| Fails to meet criteria | Not promising | Meets in some respects | Potentially meets criteria | Meets criteria |
|---|---|---|---|---|

* For explanation of criteria see Box B, page 22

# ASSESSMENT TABLE: **Buildings**

| | Credible | | | Capable | | Compelling | | | Priority approach |
|---|---|---|---|---|---|---|---|---|---|
| | Maturity | Economic viability | Social acceptability | Fit for purpose | Net-zero pathway potential | To critical stakeholders | Related costs and benefits | Economic development opportunities | |
| **Methane** | | | | | | | | | |
| **Natural gas** | High. Mature technology | High. Very low price | No particular concerns. In general use | Yes. In general use | No – GHG emissions at point of use and during extraction | High for producers, pipeline companies and consumers | Uses existing infrastructure; indoor air quality issues | Already mature | Not a priority<br>Fossil fuel |
| **Renewable NG** (biogas) | Early maturity. | Costs higher than natural gas. Limited sources of feedstocks | No particular concerns | Yes, similar to natural gas | Unlikely to be practical at scale. Lack of necessary feedstocks. Applicable in specific contexts. Could serve as back up for heat pumps | Interest from gas distribution companies and potential feedstock suppliers | Can use existing distribution infrastructure and appliances; air pollution not addressed | Some local opportunities | Low/medium Could play a part in a net zero economy but not at scale. |
| **Synthetic NG** (power from decarbonized sources, carbon from biomass or air capture) | Early research stage | Very high costs | No particular concerns | Yes, similar to natural gas | In principle, but requires cheap net zero hydrogen or renewables and biomass or air capture | Still at research phase | Can use existing infrastructure and appliances; air pollution not addressed | Remote for now | Low<br>Could be part of net zero economy but a long trajectory |
| **Electricity** | | | | | | | | | |
| **Base board or electric furnace** | High, Mature technology | More expensive than gas, but widely used | No particular concerns | Yes, slower heating response time than gas | Yes, assuming net zero electricity supply | Not seen as particularly desirable because of cost concerns | Easy and well-known; low capital costs for baseboard heaters but inefficient | Limited as already mature technologies | Low but can be part of net zero buildings |
| **Air and ground source heat pumps** | High, but still improving | Good but high upfront costs | No particular concerns | Yes. Not applicable in all conditions. Less efficient in very low temperatures | Yes, assuming net zero electricity supply | Increasing interest from utilities as need to decarbonize become clearer | Significantly lowers utility bills and fuel costs. Reduces grid demand | Some potential | Very High<br>Potentially significant part of net zero emission world. |
| **Hydrogen** | | | | | | | | | |
| **Piped as a natural gas replacement** | Pilot project phase | Depends on cheap low emission hydrogen | Some safety concerns. | Yes. | Yes. If hydrogen is made from decarbonized electricity such as renewables or from fossil sources with CCS and offsets. | Interest from existing natural gas distributors | Requires substantial adjustment to gas infrastructure. Requires new gas furnaces. Can support emergence of hydrogen economy | Transition to hydrogen economy for oil and gas. Potential life extension for gas distribution companies. | Medium to High<br>Potentially part of net zero emission world. |
| **Building generated power** | | | | | | | | | |
| **PV panels** | High but new technologies can improve performance further | Dramatic cost reductions over previous decade. But not competitive for heating applications | No particular concerns. Positive public image | Yes. But power output not sufficient for heating in traditional buildings | Yes. Can be part of net zero buildings | Interest among some building firms | Net metering, sell back to grid; Can couple with storage | Industry well established. Some opportunities for local installers. | Medium.<br>As part of integrated building solutions |

| Fails to meet criteria | Not promising | Meets in some respects | Potentially meets criteria | Meets criteria |
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| **Building integrated PV** | Technologies just emerging on the market | More expensive than traditional materials | No particular concerns | Yes. But variable, and power output not sufficient for heating in traditional buildings | Yes. As part of integrated energy solutions. | Still at demo stage. Intrigues some architects | Can reduce grid load and transmission losses. Contribute to system resilience. | Emerging materials opportunities: roofing, facades, windows etc | Medium<br>As part of integrated building solutions |
| **Micro wind turbines** | Still be developed for integrated applications | Low – Long cost recovery | Birds and noise issues | Yes, but variable | Highest for AB, SK, and remote locations | Low at present. | Can couple with storage. Reduce grid load or congestion | Uncertain | Low, except for remote locations |
| **Energy Efficiency** | | | | | | | | | |
| **Net-zero design** (building shells and equipment) | Emerging but experience of deployment at scale lacking | Upfront cost higher. Already competitive over life cycle of building | No particular issues | Yes | When coupled with net-zero electricity | Some builders adopting as competitive advantage. Many wary of costs, lack skills. Consumers not convinced | Improved comfort: air quality, warmth, street noise, and lighting. | High, but need further skill training | High.<br>Need to stop constructing buildings that will require retrofits for net zero |
| **Retrofitting** (building shells and equipment) | Specific technologies high. Approaches to mass retrofit emerging | Many investments repay in energy savings over time. Deep retrofits more challenging | No particular issues | Yes | When coupled with net-zero electricity | Becomes more attractive as carbon pricing and regulations rise. | Modern design; improved air quality and lighting | High for jobs creation, but need further skill training | High. Retrofits required to reduce net zero energy required. |
| **Shared energy solutions** | | | | | | | | | |
| **District energy systems** | Mature | High up front investment, but high efficiency and lower fuel costs | No particular issues with existing systems. Controversial to institute new schemes (finance, regulation) | Yes: can provide reliable heat and cooling | Yes, provided they run on net zero energy. Require minimum density of buildings. | Yes, especially for extending and upgrading existing systems. | Cost reduction, air pollution reductions. | Yes. Municipally owned systems or private companies. | Medium to high in contexts where it can be applied |
| **Inter building energy transfers** | Mature technologies can recover heat from industrial processes, server farms, sewage , etc. | Can be economic today, more so as carbon price and regulation increase | No particular issues | Yes. But systems must be designed for each specific application, matching source and recipient | Can be part of net zero building infrastructure | Yes, when building owners appreciate potential revenues, savings | Reduces energy consumption and costs, reduces pollution. Requires careful case by case design. | Yes. Underdeveloped in Canada and opportunities for engineering, design and construction | Medium to high in contexts where it can be applied |