

# SAE Progress on Sustainable Heat Pump Refrigerants

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# SAE Research – where we've been

- Cooperative Research Program (CRP) Work
  - SAE Thermal Management Refrigerant (TMR) CRP since 2021
  - Another example of regulator+industry+expert pre-competitive project
  - EV with an efficient Heat Pump is target with eye on low/no PFAS
- CRP Sub team: Team Entropy
  - System layout Concept – Dual Secondary Loop, R-290 and others
  - Component supply – Tier 1s → complete module
  - Bench build & test @ Creative Thermal Systems (CTS)
  - Test, component and understanding iterations
- Result
  - Feasibility of R290 & Dual Secondary Loop
  - Performance Test data
  - Strengths / Weaknesses / Opportunities quantified

# SAE Research – where we are

- CRP Sub teams: Seven Sub-teams
  - Multiple new refrigerant and system options; blends prevalent
  - Much focus on R-290
- R-290 Risk Analysis - Fault Tree Analysis (FTA)
  - Led by Gradient
  - Fault Trees at EV level and specific to R-290
  - Vehicle leak simulation testing at Jensen Hughes
- Results
  - OEMs judge risk manageable, proceed
  - Use FTAs and research as input to develop SAE J-standards
  - Ford & other OEMs actively working on US EPA SNAP approval
  - New SAE standards for the safe design with R-290 in process

# SAE Research – what's next for R-290?

- Complete R-290 standards
  - SAE J3343 (System) and SAE J3342 (Refrigerant Module)
  - 7 additional and related SAE standards being updated
  - Coordinated update with ISO 13043 revision team
- Industry Preparation
  - Tier 1 Thermal Suppliers designing new compact refrigerant modules
  - Vehicle OEMs designing vehicles with Dual Secondary Loop systems
  - US EPA and Industry representatives cooperating on SNAP
- Path Forward
  - US SNAP regulation
  - Designs that comply with SAE J-standards and ISO 13043
  - R-290 enters regular production by 2030's