What is claimed:

1. A process for producing olefins and/or dienes, the process comprising:

thermally cracking a C1-C4 hydrocarbon containing feed to produce a cracked hydrocarbon effluent containing methane and a mixture of C2-C4 olefins and paraffins, wherein a conversion of hydrocarbons in the hydrocarbon containing feed is in a range from about 10 mol % and to 70 mol %;

without componential separation of the cracked hydrocarbon effluent, dehydrogenating the cracked hydrocarbon effluent to produce a dehydrogenated hydrocarbon effluent containing additional olefins and/or dienes.

2. The process of claim 1, further comprising cooling the cracked hydrocarbon effluent via direct heat exchange with a hydrocarbon feed containing one or more C1-C4 hydrocarbons.

3. The process of claim 1, wherein the thermally cracking is performed in one of a pyrolysis reactor or a heat exchanger, wherein the cracked hydrocarbon effluent recovered from the pyrolysis reactor or heat exchanger is at a temperature in a range from about 550°C. to about 725°C.

4. The process of claim 3, further comprising cooling the cracked hydrocarbon effluent to a temperature in a range from about 500°C. to about 650°C. prior to dehydrogenating the cracked hydrocarbon effluent.

5. The process of claim 1, further comprising separating the dehydrogenated effluent into one or more fractions selected from a hydrogen fraction, a methane fraction, a C2 fraction, an ethylene fraction, an ethane fraction, a C3 fraction, a propylene fraction, a propane fraction, a C4 fraction, a butadiene fraction, a butene fraction, a butane fraction, and a C5+ containing fraction.

6. The process of claim 1, wherein the C1-C4 hydrocarbon-containing feed comprises n-butane, the process further comprising controlling the thermally cracking step to a conversion in the range from about 40 mol % to 60 mol %.

7. The process of claim 1, wherein the feed C1-C4 hydrocarbon-containing comprises propane, the process further comprising controlling the thermally cracking step to a conversion in the range from about 25 mol % to 40 mol %.

8. The process of claim 1, further comprising mixing steam, carbon dioxide, and/or nitrogen with the C1-C4 hydrocarbon-containing feed to form a diluted feed mixture.

9. The process of claim 8, wherein the diluted feed mixture has a diluent to hydrocarbon ratio in the range from about 0.04 to 0.2, by weight.

10. The process of claim 1, further comprising conducting the thermal cracking step at a pressure greater than the dehydrogenation.

11. The process of claim 1, further comprising conducting the thermal cracking step at a coil outlet temperature greater than a feed inlet temperature of the dehydrogenation.

12. The process of claim 1, wherein the C1-C4 hydrocarbon-containing feed comprises isobutane, the process further comprising positionally isomerizing the isobutane to form n-butanes.

13. The process of claim 1, wherein the C1-C4 hydrocarbon-containing feed comprises isobutane, the process further comprising positionally isomerizing isobutene in the dehydrogenated hydrocarbon effluent to form n-butenes.

14. A process for producing olefins and/or dienes, the process comprising:

heating a hydrocarbon feedstock, comprising one or more C1-C4 hydrocarbons, in a convection zone of a pyrolysis reactor to form a heated hydrocarbon mixture;

mixing the heated hydrocarbon mixture with steam to form a mixed feedstock having a steam to hydrocarbon ratio in a range from 0.04 to 0.2;

heating the mixed feedstock in the convection zone of the pyrolysis reactor;

reacting the mixed feedstock in a radiant zone of the pyrolysis reactor to produce a cracked hydrocarbon effluent containing methane and a mixture of olefins and paraffins;

feeding the entirety of the cracked hydrocarbon effluent, without componential separation, to a dehydrogenation reaction zone for dehydrogenating the cracked hydrocarbon effluent to produce a dehydrogenated hydrocarbon effluent containing additional olefins and/or dienes and;

separating the dehydrogenated hydrocarbon effluent to recover one or more fractions selected from a hydrogen fraction, a methane fraction, a C2 fraction, an ethylene fraction, an ethane fraction, a C3 fraction, a propylene fraction, a propane fraction, a C4 fraction, a butadiene fraction, a butene fraction, a butane fraction, and a C5+ containing fraction.

15. The process of claim 14, wherein the feedstock comprises n-butane, the process further comprising controlling the thermal cracking step to a conversion in a range from about 40 mol % to 60 mol %.

16. The process of claim 14, wherein the feedstock comprises propane, the process further comprising controlling the thermal cracking step to a conversion in a range from about 25 mol % to 40 mol %.

17. The process of claim 14, further comprising controlling a coil outlet temperature of the cracked hydrocarbon effluent from the pyrolysis reactor to a temperature in a range from about 660°C. to about 725°C.

18. The process of claim 17, further comprising cooling the cracked hydrocarbon effluent, via direct heat exchange with a hydrocarbon feed comprising one or more C1-C4 hydrocarbons, to a temperature in a range from about 550°C. to about 650°C., prior to dehydrogenating the cracked hydrocarbon effluent.