What is claimed is:

1. A system for mixing natural gas with a hydrocarbon solvent to yield a liquid medium suited for storage and transport at greater storage densities than compressed natural gas at the same storage conditions, comprising:

a metering system having an inlet to receive a natural gas and an outlet,

a mixer having an inlet connected to an outlet of the metering system,

a solvent injection line connected to the inlet of the mixer,

a gas monitoring unit configured to determine the gas composition of the natural gas and the liquid hydrocarbon solvent to be combined in the mixer into a single phase liquid medium comprising the natural gas absorbed in the liquid hydrocarbon solvent, wherein the natural gas comprises a varying composition of more than one gas, and

a solvent optimizer controller connected to the metering system, the gas monitoring unit and the solvent injection line, the solvent optimizer controller comprising a processor configured to adjust the mol percentage of the liquid hydrocarbon solvent to be combined in the mixer with the natural gas as a function of the gas composition of the natural gas, the gas composition of the liquid hydrocarbon solvent, and the storage pressure and temperature conditions to optimize the storage densities of the natural gas of the single phase liquid medium for pressures and temperatures at which the single phase liquid medium is set to be stored to storage densities that exceed storage densities of compressed natural gas for the same pressure and temperatures.

2. The system of claim 1, wherein the processor of the solvent optimizer controller is further configured to optimize the storage densities of the natural gas of the single phase liquid medium for storage temperatures in a range between -80° F to about -120° F, and storage pressures in a range between 500 psig and 900 psig.

3. The system of claim 1, further comprising

a heat exchanger configured to cool the single phase liquid medium to a storage temperature in a range between -80° F to about -120° F, and

a pump configured to compress the single phase liquid medium to a storage pressure in a range between 500 psig and 900 psig, wherein the storage densities of the natural gas of the single

phase liquid medium exceeds the storage densities of compressed natural gas for the same pressure and temperatures.

4. The system of claim 1, wherein the mixer is a static mixer.

5. The system of claim 1, wherein the solvent injection line comprises a solvent flow meter and a solvent flow control valve, the solvent flow meter and the solvent flow control valve being connected to the solvent optimizer controller.

6. The system of claim 1, wherein the metering system further comprising a plurality of individual metering runs interposing the inlet and outlet of the metering system with one of a flow meter and a flow sensor disposed within each of the plurality of individual metering runs, wherein the solvent optimizer controller is connected to each of the one of a flow meter and a flow sensor.

7. The system of claim 1, wherein the gas monitoring unit is configured to determine the composition of the natural gas received from one of a location prior to the metering system and a location between the metering system and the mixer.

8. The system of claim 7, wherein the gas monitoring unit is configured to determine the composition of the liquid hydrocarbon solvent received from a location prior to the flow meter in the solvent injection line.

9. The system of claim 1, wherein the hydrocarbon solvent is one of ethane, propane, butane and a combination of two or more of ethane, propane and butane constituents.

10. The system of claim 1, wherein the natural gas is methane.

11. The system of claim 1, wherein the hydrocarbon solvent is ethane (C2) and the volumetric ratio of the natural gas component of the single phase liquid medium being in

a range of about 270 to about 414.

12. The system of claim 1, wherein the hydrocarbon solvent is propane (C3) and the volumetric ratio of the natural gas component of the single phase liquid medium being in a range of about 196 to about 423.

13. The system of claim 1, wherein the hydrocarbon solvent is butane (C4) and the volumetric ratio of the natural gas component of the single phase liquid medium being in a range of about 158 to about 423.

14. The system of claim 1, wherein the hydrocarbon solvent is a natural gas liquid (NGL) solvent with a propane bias of 75% C3 to 25% C4 and the volumetric ratio of the natural gas component of the single phase liquid medium being in a range of about 187 to about 423.

15. The system of claim 1, wherein the hydrocarbon solvent is a natural gas liquid (NGL) solvent with a butane bias of 75% C4 to 25% C3 and the volumetric ratio of the natural gas component of the single phase liquid medium being in a range of about 167 to about 423.

16. The system of claim 1, wherein the processor of the solvent optimizer controller is further configured to calculate a target solvent-to-gas ratio of the single phase liquid medium to achieve a predetermined net volumetric ratio of the natural gas in the single phase liquid medium at predetermined storage temperatures and pressures.

17. The system of claim 16, wherein the processor of the solvent optimizer controller is further configured to calculate the target solvent-to-gas ratio by calculating a net volumetric ratio of the natural gas in the single phase liquid medium over a range of storage temperatures and pressures and solvent-to-gas ratios to determine a solvent-to-gas ratio that maximizes the net volumetric ratio of the natural gas in the single phase liquid medium.

18. The system of claim 17, wherein the processor of the solvent optimizer controller is further configured to

measure a solvent-to-gas ratio of the single phase liquid medium prior to cooling the single phase liquid medium to a storage temperature,

compare the measured solvent-to-gas ratio of the single phase liquid medium with the target solvent-to-gas ratio of the single phase liquid medium, and

adjust the mol percentage of the liquid hydrocarbon solvent to be combined with the natural gas as a function of the measured solvent-to-gas ratio of the single phase liquid medium to meet the target solvent-to-gas ratio of the single phase liquid medium.

19. The system of claim 1, wherein the processor of the solvent optimizer controller is further configured to adjust the mol percentage of the liquid hydrocarbon solvent to be combined with the natural gas to a level at which an increase in the mol percentage of the liquid hydrocarbon solvent results in no increase in the storage densities of the natural gas of the single phase liquid medium for pressures and temperatures at which the single phase liquid medium is set to be stored.

20. The system of claim 3, further comprising a containment system adapted to store a single phase liquid medium comprising natural gas absorbed in a hydrocarbon gas solvent at storage pressures and temperatures associated with storage densities for the natural gas in the single phase liquid medium that exceeds the storage densities of compressed natural gas (CNG) for the same storage pressures and temperatures, wherein the containment system is adapted to store the single phase liquid medium at temperatures in a range of less than -80 F to about -120 F and at pressures in a range of 500 psig to 900 psig.

21. The system of claim 20, wherein the containment system includes a looped pipeline system.

22. The system of claim 21, wherein the looped pipeline system adapted to store the single phase liquid medium at pressures in a range from 300 psig to 900 psig.

23. The system of claim 21, wherein the looped pipeline system includes recirculation facilities adapted to control temperature and pressure.

24. The system of claim 21, wherein the looped pipeline system is configured for serpentine fluid flow pattern between adjacent pipes.