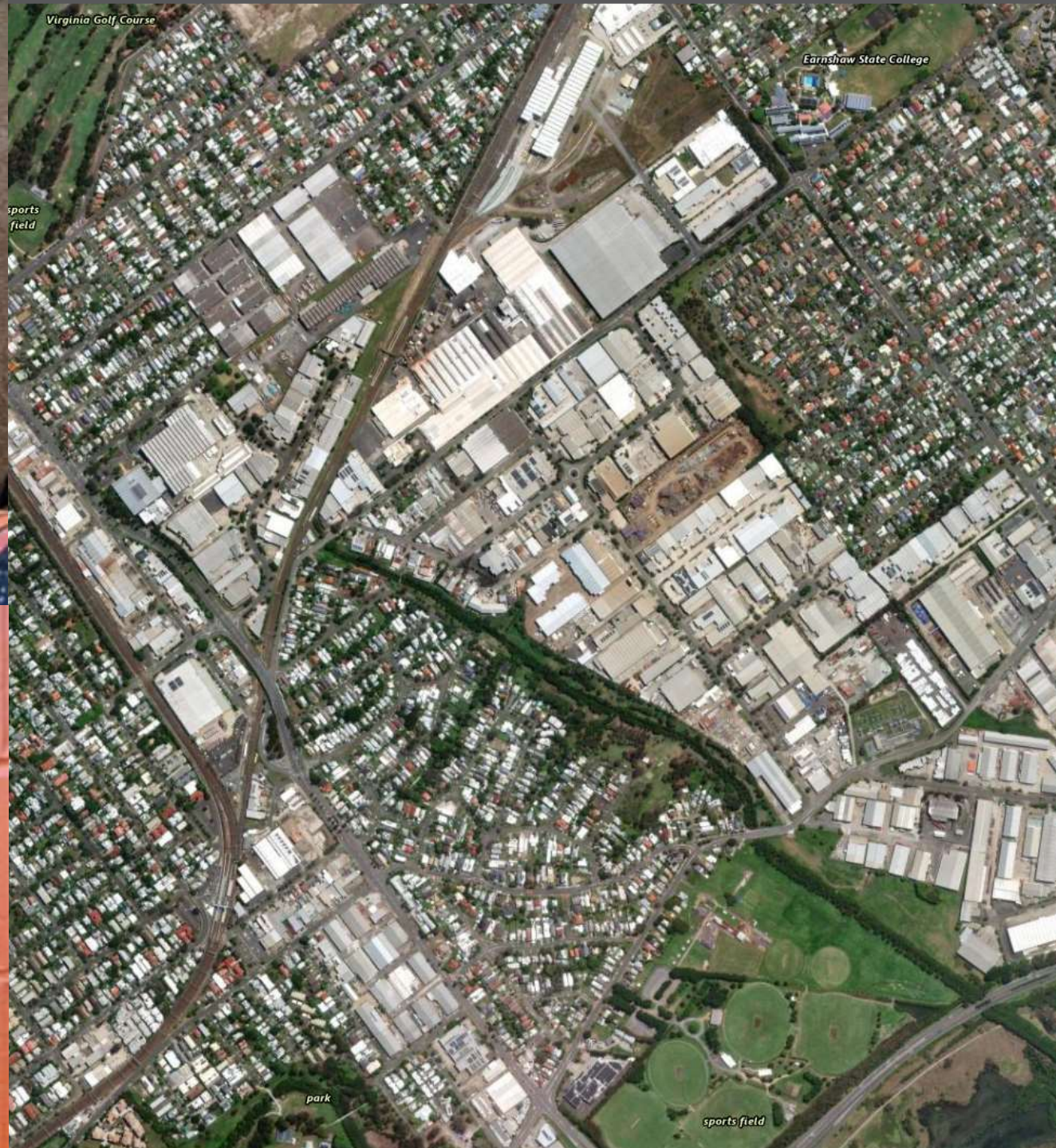
The Future of Type B Appliances

Lessons Learned

Consult
Engineer
Deliver

Ideas
Realised

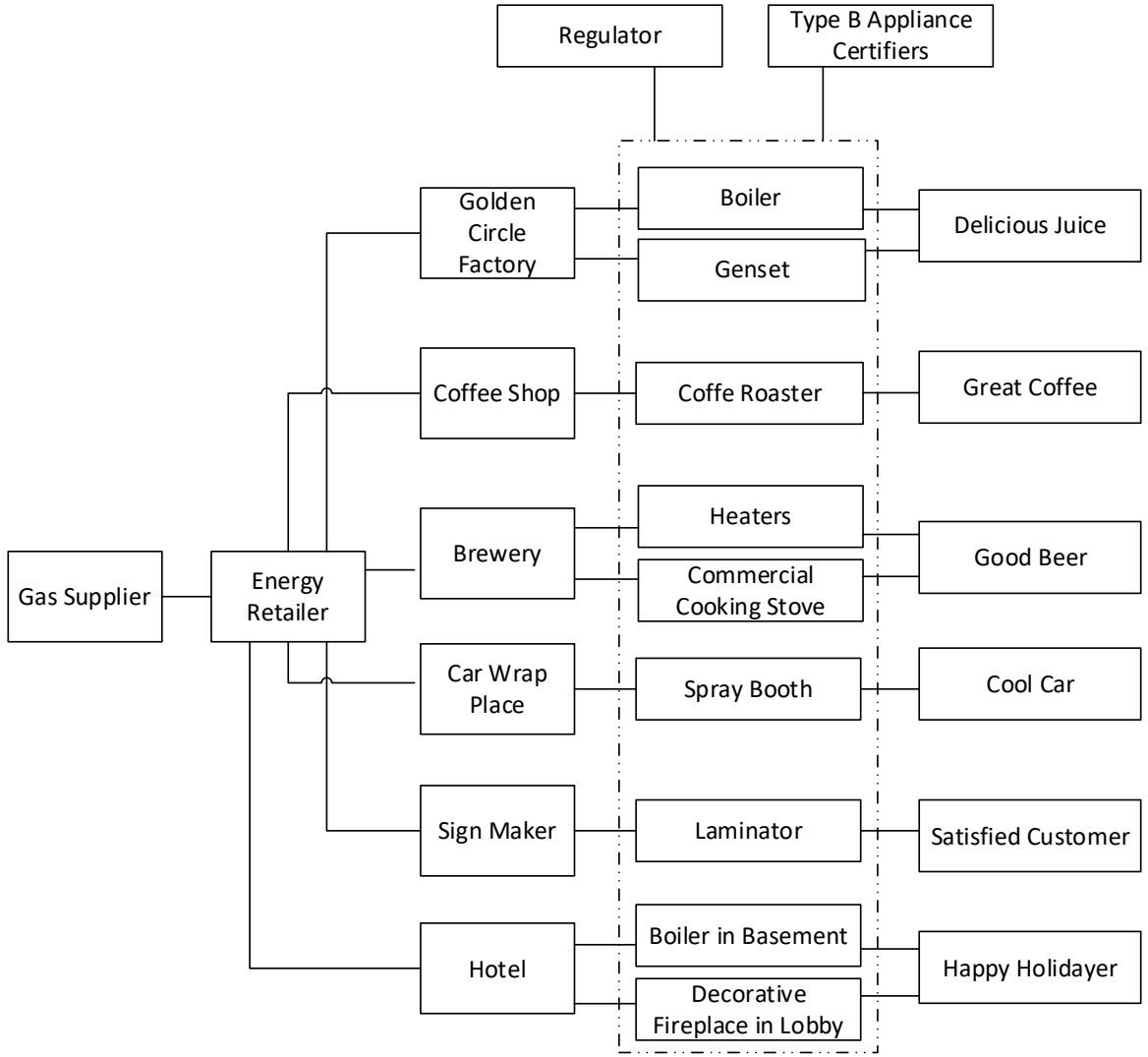

DANGER
DO NOT DIG OR BORE
HIGH PRESSURE GAS
PIPELINE IN VICINITY


Virginia Golf Course
Earnshaw State College
sports field
park
sports field

Gathering Necessary Information

When starting a compatibility study…

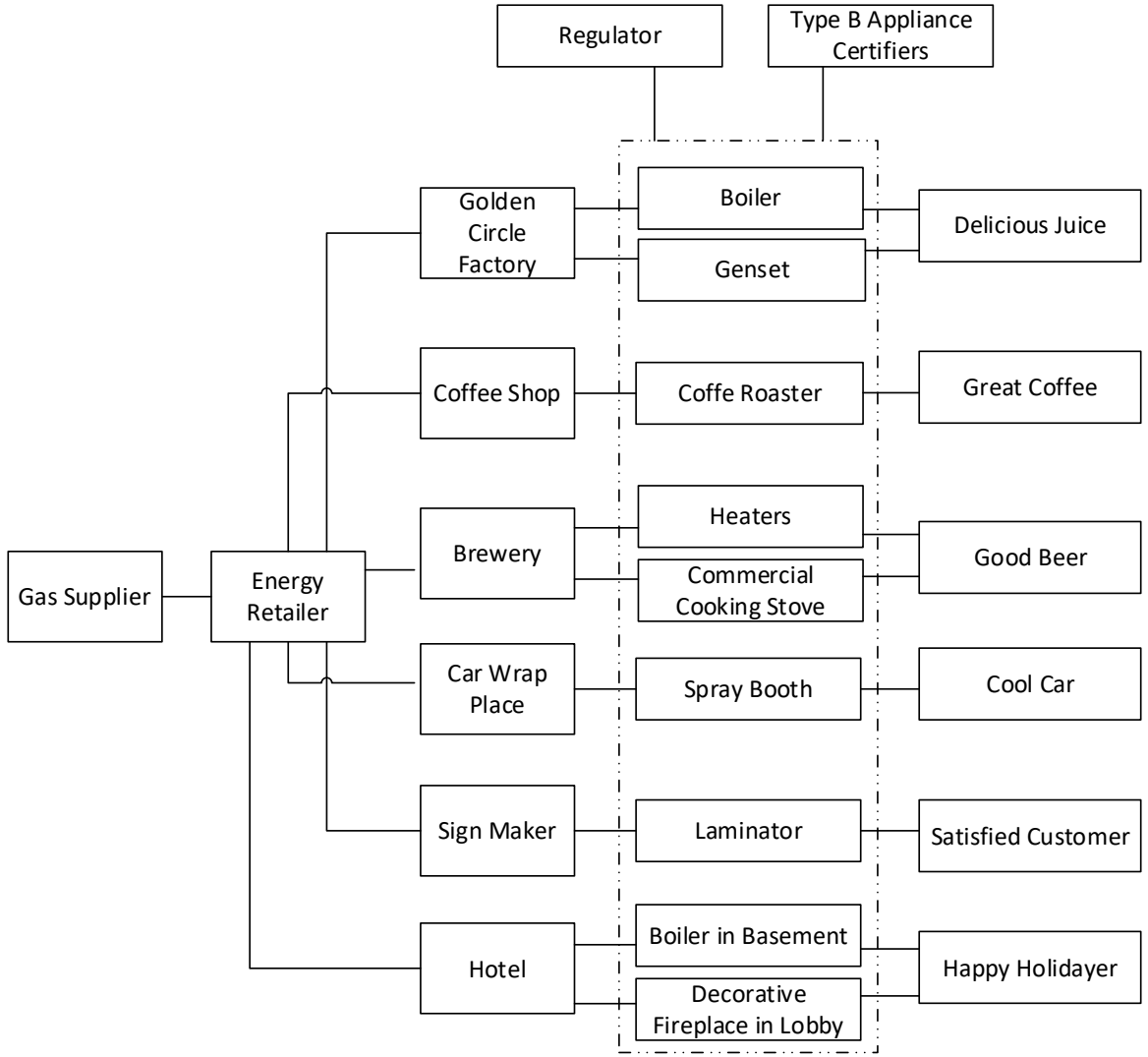
- Consumption Data & Google Maps.
- Type B Appliance Data Bases from the regulating bodies.
- NGER and NPI Reporting Data.
- Market Data.
- Type B Gas Appliance Certifiers.
- The Businesses who owns the appliance.



Unravelling Stakeholder Complexity

When considering decarbonisation

1. Business who understand what is going to happen and how that may affect their business and are already thinking about it.
2. Businesses who understand what is going to happen but don't think it will affect them.
3. Businesses do not understand what is going to happen and are unaware of what will affect them.



Proactive Engagement is Essential

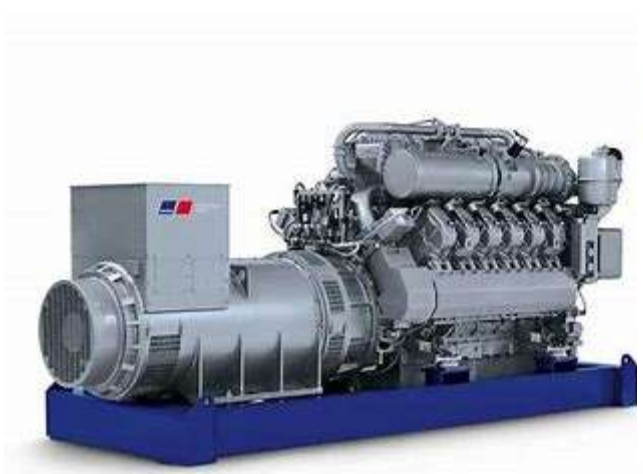
Appliance owners—typically small to medium sized business—must be supported to understand their challenges and develop their transition plans.

Larger businesses tend to have a better grasp over their transition requirements.

What do we know about Type B Appliances

Anything with a gas consumption rate that exceeds 10MJ/h

- Diverse.
- Must be signed off by a Type B certifier.
- Resilient (although the business may not be).
- Burners are central to how they operate.

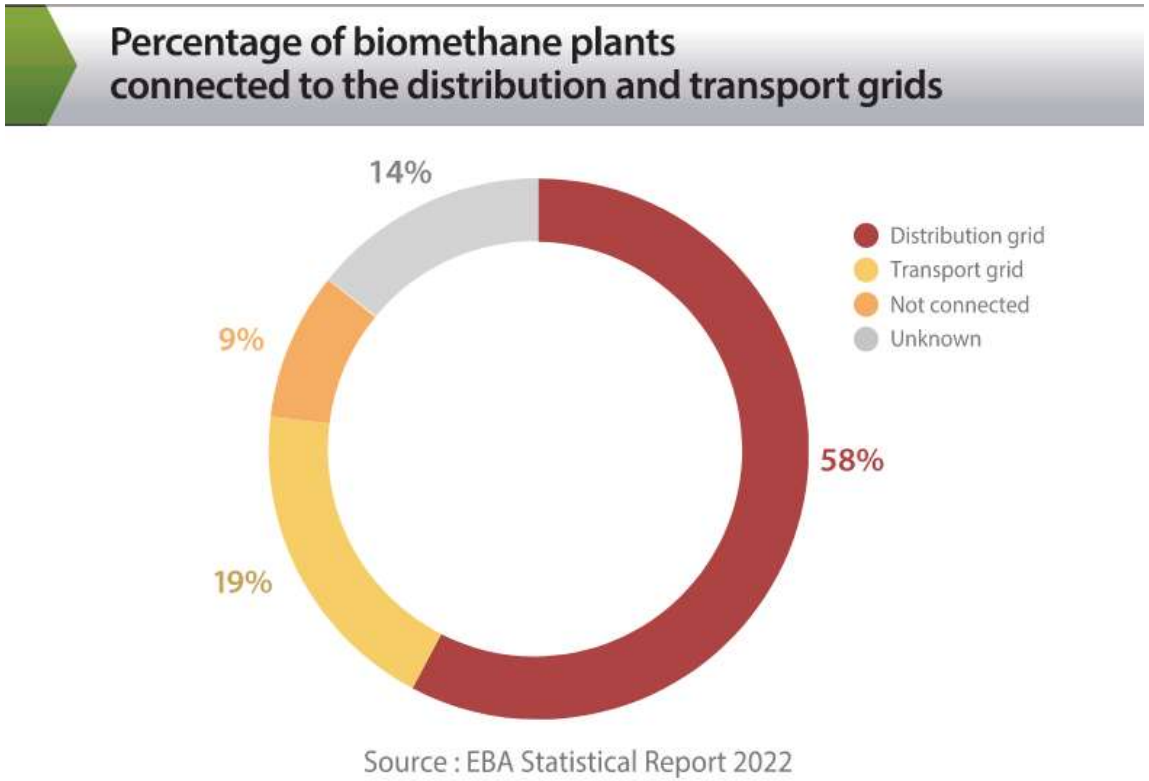


Europe

What can international trials teach us?

Biomethane

- Combusts the same as natural gas.
- Works on European appliances.
- Large majority injected into gas grid.
- On site applications likely not reported.



HyDeploy

What can international trials teach us?

Hydrogen at 20%

- **All** UK gas appliances are **hydrogen tested** up to at least 23% before certification.
- Appliance monitoring during the hydrogen blend trial revealed **no appliance failures or performance decrease**.
- Glass Manufacturing Trail required **18 months** of detailed engineering and logistics planning.

FFCRC

What can our research tell us?

Type B Appliance Testing (RP1.4-08)

- Open firing testing has been completed and the team are currently progressing with enclosed fire testing.
- Different burners yield different results.
- At higher percentages of hydrogen NOx levels increase and need to be managed (increase in air pressure can effectively reduce NOx, albeit at the expense of CO emissions).

Table 3: Maximum %H_2 for the various burners with no modification and the reason for this maximum.

Appliance/burner	Max H_2 [%]	Reason/observation
AN burner (open)	55	Light-back at low rate
AN burner (closed)	80	Flame detection (flame rod)
Riello package burner	99	Flame detection (flame rod) – possibly lower (overheating)
Eclipse air-heat burner	40–50	Overheating of burner (+ noise)
Tempest nozzle-mix burner	100	No issues in flame detection or stability
Radiant burner	40	High probability of light-back on ignition

Table 4: Maximum %H_2 for the various burners with normal adjustments and the reason for this maximum.

Appliance/burner	Max H_2 [%]	Change made	Reason/observation
AN burner (open)	70	Constant heat input of 35 kW	Light-back
AN burner (closed)	100	Flame rod replaced by UV sensor	No limit observed
Riello package burner	100	Flame rod replaced by UV sensor	Overheating may be a concern
Eclipse air-heat burner	40–50	Check valve sealed off	Overheating of burner
Tempest nozzle-mix burner	100	No change necessary	No limit observed
Radiant burner	40	No adjustment feasible	High probability of light-back on ignition

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Blending Hydrogen and Biogas in Commercial Burners

Adopters of hydrogen and biogas will be looking to widen the available operating rages to maximize H2 addition or utilize the lowest quality biogas

Key Findings

- Increasing the injector size widened the operating range.
- CO2 content impacted the stability and operation of an unmodified burner.
- Added CO2 component caused a shortening of the flame length due to increase entrainment of primary air.
- Increased CO2 decreased the NOx emissions.

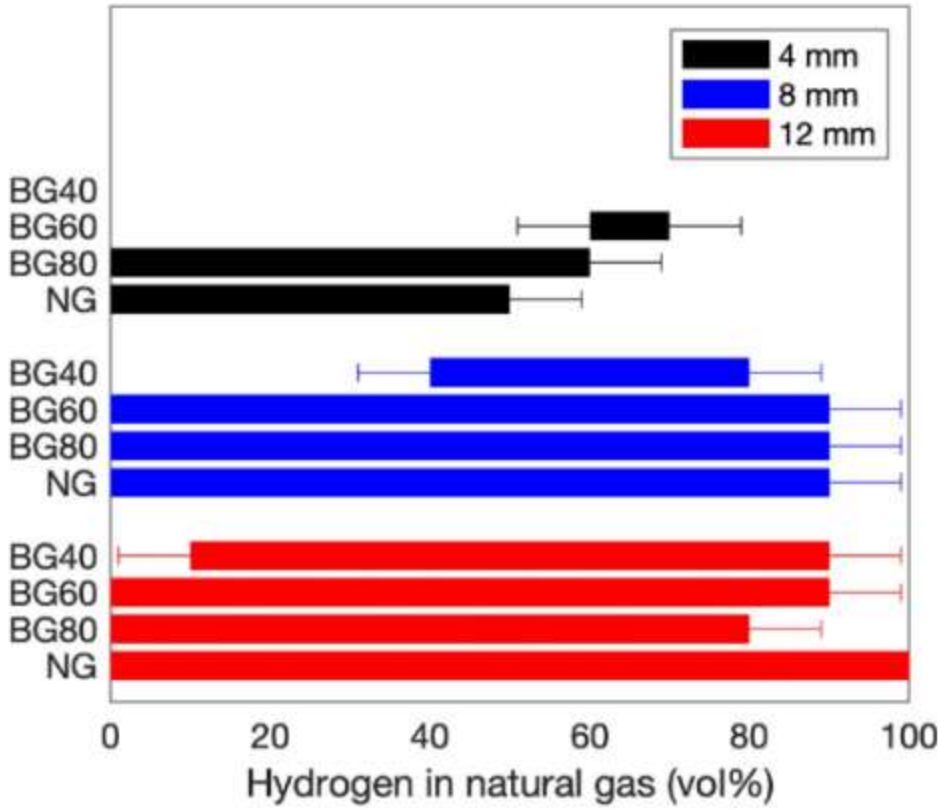

Fig. 2. Minimum and maximum fractions of hydrogen able to be blended into various natural gas (NG) and biogas (BG) fuels before blow-off or flashback while conserving heat input.

Risk assessments (on an appliance level) are key to project feasibility

- Safety Related (e.g. Light Back).
- Materials Related (e.g. Embrittlement).
- Appliance Efficiency Related (e.g. Flame Temperature & Siloxane Build Up).
- Emissions Increases (e.g. NOx, CO, Combustion Performance & Air Fuel ratio adjustments).
- User Interface (e.g. Odorant).

Who to watch out for?

What the business does?

- The business creates a product subject to strict quality requirements e.g.,
  - Glass making,
  - Steel making.
- The business is a testing site for appliances.
- The business is ill equipped to be retrofit for change (esp. when considering 100% H2).
- The business has multiple type B appliances on a single premises feeding a variety of needs.

The appliance itself?

- Age,
- Materials,
- Components,
- Burner Configuration & Air Control.

Sensitive businesses require more support and detailed investigations

Appliances are configuration specific so would need to be risk assessed and optimized on a case by case basis.

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Type B BBQ Conversation

Decarbonising the Eternal Flame

Brisbane's Shrine of Remembrance

- Holograph? LCD TV?
- Biogas?
- Hydrogen?

Important to Consider

- Public Facing
- Emissions over ‘eternity’

Fun Fact: Naturally occurring eternal flames around the world are ignited to avoid methane emissions

Considerations

1. How do you gather necessary appliance information to conduct a compatibility study?
2. How do you apply international and domestic research to your appliance's compatibility determination?
3. What are the biggest common traps and risks in decarbonising type B appliances?
4. How do we decarbonize the eternal flame?

Lessons

1. Proactive engagement is essential
2. Risk assessments (on an appliance level) are key to project feasibility.
3. Sensitive businesses require more support and usually detailed investigations.

References

› HyDeploy2Project, 2021, 3rd Project Progress Report https://hydeploy.co.uk/app/uploads/2022/06/HYDEPLOY2-THIRD-OFGEM-PPR.pdf

› Adam J. Gee, Neil Smith, Alfonso Chinnici, Paul R. Medwell, 2024,Performance of biogas blended with hydrogen in a commercial self-aspirating burner, https://doi.org/10.1016/j.ijhydene.2023.11.322

› FFCRC, 2022, Interim Report for RP1.4-08 Detailed Assessment of Type B Appliances, https://www.futurefuelscrc.com/project/rp1-4-08-detailed-assessment-of-type-b-appliances-with-blends-of-hydrogen-and-natural-gas-and-100-hydrogen/