improved survivability from blade failure relative to a rotor with a different configuration.

[0013g] In some preferred and alternative embodiments, the hub shape in combination with the configuration of the mounted position of the blade roots is adapted to enable the blades to operate at maximum capacity whilst experiencing a lower stress loading in the blades compared to mounting longer blades to a hub of smaller diameter.

[0013h] Preferably, each blade has a span and the mounted position of each blade is adapted such that an incident velocity and an incident angle of fluid flowing local to the hub is approximately uniform across the blade span.

[0013i] In some embodiments, the mounted position of each blade is further adapted such that each blade can be articulated in pitch without reduction in performance induced by blade twist.

[0013j] In some alternative embodiments, allowing articulation of pitch during operation permits the rotor to run at a constant revolution per minute rate irrespective of stream flow velocity.

[0013k] In some preferred and alternative embodiments, the rotor is connected directly to an electrical grid.

[0013l] In other preferred and alternative embodiments, the rotor excludes an electrical frequency inverter drive system.

[0013m] In some further preferred and alternative embodiments, the rotor excludes a shroud.

[0013n] In yet still further preferred and alternative embodiments, the rotor comprises ten blades.

[0013o] Preferably, a ratio between the diameter of the tips of the blades to the diameter of the widest part of the hub is less than about 2:1.

[0013p] In some embodiments, the hub shape is adapted to redirect and concentrate fluid flow in an inner two-thirds of the region of the blades.

[0013q] In some preferred embodiments, the hub shape is further adapted to accelerate the concentrated fluid flow to an outer one-third of the region of the blades.

[0013r] Preferably, a maximum amount of energy is extracted from the outer one-third of the region of the blades.

[0013s] In some preferred and alternative embodiments, the ratio between the diameter of the tips of the blades to the diameter of the widest part of the hub is between about 1.2:1 and 2:1.

[0013t] In some other preferred and alternative embodiments, the ratio between the diameter of the tips of the blades to the diameter of the widest part of the hub is about 1.5:1 or about 1.6:1.

[0013u] In some preferred embodiments, the diameter of the tips of the blades is between 3.6 and 4.8 metres and the diameter of the widest part of the hub is 2.4 metres.

[0013v] In some preferred embodiments, the diameter of the tips of the blades is between 30 and 32 metres and the diameter of the widest part of the hub is 20 metres.

[0013w] In some preferred and alternative embodiments, a surface of the hub has a profile and the profile radius of the hub surface, in the region where each of the blade roots are mounted to the hub, is between one-sixth of, and equal to, the radius of the widest part of the hub.

Brief Description of the Drawings

[0014] Preferred embodiments of the invention will now be described, by way of examples only, with reference to the accompanying drawings in which:

CLAIMS:

1. A rotor for a hydro-powered electricity generator suitable for installation in a free stream, the rotor including:

a hub formed of a shape with a circular cross section and a longitudinal rotational axis, the hub shape adapted to cause pressure in fluid flowing local to the hub to decrease relative to pressure of a balance of fluid in the free stream, and

a plurality of blades, each having a proximal root and a distal tip, each of the blade roots being mounted to the hub at the widest part thereof,

wherein the mounted position of the blade roots is configured so that energy in the free stream of the fluid is concentrated in a region of the blades.

2. The rotor of claim 1, wherein the relative pressure decrease in the fluid flowing local to the hub results from an increase in velocity of that fluid relative to velocity of the balance of fluid in the free stream.

3. The rotor of claim 1 or 2, wherein the relative pressure decrease in the fluid flowing local to the hub leads to the concentration of the energy in the free stream being in a region of the blades.

4. The rotor as claimed in any one of claims 1 to 3, wherein the hub shape is further adapted to accelerate fluid flow reducing turbulence in the region of the blades.

5. The rotor as claimed in any one of claims 1 to 4, suitable for installation in fluid flows with high levels of turbulence.

6. The rotor as claimed in any one of claims 1 to 5, wherein each blade has a span and the mounted position of each blade is adapted such that an incident velocity and an incident angle of fluid flowing local to the hub is approximately uniform across the blade span.

7. The rotor as claimed in any one of claims 1 to 6 wherein the mounted position of each blade is further adapted such that each blade can be articulated in pitch without reduction in performance induced by blade twist.

8. The rotor of claim 7 wherein allowing articulation of pitch during operation permits the rotor to run at a constant revolution per minute rate irrespective of stream flow velocity.

9. The rotor of claim 8 connected directly to an electrical grid.

10. The rotor of claim 8 or 9 which excludes an electrical frequency inverter drive system.

11. The rotor of any one of claims 1 to 10, which excludes a shroud.

12. The rotor of any one of claims 1 to 11 comprising ten blades.

13. The rotor of any one of claims 1 to 12, wherein the ratio between the diameter of the tips of the blades to the diameter of the widest part of the hub is less than about 2:1.

14. The rotor of claim 13, wherein the hub shape is adapted to redirect and concentrate fluid flow in an inner two-thirds of the region of the blades.

15. The rotor of claim 14, wherein the hub shape is further adapted to accelerate the concentrated fluid flow to an outer one-third of the region of the blades.

16. The rotor of claim 15, wherein a maximum amount of energy is extracted from the outer one-third of the region of the blades.

17. The rotor as claimed in any one of claims 13 to 16, wherein the ratio between the diameter of the tips of the blades to the diameter of the widest part of the hub is between about 1.2:1 and 2:1.

18. The rotor as claimed in any one of claims 13 to 16, wherein the ratio between the diameter of the tips of the blades to the diameter of the widest part of the hub is about 1.5:1 or about 1.6:1.

19. The rotor as claimed in any one of claims 13 to 17, wherein the diameter of the tips of the blades is between 3.6 and 4.8 metres and the diameter of the widest part of the hub is 2.4 metres.

20. The rotor as claimed in any one of claims 13 to 16 and 18, wherein the diameter of the tips of the blades is between 30 and 32 metres and the diameter of the widest part of the hub is 20 metres.

21. The rotor as claimed in any one of claims 13 to 20, wherein a surface of the hub has a profile and the profile radius of the hub surface, in the region where each of the blade roots are mounted to the hub, is between one-sixth of, and equal to, the radius of the widest part of the hub.