WE ARE PRINT INSPECTION

AVT INDUSTRY REPORT · FLEXIBLE PACKAGING 2026

When Oil Spikes, Print Waste Becomes a Profit Killer

Why inline print inspection has quietly become one of the most effective hedges flexible packaging converters have against oil volatility.

$138
BRENT PEAK
APRIL 2026

60-80%
FILM COST TIED TO OIL

75%
OF CONVERTER
PURCHASES

Intro

Every barrel of crude oil that costs more turns every wasted meter of film into a bigger loss.

When Brent crude oil reached $138 per barrel in April 2026, flexible packaging converters faced significant costs due to print defects, as raw materials account for about 75% of their purchases and 60–80% of film costs are tied to oil. Inline print inspection, originally valued for quality, has become a critical strategy against oil price volatility.

Structural pressures from high energy costs in Europe, geopolitical instability, and supply chain disruptions have compounded these challenges. Events that restrict supply or inflate logistics costs increase the financial impact of production waste, meaning **converters face greater losses for scrapping materials as prices rise.**

WHY READ THIS

When crude oil moves, your film cost moves, and so does the cost of every wasted meter.

This report shows how to turn the one variable you control, **your waste rate**, into a hedge against the ones you don't.

Contents

What's Eating Your Margins Right Now

Can You Put a Dollar Figure on What You're Losing?

01 Oil Prices Volatility

Brent crude reached $138/barrel in April 2026, causing raw plastic material costs to rise over 100% in some categories. This impacted your film budget, but your scrap rate remained unchanged. **Do you know the cost of your 10% waste rate at $2,500/ton compared to $3,750/ton?**

02 Print Errors And Process Drift

Conventional flexo wastes 150-400 meters of substrate per job change and 50-150 meters for each manual color correction, with color drift causing about 18% of flexible packaging rejects. Consider how much of your annual substrate spending is lost before producing a single good unit.

03 Supply Chain Disruption

Covid disruptions led to port closures, skyrocketing shipping container costs, and import restrictions, all affecting material availability and increasing costs. Consider how future disruptions could impact your scrap rate and material use before you can respond.

04 Regulatory Exposure

The EU's PPWR will be effective from August 2026, imposing binding recyclability deadlines from 2030 to 2040. As every roll enters the waste stream, brand owners are creating supplier scorecards. **Can your production data demonstrate measurable waste reduction for customers now?**

05 Makeready And Hidden Losses

Makeready waste, ink changeover, splice losses, and converting-stage rejects add up silently. Most converters budget for them as a cost of doing business. Fewer track what those losses actually total at year-end.

↳ **If you added up every meter lost to setup, correction, and undetected defects across a full year, would the number surprise you?**

How crude oil flows into every meter of film

Every flexible packaging film starts life as crude oil. The plastic films your presses run every day, from the clear wrap on a snack bag to the glossy label on a shampoo bottle, get their raw material from oil refineries. Refineries break crude oil down into building blocks like naphtha and natural gas liquids, which get cracked into chemical monomers that manufacturers polymerize into the raw plastic material film producers then extrude into rolls.

01
Crude Oil
Brent / WTI

02
Refining
Naphtha · NGLs

03
Cracking
Monomers

04
Polymerize
Plastic resin

05
Film
BOPP · PE · PET

BOPP, polyethylene films, PET, and nylon all follow the same **crude oil-to-plastic-to-film chain**. According to ICIS-cited industry data, naphtha alone accounts for 70–90% of raw plastic material production cost, and that raw material in turn represents 60–80% of finished film cost. The practical rule of thumb ICIS analysts use is blunt: every $10 per barrel rise in Brent crude oil adds roughly $110–175 per ton to the cost of the raw plastic material your films are made from. When oil moves, your substrate cost moves with it.

The price increase doesn't hit your materials bill the same week crude oil spikes, but it reliably arrives within one to four weeks. Research published in Energy Economics by King Fahd University confirms that oil price moves flow through to plastic film prices with 80–90% consistency across European and Asian markets. North American converters have some buffer because US producers use ethane rather than naphtha as a feedstock. But as ChemPMC's Esteban Sagel told the FPA's 2025 Annual Meeting, that buffer erodes through import competition: "North American domestic polyethylene prices remain high when compared to overseas benchmarks, fostering ever-increasing imports of polyethylene film." The practical result is the same on both sides of the Atlantic. **When oil goes up, your film costs follow, and every meter of wasted substrate costs more than it did last month.**

70–90%
of resin cost is naphtha alone (ICIS)

80–90%
oil-to-film price pass-through (Energy Economics)

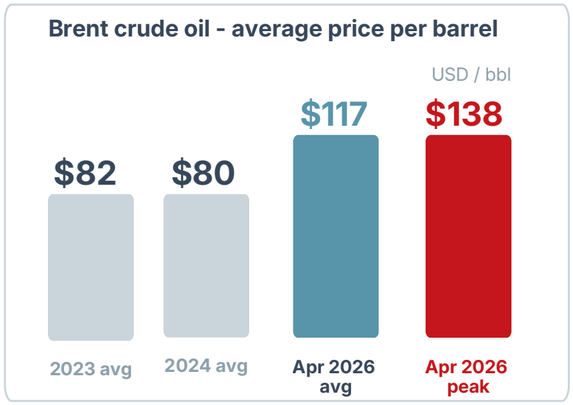
1–4 week
lag before a crude oil spike hits your bill

How external shocks change the calculus

For much of 2023–24 Brent averaged an orderly $80–82, and oversupply even pushed film prices lower. Then April 2026 reminded converters how fast calm reverses, and Covid proved port closures can do the same without warning.

Packaging converters have learned, more than once, that calm market conditions can reverse quickly. Oil price spikes are the most direct trigger, because of crude oil's direct link to film feedstocks. But the Covid-19 pandemic demonstrated that supply chain disruptions, port closures, shipping container shortages, and import restrictions can drive material costs and scarcity just as sharply, and without the weeks of warning that crude oil futures sometimes provide. In practice, any event that constrains the supply of petrochemical inputs, disrupts global logistics, or creates sudden regional shortages raises the financial stakes of every wasted meter on the press floor.

Oil remains the clearest example of the mechanism, so it is worth examining closely.



For much of 2023 and 2024, Brent averaged a relatively orderly $80–82 per barrel, and raw plastic material markets saw a paradoxical decline as Chinese and Middle Eastern capacity additions created oversupply. BOPP and PET film prices drifted lower in many regions through late 2024. When supply routes through the Strait of Hormuz face disruption, the effect on converters is fast and severe. Roughly 20% of global oil and over 40% of global polyethylene exports originate in or transit the Middle East. The April 2026 spike, when Brent averaged $117 per barrel and peaked at $138, was the highest level since June 2022. Dow's COO Karen Carter told investors that "roughly half of global ethylene and polyethylene supply is offline, constrained, or directly impacted." Kevin Kelly, CEO of California converter Emerald Packaging, described his company pushing through its largest-ever single-month price increase of roughly 8% in May 2026, calling conditions "a nightmare of rising energy costs, supply chain disruption, and material shortages." Major producers including LyondellBasell responded with a series of price hikes. Silgan, one of the largest packaging manufacturers in North America, absorbed a $50 million cost increase in a single quarter.

How external shocks change the calculus

European converters entered any such shock already under pressure. Gas and electricity costs across the EU have been running two to four times higher than in the US for several years. FINAT, the global association representing the self-adhesive label industry, has consistently flagged rising production costs as one of the top concerns among European converters, with energy at the top of that list. For European converters, an oil shock doesn't arrive in isolation. It lands on top of an industry already fighting to protect its margins.

The structural lesson from April 2026 reinforces what the Covid years already demonstrated: external shocks to material costs are not anomalies. They are a recurring feature of operating in a globally connected supply chain. Converters who treat each episode as a one-time event will be caught off-guard again. Those who build resilience into their operations, by controlling what they can control, arrive at each disruption better positioned to absorb it.

> **"Roughly half of global ethylene and polyethylene supply is offline, constrained, or directly impacted."**
>
> KAREN CARTER · COO, DOW

The waste math gets brutal when prices rise

Converters quietly tolerate 10–15% total scrap without disciplined quality control. The percentage feels fixed but the dollars attached to it are not. The same rate costs far more once film prices climb.

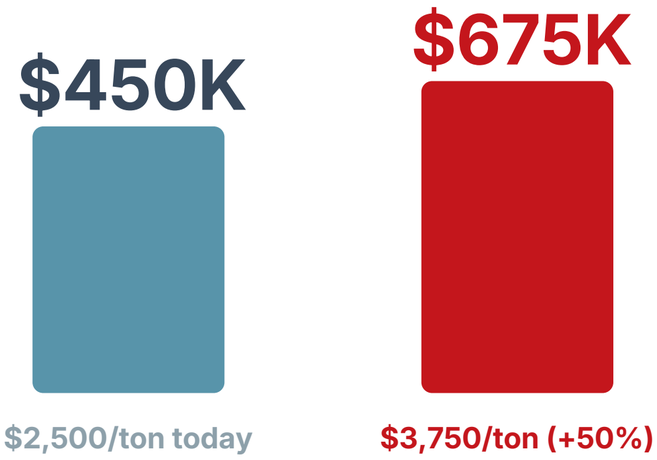
Flexible packaging converters quietly tolerate substantial waste. Flexographic Technical Association benchmarks indicate makeready waste alone consumes 3–8% of total substrate per job, climbing at higher press speeds. Conventional flexible packaging converters lose 150–400 meters of substrate per job change. Each manual color correction event burns another 50–150 meters. Add run-time defect waste, splice losses, and converting-stage rejects, and total scrap rates of 10–15% are typical for converters without disciplined print quality control. Color drift alone drives roughly 18% of all flexible packaging rejects in conventional press rooms, per industry estimates.

Conventional flexible packaging converters loses 150–400 meters of substrate per job change

Consider a representative mid-size converter processing 10 million square meters of 20-micron BOPP annually. At a recent US price of roughly $2,500 per ton, that converter spends about $4.5 million on that single substrate. At a 10% waste rate, $450,000 of film hits the floor each year before ink, plates, energy, or labor are factored in. Apply a 50% film price surge: the same 10% scrap rate now costs $675,000 annually. The percentage didn't change. The dollar amount did.

Annual film on the floor at 10% waste

Mid-size converter · 10M m² of 20-micron BOPP



The waste math gets brutal when prices rise

Converters quietly tolerate 10–15% total scrap without disciplined quality control. The percentage feels fixed but the dollars attached to it are not. The same rate costs far more once film prices climb.

Ink adds another layer. **Specialty UV inks run $15–$35 per kilogram**, and the FTA estimates that cutting ink waste by just 2% saves tens of thousands of dollars annually on a high-volume press. But the deeper issue is margin. Converter gross margins are thinner than most outsiders assume. Winpak's 2023 financial disclosure put gross margin at 29.3%. When raw materials already account for 75% of total cost (FPA, 2025) and those material prices suddenly jump, there is very little cushion left.

Every point of waste eliminated goes almost directly to the bottom line.

Across a $44.6 billion US flexible packaging industry (FPA, 2025), even conservative waste rates of 8–10% represent a multi-billion-dollar hidden cost, one that grows in direct proportion to every material price increase, whether driven by oil markets, supply chain disruptions, trade policy shifts, or any other external event outside a converter's control.

$44.6B

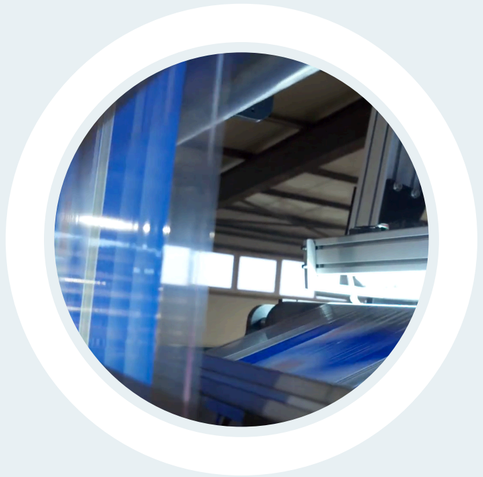
US flexible packaging industry size (FPA, 2025).
Even conservative 8–10% waste is a multi-billion-dollar hidden cost that grows with every price increase.

+$225K

more wasted per year.
The percentage never changed, the price did.

What 100% inline inspection actually delivers

When film costs rise, catching defects early becomes hard to argue with. Every meter scrapped at the laminator, slitter, or brand owner's dock costs more in an elevated-price market.



When film costs rise for any reason, the financial case for catching defects early becomes hard to argue with. Every meter of substrate that runs through a press undetected and gets scrapped at the laminator, the slitter, or worst of all, at the brand owner's receiving dock, costs more during a period of elevated material prices than it does in a stable market.

Oil spikes are the most visible trigger, but pandemic-era supply constraints produced the same effect:

material that was already expensive or hard to source made every wasted meter more painful.

The question converters are asking has shifted from whether inspection pays to how fast it pays.

The answer from converters already running 100% inline print inspection is consistent. Plastica, a flexible packaging converter, reported a 25% reduction in production costs and a 30% increase in productivity after deploying AVT's inspection systems across its presses. General Manager Ioan Holdis described the outcome plainly: "We eliminated all the faults we had in the production process. As a result, customers are now 100% satisfied with the delivered products."

25%

Lower production cost

+30% productivity, zero complaints.

PLASTICA

250m+

Setup waste saved per order

No press stops for color approval.

WIPAK

0

Complaints to market

Zero defect complaints.

AMERICAN FUJI SEAL

The system empowers us to control quality at every step, ensuring accountability throughout the entire printing process.

Dan Cissell
Plant Manager
American Fuji Seal

The color story is where the oil-price connection becomes most direct. Color drift, ink density shifting gradually as a press run continues, is one of the most common sources of flexible packaging waste. Operators working at high speed often don't catch it until several hundred meters have already printed out of spec. Wipak, a major European flexible packaging producer, addressed this by adding AVT's SpectraLab XF inline color measurement to its press lines. The result was immediate: "We save setup waste of 250–300 meters per order, since we do not need to stop the press and take color measurements for color approval." Across a production schedule with hundreds of job changes per year, that saving compounds into a meaningful reduction in substrate consumed, and substrate not wasted means substrate not paid for twice.

American Fuji Seal's experience at its Hickory, North Carolina facility shows what 100% inspection means at the customer-complaint level. **Plant Manager Dan Cissell,** after installing AVT's Argus Turbo HD with SpectraLab XF inline color measurement, described the outcome directly:

"We have had no complaints regarding color, which was extremely important for us, and also no complaints about any printing defects reaching the market."

The mechanism behind these outcomes is straightforward. At modern production speeds, typically 300 to 600 meters per minute on a converter's press, a human operator cannot review every meter of printed film reliably. A 100% inline inspection system uses high-speed cameras mounted on the press to compare every meter of printed output against the approved master image in real time. When something drifts, a color shift, a registration error, a spot or streak, the system flags it immediately before the defect accumulates into a roll of scrap. The press operator gets an alert and can correct the issue within meters rather than discovering it after hundreds of meters have already printed out of spec.

How it works:

300-600

meters / minute

High-speed cameras compare every meter of output against the approved master in real time. A color shift, registration error, spot or streak is flagged immediately. The operator corrects within meters, not after a roll of scrap.

How 100% inline inspection protect your margins

Color gets the most attention in print quality conversations, and for good reason. But color is one signal among many. At 300-600 meters per minute, a 100% inline system monitors every meter of output and acts on four categories of loss that converters carry on every job.

01 Preventing costly re-prints due to initial mistakes.

The system compares each job against the approved PDF at setup, catching wrong versions, outdated artwork, or problems in the plates, before real production starts

02 Catching process problems at a very early stage.

Mis-register, color drifting, dirty plates, misprints or streaks. Detected right on time, before it becomes costly waste.

03 Protecting material, ink, labour, and machine time.

Every out-of-spec meter that gets discarded carries the combined cost of substrate, ink, energy, and the press time spent producing it. Reducing the defect rate cuts all four simultaneously.

04 Reducing makeready waste on every job change.

Automated registration control and inline colour measurement shorten the trial-and-error cycle at setup, reducing the meters of substrate consumed before the first good unit ships.

The financial case for inspection gets strongest when you account for all four loss categories together, not just the ones that surface in a quality complaint.

06

The sustainability case is now a regulatory case

Under 5% of laminated plastics are recycled in Europe today, and the EU has responded with binding law. The PPWR began applying from August 2026, setting deadlines converters must plan for now.

Waste in flexible packaging carries two costs now. The first is the one converters have always known: scrapped substrate, wasted ink, lost production time. The second is newer and growing: regulatory exposure.

Plastic packaging generates a significant share of global plastic waste, and flexible packaging is among the hardest formats to recycle. Under 5% of laminated plastic materials currently get recycled in Europe. Brand owners and regulators have both taken notice.

The EU responded with binding law. EU Regulation 2025/40, known as the Packaging and Packaging Waste Regulation (PPWR), was adopted in December 2024 and began applying from August 2026. In plain terms, it sets a series of deadlines that converters need to plan for now:

2030
All packaging recyclable, with minimum recycled content.

2035
Recycled at meaningful scale across Europe.

2038
Only the two highest recyclability grades permitted.

2040
Total packaging waste per person down 15% vs 2018.

The sustainability case is now a regulatory case

Under 5% of laminated plastics are recycled in Europe today, and the EU has responded with binding law. The PPWR began applying from August 2026, setting deadlines converters must plan for now.

For converters, the connection to inspection is direct. Every roll of flexible packaging film that gets scrapped, whether from a color defect, a registration error, or a contamination event, is material entering the waste stream rather than reaching a customer. A converter running 10% scrap on 10 million square meters of annual film production sends roughly 1 million square meters of plastic to waste each year. Cutting that rate in half through tighter inline print quality control removes 500,000 square meters from the waste column. Brand owners and regulators are increasingly asking suppliers to demonstrate exactly that kind of measurable, documentable improvement.

Production waste is a hidden environmental cost that has largely been overlooked while the industry focused on recyclability and biodegradability. Reprints are the biggest culprit.

When printing errors require a job to be rerun, substrates, inks, and energy all go to waste.

An inefficient makeready process wastes more. An inspection system that catches content errors before even the first meter prints, and flags run-time defects before they compound, reduces all of it simultaneously.

1M m² wasted / yr → **500K** m² removed

Halving a 10% scrap rate takes 500,000 m² out of the waste column — the measurable, documentable improvement brand owners and regulators now ask suppliers to demonstrate.

The converging case for inspection investment

The case for inline inspection used to rest on one pillar: quality. That pillar still stands, but two more now sit alongside it, and all three point toward the same investment.

01

Quality

Catch defects before they reach the customer, reduce complaints, protect the brand relationship. The original case still the foundation.

02

Cost

Resin prices double within months after disruptions. Every point of scrap eliminated is worth more when materials are expensive, ROI rises without the technology changing.

03

Regulation

PPWR turns waste into a compliance obligation. A converter who can't show measurable waste reduction risks losing business to one who can.

All three pillars point toward the same investment. Converters who installed inline inspection systems in quieter market conditions built the infrastructure to manage this moment. Those evaluating inspection now are making the decision in a higher-stakes environment, but also with more evidence that it pays.

Cut your waste rate before the next disruption does it for you

Inline print inspection started as a quality tool. In the current environment, it functions as something broader: a direct lever on input costs that converters cannot otherwise control.

When crude oil moves, raw plastic material prices move, film costs move, and the cost of every wasted meter moves with them.

The same dynamic played out when Covid-19 shut ports and choked supply chains: material that was scarce or delayed made every scrapped meter twice as damaging. Oil spikes, shipping disruptions, trade restrictions, and force majeure events of every kind have one thing in common for converters. They raise the price of waste without raising your output. But the waste rate itself, the percentage of substrate that never reaches a customer, is something a converter can control. Reducing scrap from 10% to 5% on a $4.5 million annual film spend recovers $225,000 at current pricing. If film prices rise another 50%, that same waste reduction recovers $337,500. The technology that enables it hasn't necessarily changed. The price tag of not having it has.

Three powers move your profit needle:

- PPWR adds a regulatory dimension
- volatile markets add a financial impact
- Brand owners add a contractual one

The question is not whether a print quality control system makes sense, it's how **much each month of delay is costing you.**

CUT SCRAP 10% → 5%, TODAY

$225K

recovered on a $4.5M annual film spend.

THE SAME CUT, FILM UP ANOTHER 50%

$337.5K

The technology hasn't changed; the price of not having it has.

Questions converters ask

What is inline print inspection and how does it work?

High-speed cameras check every meter of printed film against an approved master in real time. When something shifts — color drift, a registration error, a spot — the system alerts the operator immediately, so the issue is corrected within meters rather than after a full roll has printed out of spec.

What results have converters seen?

Plastica reported a 25% production-cost reduction and 30% productivity gain with zero complaints. Wipak saves 250–300 m of setup waste per order with SpectraLab XF. American Fuji Seal's reported zero color and zero defect complaints after installing Argus Turbo HD.

What defects does the system catch?

Color misregister, ink-density variation, color drift, hazing, spots and splashes, missing print, varnish defects and barcode errors. Human operators can't reliably spot most of these at 300–600 m/min — the system flags them in real time so operators correct before defective material accumulates.

How does oil price affect waste costs?

Every $10/bbl rise in Brent adds ~$110–175/ton to resin (ICIS). Since resin is 60–80% of film cost, a converter running 10% waste at $2,500/ton loses $450,000 a year before ink, energy or labor; at $3,750/ton that same 10% costs $675,000. The waste rate is the one variable you control.

How does the EU PPWR affect converter waste?

PPWR sets binding recyclability requirements with deadlines from 2030 to 2040. Higher scrap rates mean more plastic entering waste streams — creating exposure to both regulation and brand-owner sustainability commitments. Tighter inline inspection lowers a converter's footprint and strengthens its position with customers.

Does it work across film types and presses?

Yes — across BOPP, polyethylene, PET, nylon and multi-layer laminates, on narrow- and wide-web presses. Camera arrays scale to the full web width, and illumination adjusts for substrate reflectivity, including clear varnish and coating inspection without UV additives.

About AVT

AVT is the print inspection company.

With more than 30 years of experience, 8,200+ systems installed at label and flexible packaging converters worldwide, and the only ISO-compliant inline color measurement solution for packaging applications, AVT gives production teams the visibility and control they need to protect quality, reduce waste, and defend their margins every meter, every run.

>8200

More than 8,200 AVT systems installed worldwide

>30

More than 30 years of print inspection experience

50%

Over 50% of all high-end inspection and quality assurance systems installed in label & packaging are AVT platforms

WE ARE PRINT INSPECTION

TAKE CONTROL OF WHAT YOU CAN CONTROL

See exactly what you're scrapping, before the next spike does.

Book a 30-minute walkthrough with an AVT expert. We'll map your current waste rate and model the inspection solution to fit your current operation.

Request a call

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Figures cited from FPA, ICIS, FTA, Energy Economics, FINAT and named company disclosures.