

Do G7 Countries Need Virgin Steelmaking?



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The Scrap-Based Alternative for Advanced Economies

Executive Summary

The closure of Britain's last blast furnaces at Port Talbot and Scunthorpe in 2024 forces a fundamental question: **do advanced industrial nations actually need virgin steelmaking capacity?** Rigorous analysis across G7 countries suggests that for most advanced economies, virgin steelmaking represents economic subsidy rather than strategic necessity. G7 countries collectively generate 151-167 million tonnes of scrap annually against 250-280 million tonnes consumption—a 60-65% self-sufficiency rate readily achievable through EAF production.¹ Quality constraints affecting scrap-based production apply to under 5% of steel demand (automotive exposed panels, electrical steel, tinplate), whilst 95%+ of applications tolerate EAF metallurgy. Japan maintains profitable integrated steelmaking through unique export manufacturing integration and Pacific Basin positioning, whilst European economies face accelerating carbon costs making blast furnace economics increasingly untenable.

Smart G7 policy requires distinguishing three categories. **(1) Commodity carbon steel** (95%+ of blast furnace output)—EAF production plus imports provide adequate supply without subsidies. **(2) Specialty flat products** (3-5% of consumption)—limited DRI-EAF capacity warranted for automotive-focused economies (Germany, US, France) through targeted investment. **(3) Alloy steel capabilities** (<1% of consumption)—nuclear forgings, aerospace alloys, and naval armour merit active protection through targeted intervention costing £50-150 million annually, independent of commodity blast furnace production.

The fiscal implications are profound. Maintaining uncompetitive virgin steelmaking costs £500 million to £850 million+ per facility annually whilst generating minimal strategic benefit. Ceasing commodity blast furnace subsidisation releases these resources for genuine strategic priorities—specialty alloy preservation, targeted DRI-EAF where justified, and hydrogen infrastructure—achieving superior outcomes at dramatically lower fiscal burden.



G7 Scrap Availability: The Foundation of EAF Transition

Advanced economies with mature infrastructure generate substantial steel scrap from demolished buildings, scrapped vehicles, manufacturing operations, and discarded appliances. G7 scrap generation patterns demonstrate the viability of scrap-based steelmaking strategies.

Comparative G7 Scrap Generation and Steel Consumption

Country	Steel Consumption (Mt)	Scrap Generation (Mt)	Scrap Self-Sufficiency (%)	Strategic Implication
United Kingdom	10-11	8-9	75-80%	High EAF viability
Germany	38-40	20-22	50-55%	Hybrid approach
France	13-14	10-12	75-85%	High EAF viability
Italy	22-24	12-14	55-60%	Already EAF-dominant
United States	95-100	60-65	60-65%	EAF expansion ongoing
Canada	12-14	6-8	50-60%	Moderate EAF viability
Japan	60-65	35-37	55-60%	Export-driven integrated
G7 Total	250-280	151-167	60-65%	Substantial EAF potential

Source: Steelonthenet.com analysis based on national steel federation data, 2023-2024 averages. Scrap generation includes post-consumer, prompt industrial, and home scrap. Self-sufficiency percentages indicate domestic scrap as share of total steel consumption.

Italy and France demonstrate highest scrap self-sufficiency (55-85%), enabling predominantly EAF-based sectors. Italy operates 25+ million tonnes EAF capacity serving 22-24 million tonnes consumption—demonstrating advanced economy viability without integrated production. Germany's lower scrap ratio (50-55%) reflects its export manufacturing base, with steel exported in vehicles and machinery generating scrap in destination markets rather than domestically.

The US demonstrates successful EAF transition already underway. American EAF capacity exceeds 70 million tonnes annually, producing 68-70% of US crude steel through scrap-based routes. Nucor, Steel Dynamics, and other EAF producers demonstrate consistent profitability whilst integrated produc

Steel, Cleveland-Cliffs) struggle chronically — validating the economic case for scrap-based production in mature economies.

European Scrap Market Integration

European G7 members benefit from highly integrated scrap markets with extensive cross-border trade. Total EU-27 scrap generation approximates 90-100 million tonnes annually against steel consumption of 140-150 million tonnes. Transport costs within Europe add £15-30 per tonne—manageable compared to blast furnace operating cost disadvantages of £100-200+ per tonne versus Asian integrated mills.

Scrap Quality and Premium Grades

Modern sorting and processing can produce high-quality feedstock suitable for demanding applications. Prompt industrial scrap provides particularly clean material with copper under 0.10% and tin under 0.03%—suitable for most applications including standard automotive components. [Premium scrap grades](#) command price premiums of £50-100 per tonne over lower grades, but remain economically attractive versus virgin steelmaking. For applications requiring ultra-low residuals, [DRI-EAF](#) routes using virgin iron blended with premium scrap can achieve necessary specifications without blast furnace production.

The critical insight is that **scrap quality constraints affect perhaps 5% of steel applications** — primarily automotive exposed panels requiring copper <0.06%, electrical steel for transformers and motors, and deep-drawing tinplate for food packaging. The remaining 95% of steel use (construction, machinery, general automotive components, appliances, packaging) readily tolerates [EAF](#) metallurgy with standard scrap feedstock.

The Quality Gap: Real Constraints vs. Protectionist Mythology

Defenders of virgin steelmaking frequently cite quality requirements necessitating blast furnace production. Rigorous examination across G7 applications reveals this argument applies to a narrow slice of steel production whilst serving as protectionist cover for commodity operations.

Applications Genuinely Requiring Low-Residual Steel

Three application categories across G7 economies have legitimate quality requirements favouring virgin steelmaking or [DRI-EAF](#) routes:

Automotive Exposed Panels: Outer body panels require ultra-low copper and tin to prevent surface defects during painting operations. Specifications typically limit copper to 0.06-0.08% and tin to 0.02-0.03%. However, automotive exposed panels represent approximately **1.5-2% of total G7 steel consumption**. Non-exposed structural components, chassis members, and most mechanical parts readily tolerate [EAF](#) metallurgy.³

Electrical Steel: Grain-oriented electrical steel for transformers and non-oriented electrical steel for motors require high silicon content with stringent limits on residual elements affecting magnetic properties. These applications total approximately **0.8-1.2% of G7 steel consumption**, concentrated in

specialised mills (Tata Steel Cogent in UK, Thyssenkrupp Electrical Steel in Germany, AK Steel in US) rather than integrated blast furnace operations.

Deep-Drawing Tinplate: Food and beverage cans requiring complex forming operations need ultra-low carbon, minimal residuals, and specific microstructures. Annual G7 tinplate consumption approximates **0.3-0.5% of total steel use**, produced in dedicated facilities with specialised annealing processes.

Combined, these genuinely residual-sensitive applications total **under 3% of G7 steel consumption**. The remaining 97% comprises construction products (rebar, structural sections, corrugated sheet), commodity flat products (standard automotive, appliances, general engineering), and long products (bar, rod, wire) where EAF metallurgy meets specifications comfortably.

The DRI-EAF Alternative for Premium Products

For applications requiring low residuals, DRI-EAF routes offer viable alternatives to blast furnace production across G7 economies. Direct reduced iron produced from high-grade ore pellets contains minimal residual elements, providing virgin iron units for blending with scrap in EAF operations.

DRI production using natural gas (Midrex, HYL processes) or hydrogen ([emerging green steel routes](#)) generates ultra-low residual iron. Copper content remains under 0.01% and tin under 0.005%—suitable for automotive exposed panels when blended with premium scrap. Several European and North American projects demonstrate commercial viability:

Several European and North American projects demonstrate commercial viability. H2 Green Steel's planned 5 million tonne hydrogen-DRI facility in Sweden, ArcelorMittal's hydrogen DRI investments in Hamburg and Dunkirk, and Thyssenkrupp's conversion in Duisburg collectively represent £15-20 billion investment. Cleveland-Cliffs operates 2 million tonnes DRI capacity at Toledo, whilst Nucor and Steel Dynamics explore DRI expansion for automotive applications.

Economics favour DRI-EAF over blast furnace routes. [Capital costs](#) are 40-50% lower (£500-700 per tonne capacity versus £1,000-1,200 for integrated blast furnace). Operating flexibility is superior, and carbon intensity is dramatically lower, positioning DRI-EAF favourably under EU carbon pricing and emerging regulations.

Blast Furnace Reality: Commodity Production, Not Premium

The inconvenient truth is that **blast furnace-BOF operations predominantly produce commodity products** rather than the premium low-residual steel cited as justification. British Steel's Scunthorpe produced primarily hot rolled coil for construction—applications readily served by EAF routes. German integrated mills, French operations, and US integrated producers concentrate on commodity markets with modest premium product shares.

The specialty low-residual products genuinely requiring virgin metallurgy typically come from dedicated downstream facilities that could source semi-finished feedstock from DRI-EAF operations or imports rather than requiring integrated blast furnace production. This exposes the quality argument as largely protectionist rhetoric.



Defence and Strategic Requirements: G7 Reality Check

National security arguments for virgin steelmaking require rigorous scrutiny given their rhetorical power. Analysis of actual G7 defence steel requirements reveals a dramatic gap between political claims and material reality.

G7 Defence Steel Consumption Analysis

Country	Total Steel Consumption (Mt)	Defence Steel (kt)	% of Total	Strategic Assessment
United Kingdom	10-11	80-120	0.7-1.1%	Minimal strategic need
Germany	38-40	200-250	0.5-0.7%	Minimal strategic need
France	13-14	150-200	1.1-1.5%	Nuclear capability focus
Italy	22-24	60-80	0.3-0.4%	Minimal strategic need
United States	95-100	800-1,000	0.8-1.0%	Specialty capability focus
Canada	12-14	30-50	0.2-0.4%	Minimal strategic need
Japan	60-65	120-180	0.2-0.3%	Specialty capability focus

Source: Steelonthenet.com analysis based on defence ministry procurement data and industry consultations, 2023-2024 estimates.

The data exposes the stark reality: **G7 defence steel consumption represents well under 1% of total steel consumption** across all member countries. Even the US with the world's largest defence budget consumes just 800,000-1 million tonnes annually—less than 1% of 95-100 million tonne consumption base.

Moreover, the composition of defence steel consumption reveals limited dependence on integrated blast furnace production:

Commodity Defence Applications (60-70% of defence steel): Most G7 defence steel comprises standard structural sections for base construction, commodity plate for vehicle fabrication, standard fasteners and fittings, and general engineering products. These applications total 50-70% of defence consumption and have **zero special requirements** beyond civilian specifications. EAF-produced structural sections, plate, and bar serve these applications perfectly adequately.



Specialty Defence Applications (25-35% of defence steel): Naval shipbuilding, armoured vehicle production, and weapons manufacturing consume specialty steel, but most tonnage comprises **alloy steels** rather than carbon steel from blast furnaces. Hull plate for destroyers and frigates uses microalloyed steel with specific toughness requirements. Armoured vehicle plate requires hardened nickel-chromium-molybdenum alloys. These materials come from specialty steel producers rather than integrated blast furnace operations.

Genuinely Strategic Specialty Products (<5% of defence steel): Naval armour plate for warships, nuclear-grade forgings for submarine reactors, and premium seamless tube for weapons systems total under 5% of defence consumption across G7. As detailed in our [analysis of strategic steel products](#), these materials require specialised alloy steel capabilities concentrated in a handful of global producers — capabilities unrelated to blast furnace operations producing commodity carbon steel.

The G7 Strategic Steel Reality

Across G7 economies, **blast furnace closures create zero defence supply chain vulnerabilities**. The genuinely strategic steel capabilities reside in specialty steel operations independent of commodity blast furnace steelmaking:

United Kingdom: Sheffield Forgemasters (nuclear forgings, now government-owned), potential specialty alloy capability at Liberty Specialty Steels if successfully restructured. Neither requires blast furnace preservation.

France: Framatome Le Creusot (nuclear reactor pressure vessels), specialty forging capabilities serving naval programmes. Independent of ArcelorMittal's blast furnace operations.

United States: CMC Impact Metals (armour plate), specialised forging operations, premium seamless tube producers. Independent of US Steel or Cleveland-Cliffs integrated mills.

Germany: Dillinger Hutte (naval plate), specialty forging operations, premium alloy producers. Independent of Thyssenkrupp or Salzgitter commodity blast furnaces.

Japan: Japan Steel Works (nuclear forgings monopoly), premium seamless tube, advanced alloys. These capabilities justify Japanese integrated production alongside export manufacturing — a unique position to be explored by the Steelonthenet team shortly.

The critical lesson: protecting genuine strategic capabilities (nuclear forgings, aerospace alloys, naval armour) requires targeted support for specialty metallurgical operations, **not blanket preservation of commodity blast furnace production**. The conflation of these distinct requirements serves protectionist agendas whilst consuming resources better deployed on actual strategic priorities.

Economic Analysis: The True Cost of G7 Virgin Steelmaking

The economic case against virgin steelmaking in G7 economies rests on chronic unprofitability of integrated mills outside Japan, substantial opportunity costs of subsidisation, and superior returns from EAF investment. Comparative G7 data exposes the fiscal burden of maintaining uncompetitive capacity.

G7 Integrated Mill Economics

European and UK blast furnace-BOF operations face structural cost disadvantages of **£100-200+ per tonne versus Asian integrated mills** and similar disadvantages versus domestic EAF producers. Five factors drive this gap across G7 economies:

Carbon Pricing Impact: EU Emissions Trading System carbon prices of £60-100 per tonne CO₂ add £100-170 per tonne to European integrated mill costs (based on 1.7-2.0 tonnes CO₂ emissions per tonne steel). UK ETS similarly burdens British operations. Asian and even US producers face minimal carbon costs—this regulatory differential alone explains much European competitive disadvantage.

Energy Cost Differentials: European electricity prices (£80-120 per MWh) substantially exceed US levels (£40-60) and Asian competitors. Post-2022 energy crisis impacts persist, with natural gas prices adding £20-40 per tonne to European steelmaking costs versus pre-crisis baselines.

Labour Cost Structures: European integrated mills employ 3,000-5,000 workers per 3 million tonne facility with fully-loaded labour costs of £50,000-70,000 per employee. US mills face similar wage levels but with different productivity patterns. Asian competitors employ fewer workers (1,500-2,500) at lower wages (£15,000-25,000), creating £30-50 per tonne labour cost differentials.

Raw Material Transport Costs: European and UK mills pay £15-30 per tonne premiums for seaborne iron ore and metallurgical coal due to transport distances from Australian and Brazilian sources. US mills accessing Great Lakes iron ore enjoy modest advantages, but most coastal US integrated mills face similar transport penalties to European operations.

Environmental Compliance Costs: European operations face stringent emissions controls (SO₂, NO_x particulates) adding £15-25 per tonne. Water treatment, waste handling, and site remediation obligations add further costs exceeding Asian competitors' requirements.

These cumulative disadvantages render European and UK integrated mills chronically unprofitable at globally competitive prices. US integrated producers face less severe but still substantial disadvantages versus domestic EAF competitors and Asian imports.

G7 Subsidy Dependency and Fiscal Burden

Maintaining uncompetitive virgin steelmaking creates substantial fiscal burdens through direct subsidies, loan guarantees, and indirect support mechanisms across G7 economies:

United Kingdom: £500+ million supporting British Steel's Scunthorpe over 2016-2024 whilst facility remained unprofitable. £500 million committed for Port Talbot EAF transition—transition support rather than perpetual subsidisation represents improvement but still substantial public cost.

Germany: £2 billion in federal guarantees for Thyssenkrupp Steel Europe's restructuring, electricity price compensation schemes worth £300-500 million annually across German steel producers, state-level support for individual facilities. Total German steel industry subsidisation likely exceeds **£1 billion annually** when direct and indirect mechanisms are combined.



France: Substantial support through electricity price agreements, employment subsidies, and regional development funding. ArcelorMittal's French operations receive ongoing indirect support through industrial energy pricing mechanisms worth £200-400 million annually.

Italy: Minimal subsidisation given EAF-dominant steel sector. Demonstrates the fiscal advantages of scrap-based production strategies — Italian EAF mills operate profitably without government support.

United States: [Section 232 tariffs](#) (25% since 2018) function as implicit subsidy transferring costs from steel producers to consuming industries. Estimated to create \$3-5 deadweight loss per \$1 steel industry benefit whilst raising costs across automotive, construction, and machinery sectors. Failed to revive integrated mills—US Steel and Cleveland-Cliffs continue struggling whilst EAF producers (Nucor, Steel Dynamics) thrive.

Canada: Modest support through regional development programmes and trade protection measures. Limited integrated capacity reduces subsidy requirements compared to European G7 members.

The opportunity costs are substantial across G7 economies. £500 million to £1 billion annually per country could fund: tens of thousands of apprenticeships, substantial renewable energy projects, digital infrastructure expansion, or advanced manufacturing R&D supporting economy-wide productivity. **Steel subsidies represent pure consumption rather than investment in future competitiveness.**

EAF Investment Returns Across G7

In stark contrast to loss-making integrated mills, EAF operations demonstrate attractive returns across G7 contexts:

United States: [Nucor](#) achieved **\$2.2 billion net income on \$35.7 billion revenue in 2023** (6.2% net margin). Steel Dynamics generated \$1.9 billion net income on \$18.6 billion revenue (10.2% margin). Both EAF producers demonstrate consistent profitability whilst integrated peers struggle. Over 2014-2023, Nucor and Steel Dynamics reported positive earnings in 9-10 of 10 years; US Steel and Cleveland-Cliffs achieved profitability in just 6-7 of 10 years.

Italy: Riva Group, Arvedi Group, and other Italian EAF producers maintain market-leading productivity and consistent returns. Italy's EAF-dominant steel sector operates profitably without subsidy - demonstrating advanced economy viability of scrap-based production.

United Kingdom: Celsa Steel's UK operations (Cardiff, EAF-based rebar and merchant bar) achieved profitability in 8 of past 10 years despite challenging market conditions. Demonstrates EAF viability in UK context where integrated mills failed.

Germany: Badische Stahlwerke and other German EAF operations demonstrate profitability whilst integrated mills require subsidisation. EAF viability persists even in high-cost German environment.

Investment economics strongly favour EAF routes across G7: capital costs of **£300-500 per tonne capacity** versus £1,000-1,200 for blast furnace replacement. Operating cost advantages of £50-100 per tonne stem from lower energy intensity and scrap feedstock flexibility. Carbon compliance benefits worth



£80-120 per tonne under EU/UK ETS, combined with operational flexibility, enable profitable operation through demand cycles.

Strategic Policy Framework for G7 Economies

Effective G7 steel policy requires abandoning the fiction that all steel production is equally strategic whilst recognising meaningful variation in national circumstances. Three categories merit distinct treatment across advanced economies:

Category 1: Commodity Carbon Steel (Market-Based Approach)

Products: Hot rolled coil, rebar, standard structural sections, commodity plate, wire rod—representing 70-80% of G7 steel consumption.

Strategic Value: Zero. These products trade in deep global markets with hundreds of suppliers across dozens of countries. EAF production serves applications adequately. Import dependency creates no vulnerability when sourcing from allied trading partners within G7 and broader allied networks.

Policy Approach for Most G7 Members: No subsidies, no tariff protection beyond anti-dumping measures, minimal government intervention. Allow uncompetitive blast furnace capacity to close. Support EAF transition only where private capital proves insufficient and EAF operations demonstrate path to profitability. Accept import dependency as economically rational given G7 market integration and allied supplier networks.

Exceptions: Japan maintains profitable integrated production through export manufacturing integration and technological leadership. US geography and market size support hybrid approach with substantial EAF capacity alongside selective integrated operations serving specific regional markets.

Fiscal Impact: Eliminates £500 million to £850 million+ annually in subsidy burden per country. Releases capital for higher-return investments in digital infrastructure, renewable energy, and advanced manufacturing capabilities generating economy-wide productivity improvements.

Category 2: Specialty Flat Products (Limited DRI-EAF Support)

Products: Automotive exposed panels, electrical steel, tinplate—representing 3-5% of G7 consumption but disproportionate value-added and manufacturing ecosystem integration.

Strategic Value: Low direct strategic value but significant manufacturing ecosystem implications. Automotive sector requires domestic supply chain integration for just-in-time production. Electrical steel supports electrification transition and renewable energy infrastructure.

Policy Approach: Support targeted DRI-EAF capacity producing low-residual steel for premium applications. Link support to hydrogen infrastructure deployment and carbon reduction commitments. Time-limited rather than perpetual subsidisation.

G7 Implementation Examples:



- **Germany:** Support ArcelorMittal Hamburg and Thyssenkrupp Duisburg hydrogen-DRI projects (£2-3 billion government contribution) enabling premium automotive and electrical steel production.
- **United Kingdom:** Could support limited DRI-EAF capacity (1-2 million tonnes) for automotive supply chain integration if private investment emerges with credible business case.
- **United States:** Leverage existing DRI capacity at Cleveland-Cliffs Toledo whilst encouraging Nucor/Steel Dynamics expansion for automotive applications through tax incentives and regulatory streamlining.
- **France:** Support ArcelorMittal Dunkirk hydrogen-DRI conversion maintaining automotive and electrical steel capability whilst eliminating blast furnace carbon intensity.

Fiscal Impact: Modest— £300-500 million per major project for DRI-EAF capital support plus hydrogen infrastructure. Time-limited transition support rather than perpetual subsidisation improves fiscal sustainability.

Category 3: Alloy Steel Capabilities (Active Government Protection)

Products: Nuclear-grade forgings, aerospace alloys, naval armour, premium seamless tube— representing <1% of G7 consumption but genuinely strategic.

Strategic Value: High. Supply concentration amongst <10 global producers. Defence criticality. No substitutes. Extended production lead times. These meet all four criteria for strategic designation detailed in our [strategic steel analysis](#).

Policy Approach: Active government intervention through direct ownership, subsidised production contracts, strategic stockpiling, and acquisition oversight preventing capability loss.

G7 Implementation Examples:

- **United Kingdom:** Government ownership of Sheffield Forgemasters securing nuclear forging capability. Potential intervention for Liberty Specialty Steels' aerospace alloy operations if restructuring fails, preventing loss of domestic aerospace-grade steel production.
- **France:** Protect Framatome Le Creusot nuclear reactor pressure vessel capability. Monitor specialty forging operations serving naval programmes.
- **United States:** Strategic oversight of CMC Impact Metals armour plate production. Maintain nuclear forging capabilities through Navy shipbuilding programme relationships. Monitor premium seamless tube producers serving defence applications.
- **Germany:** Protect Dillinger Hutte naval plate capability. Maintain specialty forging operations. Support premium alloy producers serving aerospace and defence sectors.
- **Japan:** Japan Steel Works nuclear forging monopoly warrants continued operation given global strategic importance. Premium seamless tube and advanced alloy capabilities justify integrated production alongside export manufacturing.

Fiscal Impact: Minimal relative to blast furnace subsidisation — £50-150 million annually per country supporting genuine strategic capabilities benefiting entire economy rather than single company lobbying. Sheffield Forgemasters acquisition cost UK government £2.56 million plus planned forging line investment



— orders of magnitude less than Scunthorpe's £500+ million subsidisation that created zero strategic value.

Country-Specific Considerations Across G7

Whilst the three-category framework applies broadly across G7 economies, meaningful variation in national circumstances requires tailored approaches:

United Kingdom: Accept the EAF Transition

The UK's steel sector evolution demonstrates the logic of EAF transition despite political resistance. Following [Scunthorpe's closure](#) and Port Talbot's blast furnace shutdown, the UK will rely predominantly on EAF production (4-5 million tonnes capacity) plus imports for steel supply.⁹

Strategic Approach: Accept blast furnace closures whilst supporting EAF transition (British Steel's planned Port Talbot EAF with £500 million government support). Protect genuine specialty capabilities (Sheffield Forgemasters nuclear forgings, potential Liberty Specialty Steels aerospace alloys if successfully restructured). Accept 55-65% import dependency as economically rational given European market integration and allied supplier networks.

The £500 million EAF transition cost is substantial but finite, avoiding perpetual subsidisation of uncompetitive integrated production. The UK approach — accepting blast furnace closures whilst protecting genuine strategic capabilities — represents rational strategy despite political controversy.

Germany: Selective DRI-EAF for Premium Production

Germany faces more complex strategic calculations than the UK due to export-oriented manufacturing base (38-40 million tonne consumption) exceeding domestic scrap generation (20-22 million tonnes). However, Germany's scrap deficit reflects manufacturing export surplus—steel exported in vehicles and machinery generates scrap in destination markets.

Strategic Approach: Pursue targeted integrated capacity for premium automotive and electrical steel (8-12 million tonnes through hydrogen-DRI-EAF routes) whilst accepting EAF transition for commodity production (structural steel, rebar, standard plate). Support ArcelorMittal Hamburg and Thyssenkrupp Duisburg hydrogen-DRI projects (£2-3 billion government contribution) whilst allowing commodity blast furnace capacity to decline through market attrition.

This hybrid approach preserves German manufacturing ecosystem integration where genuinely valuable whilst avoiding blanket subsidisation of uncompetitive commodity capacity. Germany can selectively apply lessons from Japanese premium positioning and export orientation without attempting full-scale replication which is impossible given European market structures and carbon pricing regimes.

France: Focused DRI Transition

France's scrap position (10-12 million tonnes generation versus 13-14 million consumption, 75-85% self-sufficiency) supports predominantly EAF-based strategy. However, ArcelorMittal's Dunkirk and Fos-sur-Mer integrated operations serve automotive and export markets.

Strategic Approach: Support ArcelorMittal Dunkirk hydrogen-DRI conversion maintaining automotive and electrical steel capability whilst eliminating blast furnace carbon intensity. Accept Fos-sur-Mer capacity reduction or conversion. Protect Framatome Le Creusot nuclear forging capability through direct oversight. Expand EAF capacity for commodity applications.

Italy: Maintain EAF Leadership

Italy's EAF-dominant steel sector (25+ million tonnes EAF capacity, 22-24 million tonnes consumption, 55-60% scrap self-sufficiency) demonstrates advanced economy success without integrated production. Riva Group, Arvedi Group, and other Italian EAF producers operate profitably without subsidisation.

Strategic Approach: Maintain EAF focus with minimal government intervention. Italy's steel sector provides G7 model for market-based scrap-steel economy. Limited specialty capability requirements given modest defence consumption and reliance on European specialty steel networks.

United States: Hybrid Approach With EAF Expansion

The US operates substantial EAF capacity (70+ million tonnes producing 68-70% of crude steel) alongside declining integrated production. Geography and market size support hybrid approach unavailable to smaller G7 members.

Strategic Approach: Eliminate Section 232 tariffs that impose deadweight losses whilst failing to revive integrated mills. Support selective integrated operations serving regional markets (Great Lakes facilities with advantaged iron ore access). Encourage EAF expansion through regulatory streamlining and grid infrastructure investment. Protect genuine strategic capabilities (CMC Impact Metals armour plate, nuclear forging operations, premium seamless tube for defence) through targeted oversight rather than blanket sector support.

Nucor and Steel Dynamics demonstrate EAF profitability whilst US Steel and Cleveland-Cliffs struggle despite tariff protection — validating EAF economics in US context.

Canada: Limited Intervention Strategy

Canada's modest steel consumption (12-14 million tonnes) and scrap generation (6-8 million tonnes, 50-60% self-sufficiency) support hybrid EAF/integrated approach with minimal government intervention requirements.

Strategic Approach: Accept market-driven capacity evolution. Support initiatives where private investment demonstrates credible business case. Canada's cheap hydroelectric power offers potential hydrogen-DRI advantage if projects emerge. Limited strategic capability requirements given modest defence consumption and reliance on US specialty steel networks through integrated North American market.



Japan: The Exception That Proves The Rule

Japan maintains profitable integrated steelmaking through several competitive advantages. Export manufacturing integration provides 18-22 million tonnes of premium steel for automotive and machinery exports annually. Technological leadership delivers blast furnace productivity of 2.2-2.4 tonnes per cubic metre versus European 1.8-2.0. Quality premium positioning commands \$50-150 per tonne, whilst Pacific Basin market access provides additional strategic value.

These firm-specific and location-dependent advantages enable [Japanese integrated steelmaking viability](#) whilst simultaneously exposing why European and UK integrated mills fail. Japan's model works *for Japan*—conditions enabling profitability in Kashima, Kimitsu, or Kurashiki don't transfer to Scunthorpe, Dunkirk, or Gary Works.

Conclusion: Context-Dependent Strategies for G7 Steel Policy

The question "Do G7 countries need virgin steelmaking?" permits no simple answer. Commodity carbon steel (70-80% of consumption) requires no virgin capacity—Italy and US EAF producers demonstrate viability without blast furnaces. Specialty flat products (3-5%) warrant limited DRI-EAF capacity for automotive-focused economies. Alloy steel capabilities (<1%) merit protection but reside in specialty operations independent of commodity blast furnaces—Sheffield Forgemasters exemplifies capabilities warranting support; Scunthorpe did not.

Japan represents the exception validating the rule. Japanese integrated steelmaking succeeds through export manufacturing integration and Pacific Basin positioning—advantages not replicable in other G7 contexts. Attempting to recreate Japanese success wastes billions whilst failing to achieve viability.

The critical insight: **virgin steelmaking and blast furnace production are not synonymous**. Virgin iron can be produced through DRI routes at lower cost and carbon intensity. Applications genuinely requiring virgin metallurgy represent a tiny fraction of blast furnace output—conflating strategic specialty capabilities with commodity production serves protectionist agendas rather than national security.

Ceasing commodity blast furnace subsidisation releases £500 million to £850 million+ annually per country whilst eliminating zero strategic capabilities. G7 countries that succeed will distinguish between economic sentimentality (preserving blast furnaces as heritage), political expediency (subsidising employment), and genuine strategic requirements (maintaining scarce alloy capabilities). This distinction is worth billions in fiscal savings. Virgin steelmaking is not strategically necessary for most G7 economies in most applications—specialty alloy steel capabilities are.

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¹ The 35-40% gap between domestic scrap availability and consumption does not constitute an argument for maintaining virgin steelmaking capacity. First, imports from allied suppliers (European neighbours, North American partners) readily fill this gap—the UK already imports 55-65% of consumption from EU sources without security concerns. Second, scrap availability increases structurally over time as steel stock accumulates in developed economies—G7 scrap generation grew 12-15% over 2015-2024 whilst consumption remained flat. Third, DRI-EAF production addresses quality requirements without blast furnaces—H2 Green Steel, ArcelorMittal Hamburg, and similar projects demonstrate virgin metallurgy capability through low-carbon routes. Fourth, the economic calculation fails—subsidising £500+ million annually per blast furnace to reduce import dependency from 65% to perhaps 50% represents poor value versus accepting imports for commodity grades whilst protecting genuine strategic capabilities (<1% consumption) directly. Italy's 55-60% scrap self-sufficiency with 40-45% imports demonstrates G7 viability of predominantly scrap-based production.

² British Metals Recycling Association (2024). "UK Steel Scrap Generation and Trade Analysis 2024." German Steel Federation (2024). "Stahlindustrie in Deutschland: Statistisches Jahrbuch 2024." US Geological Survey (2024). "Iron and Steel Scrap Statistics and Information." Comprehensive G7 scrap generation data compiled from national steel federations and recycling associations showing collective G7 scrap generation of 151-167 million tonnes annually against 250-280 million tonne consumption—demonstrating 60-65% scrap self-sufficiency achievable through EAF production across advanced economies.

³ WorldAutoSteel (2023). "Advanced High-Strength Steels Application Guidelines." Technical specifications for automotive exposed panels requiring copper <0.06-0.08% and tin <0.02-0.03% affecting approximately 1.5-2% of G7 steel consumption. Non-exposed structural components, chassis members, and most mechanical parts tolerate EAF metallurgy, limiting quality constraints to narrow application slice.

⁴ European Electrical Steels Association (2024). "Market Analysis and Production Statistics." US Energy Information Administration (2024). "Electrical Steel Market Report." Grain-oriented and non-oriented electrical steel consumption totals 0.8-1.2% of G7 consumption, produced in dedicated facilities rather than integrated blast furnace operations.

⁵ UK Ministry of Defence (2023). "Defence Supply Chain Analysis: Steel and Specialty Metals." US Department of Defense (2024). "Defense Industrial Base Assessment: Critical Materials." German Federal Ministry of Defence (2023). "Verteidigungsindustrielle Basis: Materialversorgung." Comprehensive G7 defence steel consumption analysis indicating total defence steel consumption well under 1% across all G7 members—UK 80-120kt (0.7-1.1%), Germany 200-250kt (0.5-0.7%), France 150-200kt (1.1-1.5%), Italy 60-80kt (0.3-0.4%), US 800-1,000kt (0.8-1.0%), Canada 30-50kt (0.2-0.4%), Japan 120-180kt (0.2-0.3%).

⁶ Nucor Corporation Annual Report 2023. Steel Dynamics Inc Annual Report 2023. US Steel Corporation Annual Report 2023. Cleveland-Cliffs Inc Annual Report 2023. Comparative financial performance demonstrating EAF producer profitability (Nucor \$2.2 billion net income on \$35.7 billion revenue, Steel Dynamics \$1.9 billion on \$18.6 billion) versus integrated producer struggles (US Steel, Cleveland-Cliffs reporting losses or minimal profits in multiple years 2014-2023).

⁷ Thyssenkrupp AG Annual Reports (2015-2024). ArcelorMittal Annual Reports (2015-2024). British Steel financial statements (2016-2024). Tata Steel Europe financial reports (2015-2024). Comprehensive European integrated mill financial performance showing chronic losses: Thyssenkrupp Steel Europe operating losses in 7 of 10 years with cumulative losses exceeding £2.5 billion; British Steel Scunthorpe requiring £500+ million government support whilst remaining unprofitable; Tata Steel Port Talbot cumulative losses exceeding £1 billion over past decade.

⁸ For comprehensive analysis of genuinely strategic steel capabilities requiring government protection across G7 economies, see: "[The 1% Rule: Separating Strategic Steel from Protectionist Rhetoric](#)". Analysis demonstrates nuclear-grade forgings, aerospace alloys, and naval armour represent legitimate strategic requirements warranting targeted support costing £50-150 million annually—orders of magnitude less than commodity blast furnace subsidisation.



⁹ For detailed examination of why Japan's integrated steelmaking success is context-dependent and not replicable in other G7 economies, see: ["Japan's Virgin Steelmaking Strategy: Why Asia's Model Differs from Europe"](#). Analysis [to be published in March 2026] explores Japanese export manufacturing integration (18-22 million tonnes premium steel annually), technological leadership (20-30% productivity advantages), quality positioning (\$50-150/tonne premiums), and Pacific Basin market access—firm-specific and location-dependent conditions unavailable to European and UK commodity producers.

¹⁰ The UK's EAF transition faces a critical disadvantage: UK electricity costs run approximately £16-22 per megawatt-hour higher than German and French competitors—nearly double continental European rates. Since EAF operations use approximately 0.5 MWh per tonne of steel, this cost differential translates into £8-11 per tonne competitive disadvantage versus European EAF producers. This structural cost barrier suggests the UK might be better positioned as a steel rerolling hub—importing semi-finished products (billets, slabs) from lower-cost green steel producers and processing them into finished products. Rerolling operations require significantly less energy than EAF steelmaking whilst preserving domestic steel processing capability, employment, and market proximity advantages. For comprehensive analysis of this alternative strategic positioning, see: ["British Steel Scunthorpe: Strategic Repositioning from Primary Steelmaking to Green Steel Rerolling"](#). This rerolling strategy could enable the UK to maintain substantial steel sector employment and processing capabilities without competing against fundamental electricity cost disadvantages in energy-intensive EAF production.

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