Hockey Impact Above Replacement (IAR) – 2024-2025 Results Write-Up

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Executive Summary

This write-up summarizes results from a proof-of-concept (POC) for a proposed new metric to evaluate player performance for the 2024-2025 season. This new metric, called **Impact Above Replacement (IAR)**, is reported with a 5-on-5-first structure and adopts modular special teams components (i.e., Power Play and Penalty Kill). This proposed metric attempts to mirror baseball's Wins Above Replacement (WAR) and aims to enable clear interpretation of even-strength impact while preserving role-specific special teams value.

Metric Overview – Core Outputs per Player

- IAR_5v5 (5-on-5) – Primary signal for comparability and stability
- IAR_PP (5-on-4) – Power play module
- IAR_PK (4-on-5) – Penalty kill module
- IAR_total = IAR_5v5 + IAR_PP + IAR_PK – All situations totaled (context-dependent)

For skaters, IAR is derived from on-ice versus off-ice expected goals (xG) differentials (rate-based), converted into win-scaled units. For goalies, IAR used an xG-based goals-saved-above-expected construct (xGoals minus goals). Replacement baselines in this POC are defined using a 20th percentile rate threshold within role groups (Forward vs Defence for skaters; minutes-qualified for goalies)

Skater Results

League-Wide Summary (Minutes-qualified Sample)

The skater table presents IAR_5v5, IAR_PP, IAR_PK, and IAR_total, alongside 5-on-5 time-on-ice filters to reduce small-sample noise. In this POC, most regular skaters are expected to fall above replacement by construction (since the replacement was set at the 20th percentile among regulars), but the spread and tails remain informative.

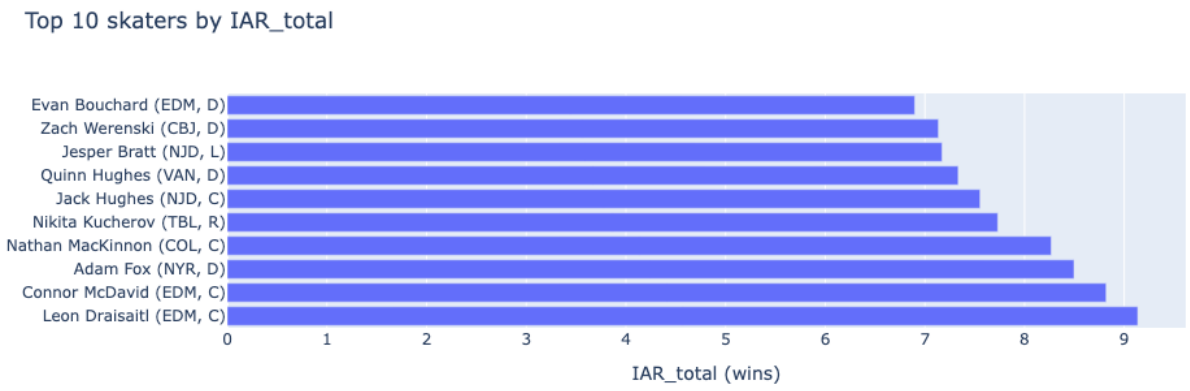

Figure1. Histogram of IAR_total for minutes qualified skaters (min 600 5-on-5 minutes)\

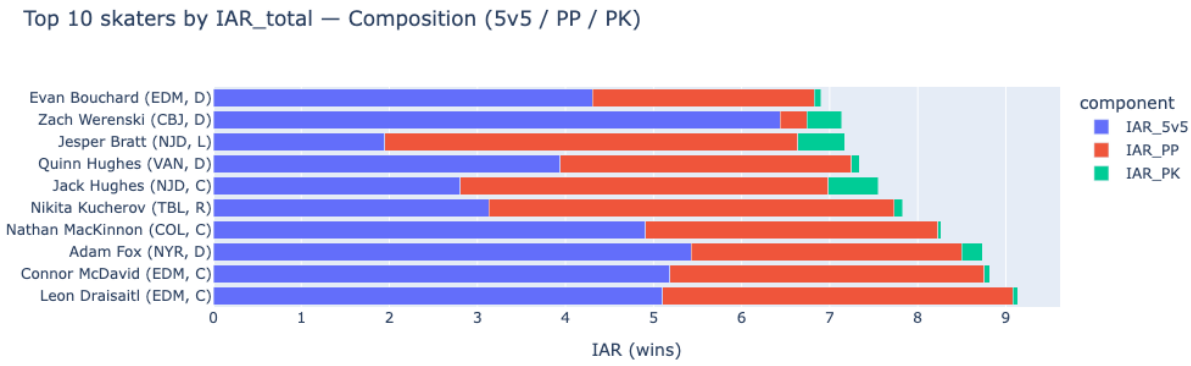

Figure2. Stacked bar chart for top 10 skaters by IAR_total, split into IAR_5v5 / IAR_PP / IAR_PK

Interpretation Guidance

- IAR_5v5 is the recommended backbone for comparing skaters across roles and teams
- IAR_PP and IAR_PK should be interpreted as role modules; totals are most meaningful when considered alongside deployment
- Because the approach is on/off, results can still potentially reflect teammate quality and matchup usage.

Notable Patterns

- Top-end impact is typically 5-on-5 backed, but elite totals often require special teams. In the Top 10 stacked composition view (Figure2), the leading skaters generally combine strong 5-on-5 impact with meaningful PP contributions, which is consistent with the intent of treating 5-on-5 as the backbone and special teams as

modular add-ons rather than letting one blended number hide the source of the value.

- **The Top 10 distinct "impact archetypes"**: Some players are balances (large 5-on-5 + large PP), others are special-teams forward-leaning (PP-heavy profiles), and a smaller subset are 5-on-5 dominant with comparatively limited special teams value.

- Bottom-end outcomes are primarily constrained by 5-on-5 deficits. In the bottom 10 composition view, negative IAR_total is usually driven by a substantial 5-on-5 shortfall that special teams can rarely offset, further enforcing why the 5-on-5 reporting is the most stable "compare across roles" lens.

- Minutes qualified filtering produces a relatively tight negative tail. The lollipop chart in the Jupyter Notebook (supplemental_iar_visualizations.ipynb), with the marker size reflecting 5-on-5 minutes, shows the bottom group clustering within a narrow band of negative values, which is useful for communicating that this approach is identifying a small set of under-replacement seasons rather than labelling a large portion of regulars as strongly negative.

Edmonton Oilers focus (Portfolio View)

For a hockey operations audience, the modular breakdown is useful for separating:

1) 5-on-5 drivers
2) PP specialists
3) PK specialists

This reduces the risk that a single blended number overstates value driven primarily by special teams.

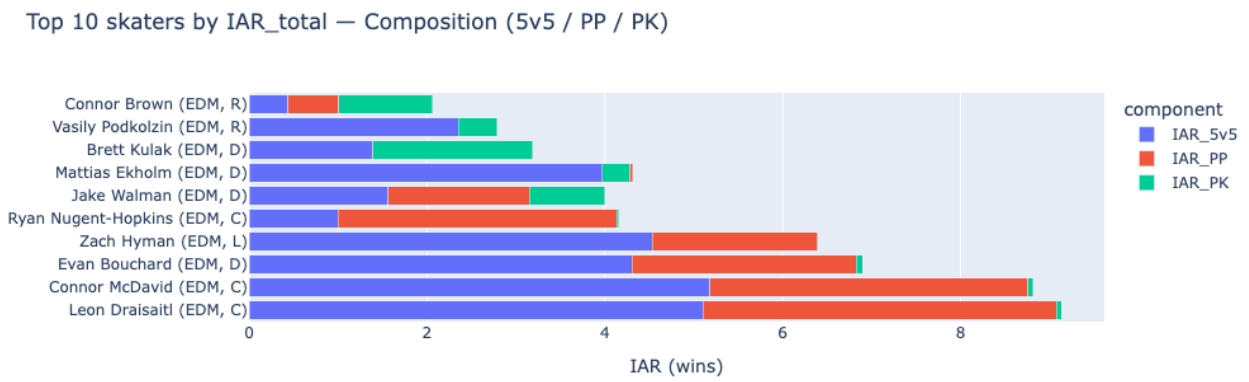

Figure3. Oilers-only stacked bar chart for IAR_5v5 / IAR_PP / IAR_PK for the top 10 Oilers by IAR_total.

Goalie Results

Goalie IAR uses a goals-saved-above-expected style construct (xGoals minus goals), converted into wins. As with skaters, minimum minutes filters are recommended to stabilize leaderboards.

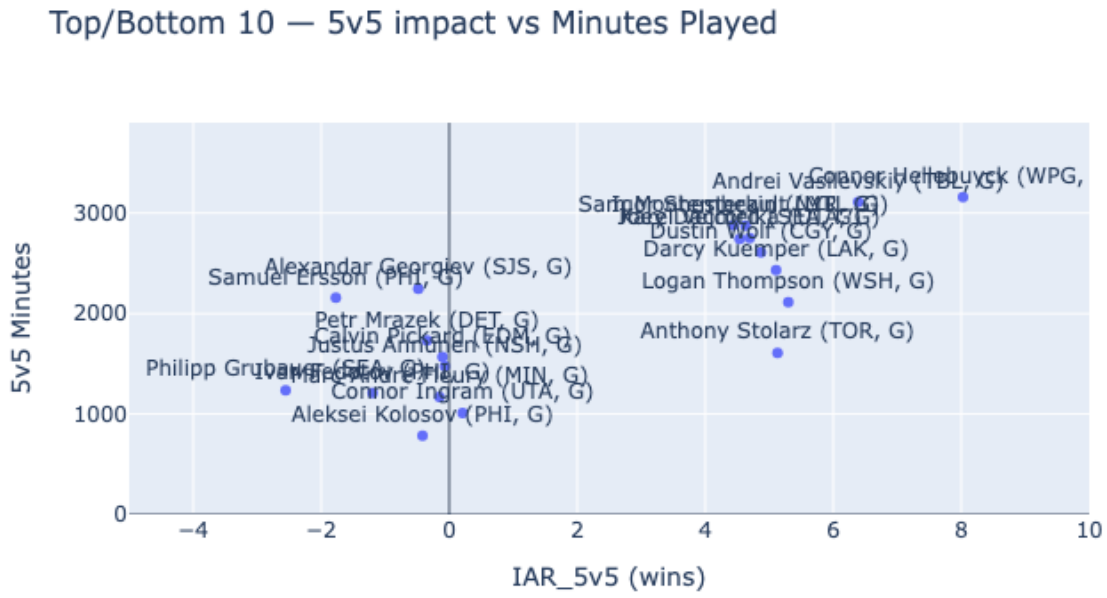

Figure4. Scatter plot of goalie IAR_total vs 5v5 minutes.

Contract Value Layers for Skaters

Where contracts matched successfully, the table includea AAV-based value features such as IAR_total_per_M (IAR_total per $1M AAV). This can surface surplus-value candidates but should be interpreted with care: entry-level and low-AAV deals can dominate value ranking and mid-season trades/retained salary can complicate contract attribution.

Figure5. Quadrant plot of IAR_total vs AAV

Limitations and Next Steps

Known Limitations (POC)

- On/off methods can't be influenced by teammate effects and deployment (i.e., quality of competition and usage)
- Replacement baselines are heuristic (20th percentile among regulars) but can be refined
- The goals-per-win conversion constant is a tunable parameter; a league-season estimate can be substituted

Recommended Upgrade to Current Analysis

The highest-impact next step is to incorporate line-level segments (lines.csv) to estimate individual effects controlling for linemates (possibly via ridge regression). This preserves the 5-on-5 + modular special teams reporting structure while reducing the primary bias of on/off approaches.