

CLAIMS:

1. A method for energy recovery from a geologic formation having predetermined available potential thermal capacity, comprising:

drilling into said formation using a destructive mechanism in a predetermined sequence of drilling and sealing to form a primary wellbore therein having a substantially impermeable interface between said wellbore and said formation;

drilling subsequent wellbores by electromagnetic guidance at least from said primary wellbore;

selectively utilizing at least one of cumulative signals and individual signals from drilled subsequent wellbores to guide drilling in forming a predetermined pattern of wellbores within said formation;

linking said predetermined pattern of said wellbores in a closed loop arrangement within thermal areas of said formation through an inlet well and outlet well to an energy recovery device to recover energy from the loop arrangement in a closed loop between the wells and said device, said closed loop arrangement having a predetermined energy output within said available potential thermal capacity of said formation;

circulating a fluid composition having a predetermined composition with a predetermined residency time within said closed loop arrangement to form an energy charged fluid, and

generating on demand energy to an end user through interaction between said charged working fluid and said energy recovery device.

2. The method as set forth in claim 1, wherein the sequenced drilling operation seals any, if present, pre-existing fissures, fractures, cracks or other geologic anomalies and any fissures, fractures, cracks or other geologic anomalies formed as a result of drilling, to form said interface.

3. The method as set forth in claim 1 or 2, further including conducting said method in formation temperatures of at least 50°C.

4. The method as set forth in any one of claims 1 through 3, further including conducting said method in formation temperatures of greater than 400°C.

5. The method as set forth in any one of claims 1 through 4, further including selectively modifying during a drilling operation at least one parameter comprising:

- i) drilling rate of penetration;
- ii) drilling face preconditioning with active coolant;
- iii) drilling destructive mechanism selection;
- iv) electromagnetic communication between selected wellbores;
- v) drilling direction of said wellbores;
- vi) networking of closed loop arrangements;
- vii) proximity of closed loop arrangements;
- viii) circulation fluid composition, flow direction, residency time, flow rate;

viv) flow cycling of compositionally different circulation fluids;

x) residency time for cycled compositionally different circulation fluids; and

xi) combinations of i) through x) in any number and sequence.

6. The method as set forth in claim 5, wherein said drilling rate of penetration parameter includes varying percussion force and rotation speed of drilling apparatus during drilling.

7. The method as set forth in claim 5, wherein said drilling face preconditioning parameter with active coolant includes cooling with a phase change material.

8. The method as set forth in claim 7, further including at least one of i) pre-cooling a rock face to be drilled with said phase change material prior to drilling, ii) cooling with said phase change material during drilling, iii) continuous sequenced combinations of i) and ii) and iv) discontinuous sequenced combinations of i) and ii).

9. The method as set forth in claim 5, wherein said drilling destructive mechanism selection includes forming a thermally conductive interface between a wellbore being drilled and the formation being drilled substantially impermeable to fluids during drilling of said wellbore by inducing irreversible formation damage to said wellbore while drilling said wellbore using at least one of a thermal mechanism, mechanical mechanism, chemical mechanism and biological mechanism, absent the presence of auxiliary material between a formed interface and said wellbore.

10. The method as set forth in claim 5, wherein said electromagnetic communication between selected wellbores parameter includes:

a) providing a U shaped well with spaced apart vertical wellbores interconnected with a horizontal well;

- b) establishing a signal path within said U shaped well;
- c) drilling a second horizontal well from at least one of said vertical wellbores;
- d) sensing a signal from said U shaped well;
- e) directing said drilling of said second horizontal well along a predetermined path relative to said first horizontal well based on a sensed signal from step d);
- f) forming a signalling pair with drilled first and second wells;
- g) drilling a third horizontal well from at least one of said vertical wellbores;
- h) sensing a signal from at least one of said signalling pair, said U shaped well and said second well; and
- i) directing said drilling of said third horizontal well along a predetermined path relative to said first horizontal well and said second horizontal well based on a sensed signal from step h).

11. The method as set forth in claim 5, wherein said electromagnetic communication between selected wellbores parameter includes:

establishing a primary horizontal bore connected to vertical wells;

drilling each subsequent horizontal bore from said vertical wells of said primary horizontal wellbore utilizing cumulative and combined sensor guidance from said precursor horizontal bore whereby trajectory drift from a finally drilled wellbore is substantially reduced relative to a first drilled horizontal wellbore.

12. The method as set forth in claim 5, wherein networking of closed loop arrangements parameter includes commonly connecting outlet wells at a central location.

13. The method as set forth in claim 5, wherein networking of closed loop arrangements parameter includes connecting an outlet well of a closed loop arrangement with an inlet well of a second closed loop arrangement at a second location.

14. The method as set forth in claim 5, wherein said proximity of closed loop arrangements parameter includes at least one of vertically stacking closed loop arrangements, interdigitating closed loop arrangements and combinations thereof.

15. The method as set forth in any one of claims 1 through 14, wherein said drilling operation includes sequencing drilling while sealing pore space in a formation with drilling with a phase change material with subsequent sealing of said pore space; and

cooling a rock face being drilled in said formation with said phase change material to increase the rate of penetration during drilling of said formation relative to the rate of penetration absent said phase change material.

16. The method as set forth in claim 15, further including the step of sealing fissures, cracks and voids in said formation pre-existing or resultant from drilling.

17. The method as set forth in claim 15, wherein the sequencing drilling while sealing pore space operation utilizes an alkali silicate composition in a drilling fluid.

18. The method as set forth in claim 15, wherein sequencing is conducted in an alternating sequence.

19. The method as set forth in claim 15, wherein sealing of said pore space forms an interface between the drilled formation and the periphery of a drilled borehole.
20. The method as set forth in claim 19, further including the step of circulating a chemical composition within said borehole capable of inducing precipitate formation with said interface to augment the sealing capacity and mechanical integrity of said interface.
21. The method as set forth in claim 20, further including the step of circulating a fluid within the sealed borehole containing an interface maintenance additive for maintaining impermeability during circulation of said working fluid within said borehole.
22. The method as set forth in claim 15, wherein drilling into said formation comprises drilling an inlet well, an outlet well and an interconnecting well to form a closed loop with an auxiliary device, at least said interconnecting well disposed within a heat producing area of said formation.
23. The method as set forth in claim 5, further including selecting modifications based on formation rock porosity, formation rock type, formation temperature, drilling depth, tectonics, faults in said formation, geologic anomalies and variations in each or as at least some in a group encountered during practice of said method.
24. The method as set forth in any one of claims 1 through 23, further including the step of forming a plurality of closed loop arrangements for recovering available potential thermal capacity.
25. The method as set forth in claim 24, further including the step of linking said plurality of closed loop arrangements in a predetermined pattern.
26. The method as set forth in claim 25, further including the step of linking discrete predetermined patterns of closed loop arrangements.

27. The method as set forth in claim 26, further including the step of linking discrete predetermined patterns of closed loop arrangements in at least one of a localized network, a dispersed network, in a nested grouping in thermal contact with proximate closed loop arrangements and combinations thereof.

28. The method as set forth in claim 26, further including the step of linking discrete predetermined patterns of closed loop arrangements by an inlet well of one closed loop arrangement with an outlet well of a proximate closed loop arrangement.

29. The method as set forth in any one of claims 1 through 28, further including the step of circulating said fluid in said closed loop arrangements loop with a predetermined residency time to thermally load circulating fluid through conduction from said formation; and
adapting the flow rate of thermally loaded fluid within said loop based on user energy demand.

30. The method as set forth in any one of claims 1 through 29, further including the step of supplementing said fluid with energy charged fluid from adjacent closed loop arrangements in said formation.

31. The method as set forth in any one of claims 1 through 30, wherein said closed loop arrangements include an inlet well, an outlet well and an interconnecting section there between for fluid communication, where said interconnecting section is cased, uncased, lined, chemically treated, chemically sealed, thermally sealed, includes single pipe, coaxial pipe and combinations thereof in a continuous or discontinuous configuration.

32. The method as set forth in claim 1, further including the step of facilitating energy delivery on demand through thermal discharge of said fluid in a power production

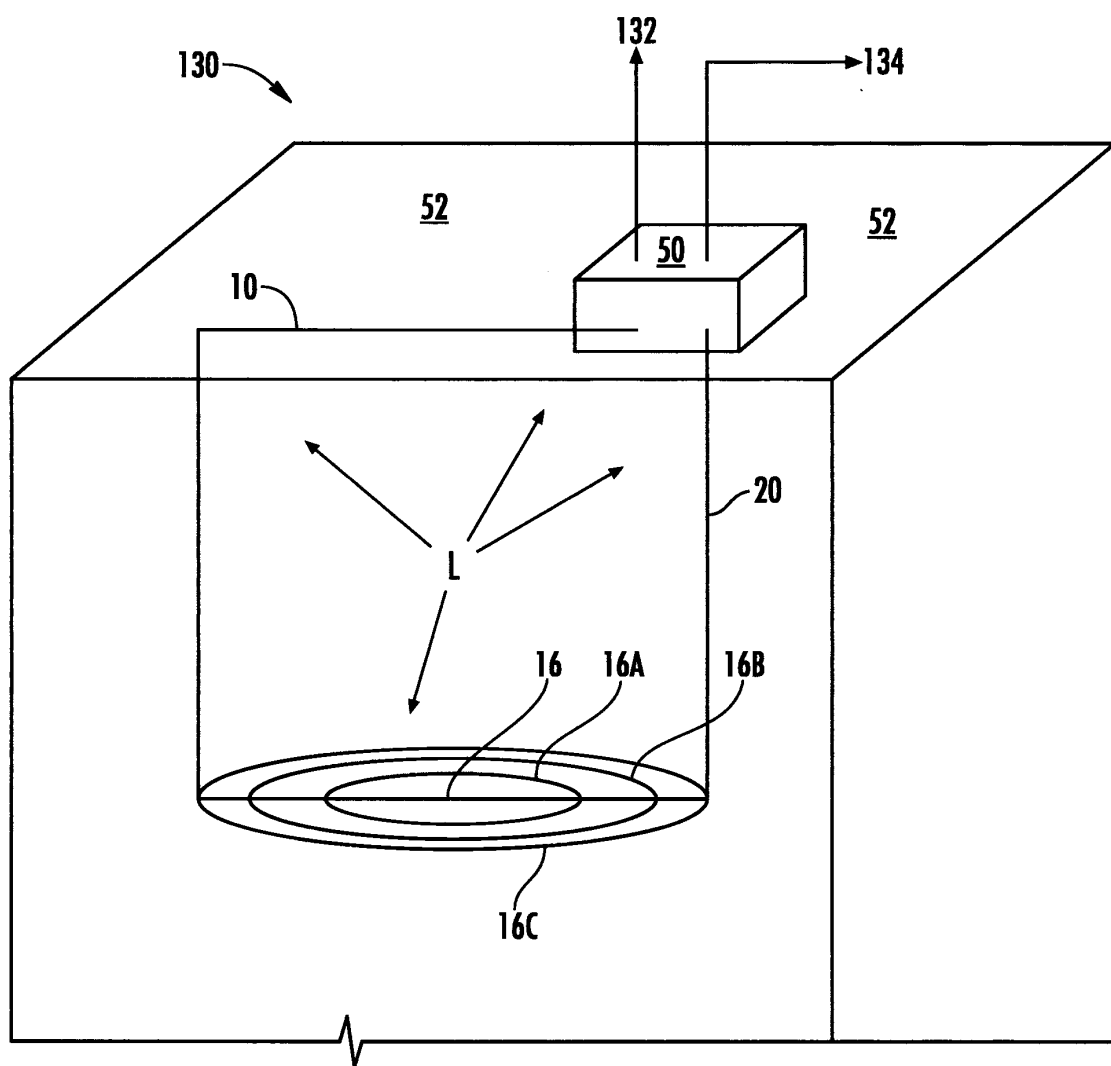


FIG. 45

selectively thermally discharging said working fluid through said intermittent power production arrangement to increase power production to a quantity above said second effective power production quantity and below said designed maximum power production quantity, whereby overall power production is optimized using said pre-existing grid.

35. An energy harvesting farm, comprising:

an energy recovering and producing closed loop system within a thermally productive geologic formation utilizing a working fluid for recovering thermal energy;

an intermittent power production arrangement having a designed maximum power production quantity and a second effective power production quantity on a pre-existing grid;

an energy processing device for processing recovered thermal energy operatively connected to said closed loop system; and

a distribution control system for selectively thermally discharging said working fluid through said intermittent power production arrangement to increase power production to a quantity above said second effective power production quantity and below said designed maximum power production quantity, whereby overall power production is optimized using said pre-existing grid.

36. The energy harvesting farm as set forth in claim 35, wherein said closed loop system comprises a plurality of closed loops having at least one of colocated inlet wells, co-located outlet wells, a common inlet well, a common outlet well, multiple lateral interconnecting wells commonly connected to an outlet well and an inlet well of a

respective closed loop, vertically stacked closed loops, closed loops with an outlet well of a first closed loop connected to an inlet well of a second closed loop, interdigitated multiple lateral interconnecting wells of adjacent closed loop systems and combinations thereof.

37. The energy harvesting farm as set forth in claim 35 or 36, wherein said intermittent power production arrangement comprises at least one of a solar energy recovery arrangement, a wind energy recovery arrangement, a battery energy arrangement and combinations thereof.

38. An energy harvesting farm, comprising:

an energy recovering and producing closed loop system within a thermally productive geologic formation utilizing a working fluid for recovering thermal energy, said formation having an available potential thermal capacity;

a pre-existing electrical grid;

an energy processing device for processing recovered thermal energy operatively connected to said closed loop system;

a distribution control system for selectively thermally discharging said working fluid through said energy processing device;

a delivery system for facilitating energy delivery on demand through thermal discharge of said fluid in said energy processing device to an end user which temporarily exceeds a predetermined energy output of said formation, while maintaining a delivered energy

output average equal to said available potential thermal capacity over a predetermined timeframe.

39. The energy harvesting farm as set forth in claim 38, wherein at least one of said distribution control system and said delivery system are operatively connected to a plurality of energy recovering and producing closed loop systems.

40. The energy harvesting farm as set forth in claim 39, further including a central transmission hub operatively connected to a plurality of discrete energy harvesting farms for redirecting deliverable energy between farms.