**Carbon Footprint Reduction Program: Packaging Material Transition Strategy**

**CONFIDENTIAL - INTERNAL REPORT**  
**Sustainability Team & Packaging Engineering**  
**Date: May 8, 2023**

**Executive Summary**

This report outlines our strategic three-year plan to reduce packaging-related carbon emissions by 40% across our product portfolio. Based on comprehensive life cycle assessments (LCA) of our current packaging and evaluation of lower-carbon alternatives, we have identified a phased transition strategy that balances sustainability goals with commercial and operational realities. The proposed approach would require a total investment of $32.4M over three years, with expected annual savings of $8.7M once fully implemented, yielding a positive ROI in year 4. Most importantly, this initiative would reduce our Scope 3 emissions by approximately 217,000 metric tons of CO₂e annually, equivalent to 18% of our total corporate carbon footprint, while maintaining or enhancing packaging performance and consumer experience.

**Current State Assessment**

**Carbon Footprint Analysis**

Our current packaging portfolio generates approximately 543,000 metric tons of CO₂e annually, representing 42% of our total Scope 3 emissions. This footprint is distributed across packaging components as follows:

| **Packaging Component** | **Annual Volume** | **Current Material** | **Carbon Footprint (tCO₂e)** | **% of Packaging Footprint** |
| --- | --- | --- | --- | --- |
| Primary Containers | 820M units | Virgin PET, HDPE, PP | 246,000 | 45.3% |
| Caps & Closures | 760M units | PP, LDPE | 68,000 | 12.5% |
| Labels & Sleeves | 1.2B units | BOPP, PVC | 42,000 | 7.7% |
| Secondary Packaging | 124M units | Corrugated, SBS | 105,000 | 19.3% |
| Tertiary Packaging | 8.2M units | Stretch film, Corrugated | 82,000 | 15.2% |
| **Total** |  |  | **543,000** | **100%** |

**Current Material Performance Assessment**

| **Material Category** | **Strengths** | **Limitations** | **Carbon Intensity (kgCO₂e/kg)** |
| --- | --- | --- | --- |
| Virgin PET | Clarity, barrier properties, recyclability | Fossil-based, energy-intensive production | 2.7 |
| HDPE | Durability, chemical resistance, barrier | Fossil-based, limited recyclability in some regions | 2.1 |
| PP | Heat resistance, clarity, durability | Fossil-based, recycling challenges | 2.0 |
| Corrugated Board | Renewable source, recyclability | Water intensity, transportation weight | 0.7 |
| Glass | Premium perception, recyclability | Weight, energy-intensive production, fragility | 0.9 |
| Aluminum | Barrier properties, recyclability | Energy-intensive production, extraction impact | 8.2 |

**Key Drivers for Transition**

1. **Corporate Sustainability Commitments**:
   * 45% reduction in total carbon footprint by 2030 (2019 baseline)
   * Net Zero by 2040 across all scopes
   * Plastic reduction target of 25% by 2025
2. **Regulatory Landscape**:
   * Plastic taxes implemented in 12 of our operating markets
   * Extended Producer Responsibility (EPR) legislation expanding globally
   * Carbon border adjustment mechanisms in development
3. **Market & Consumer Expectations**:
   * 68% of consumers consider packaging sustainability in purchase decisions
   * 74% of retail partners have established packaging sustainability requirements
   * Increasing scrutiny of carbon claims by NGOs and stakeholders
4. **Economic Considerations**:
   * Volatile fossil-based material pricing
   * Carbon pricing mechanisms affecting operational costs
   * Cost optimization opportunities through material reduction

**Alternative Material Evaluation**

**Material Candidates by Packaging Component**

**Primary Containers**:

| **Alternative** | **Carbon Reduction** | **Performance Impact** | **Cost Impact** | **Technical Readiness** |
| --- | --- | --- | --- | --- |
| 100% rPET | 60-70% | Minimal | +15-25% | High |
| Bio-based PET | 30-40% | None | +35-45% | Medium |
| PHA Bioplastics | 80-90% | Barrier properties (-10-15%) | +90-120% | Low |
| Paper Bottles | 65-75% | Water resistance, barrier issues | +40-60% | Medium-Low |
| Aluminum | 30-40% (with recycled content) | Different user experience | +50-70% | High |

**Caps & Closures**:

| **Alternative** | **Carbon Reduction** | **Performance Impact** | **Cost Impact** | **Technical Readiness** |
| --- | --- | --- | --- | --- |
| Bio-based PE/PP | 35-45% | Minimal | +25-35% | Medium-High |
| PCR Content (30%) | 25-30% | Color constraints | +10-15% | Medium |
| Paper-based solutions | 70-75% | Moisture sensitivity | +30-50% | Low |
| Tethered designs | 15-20% | Enhanced functionality | +5-15% | High |

**Secondary & Tertiary Packaging**:

| **Alternative** | **Carbon Reduction** | **Performance Impact** | **Cost Impact** | **Technical Readiness** |
| --- | --- | --- | --- | --- |
| 100% Recycled Corrugated | 30-35% | Minimal strength reduction | +5-10% | High |
| Unbleached Board | 15-20% | Aesthetic changes only | -2-5% | High |
| Reduced Gauge Materials | 15-25% | Requires testing | -10-15% | Medium-High |
| Reusable Transport Packaging | 60-80% | Logistical complexity | -25-30% (long-term) | Medium |

**Material Testing Results**

Extensive laboratory testing was conducted on high-potential alternatives, with results summarized below:

| **Performance Criteria** | **100% rPET** | **Bio-PE** | **Paper Bottle** | **Recycled Corrugated** |
| --- | --- | --- | --- | --- |
| Oxygen Barrier | 92% of virgin | 96% of virgin | 68% of virgin | N/A |
| Moisture Barrier | 94% of virgin | 97% of virgin | 45% of virgin | 82% of virgin |
| Drop Impact | 88% of virgin | 95% of virgin | 75% of virgin | 90% of virgin |
| Compression Strength | 95% of virgin | 98% of virgin | 82% of virgin | 85% of virgin |
| Sealing Performance | Identical | Identical | Requires alternative | Identical |
| Print Quality | Slightly reduced | Identical | Different technology | Slightly reduced |
| Accelerated Aging | Passes | Passes | Concerns in high humidity | Passes |
| Consumer Perception | Positive | Neutral | Very positive | Neutral to positive |

**Supply Chain Considerations**

| **Material** | **Supply Availability** | **Geographical Constraints** | **Supplier Diversity** | **Price Stability** |
| --- | --- | --- | --- | --- |
| 100% rPET | Medium, improving | Regional limitations | Limited (3-5 major suppliers) | Moderate volatility |
| Bio-based PE/PP | Limited | Concentrated production | Very limited (2-3 suppliers) | High volatility |
| PCR Plastics | Medium | Regional collection variations | Medium (5-8 suppliers) | Moderate volatility |
| Recycled Paper/Board | High | Widely available | High (10+ suppliers) | Stable |
| Paper Bottles | Very limited | Concentrated production | Very limited (1-2 suppliers) | Unknown |

**Transition Strategy**

**Guiding Principles**

1. **Phased Implementation**: Prioritize high-impact, low-risk transitions first
2. **Performance Preservation**: Maintain or enhance critical packaging functionality
3. **Commercial Viability**: Balance sustainability gains with cost implications
4. **Supply Chain Resilience**: Ensure reliable material availability
5. **Consumer Acceptance**: Maintain or enhance brand experience and perception

**Three-Year Transition Roadmap**

**Phase 1 (Year 1): Low-Hanging Fruit**

| **Initiative** | **Carbon Impact (tCO₂e)** | **Implementation Timeline** | **Investment Required** | **Annual Cost Impact** |
| --- | --- | --- | --- | --- |
| 50% rPET in beverage bottles | 28,000 | Q3 2023 - Q1 2024 | $3.2M | +$1.8M |
| 100% recycled corrugated | 32,000 | Q3 2023 - Q4 2023 | $1.5M | +$0.9M |
| Light-weighting of closures | 6,000 | Q4 2023 - Q2 2024 | $2.8M | -$1.2M |
| Unbleached board conversion | 12,000 | Q3 2023 - Q1 2024 | $0.8M | -$0.4M |
| **Phase 1 Total** | **78,000** |  | **$8.3M** | **+$1.1M** |

**Phase 2 (Year 2): Medium Complexity Transitions**

| **Initiative** | **Carbon Impact (tCO₂e)** | **Implementation Timeline** | **Investment Required** | **Annual Cost Impact** |
| --- | --- | --- | --- | --- |
| 100% rPET in non-food containers | 45,000 | Q1 2024 - Q3 2024 | $5.6M | +$2.4M |
| Bio-based caps implementation | 15,000 | Q2 2024 - Q4 2024 | $4.2M | +$1.8M |
| Paper-based secondary packaging | 18,000 | Q1 2024 - Q4 2024 | $3.7M | -$0.7M |
| Film downgauging program | 9,000 | Q2 2024 - Q3 2024 | $1.2M | -$1.5M |
| **Phase 2 Total** | **87,000** |  | **$14.7M** | **+$2.0M** |

**Phase 3 (Year 3): Transformational Changes**

| **Initiative** | **Carbon Impact (tCO₂e)** | **Implementation Timeline** | **Investment Required** | **Annual Cost Impact** |
| --- | --- | --- | --- | --- |
| Paper bottle introduction (select brands) | 22,000 | Q1 2025 - Q4 2025 | $6.8M | +$2.2M |
| Reusable transport packaging | 24,000 | Q1 2025 - Q3 2025 | $3.5M | -$2.8M |
| Bio-based films for labels | 6,000 | Q2 2025 - Q4 2025 | $1.8M | +$0.5M |
| Removal of unnecessary packaging | 12,000 | Ongoing | $1.5M | -$2.7M |
| **Phase 3 Total** | **64,000** |  | **$13.6M** | **-$2.8M** |

**Expected Outcomes**

By the end of the three-year implementation period:

* **Total Carbon Reduction**: 217,000 tCO₂e annually (40% of packaging footprint)
* **Cumulative Investment**: $32.4M
* **Net Annual Cost Impact**: +$0.3M
* **ROI Timeline**: Break-even in Year 4, positive thereafter
* **Plastic Reduction**: 22,000 metric tons annually (28% reduction)
* **Virgin Material Reduction**: 30,000 metric tons annually (36% reduction)

**Implementation Requirements**

**Technical Development Needs**

1. **Material Testing & Validation**:
   * Accelerated shelf-life testing for all alternative materials
   * Transportation and distribution testing
   * Consumer usage testing for new formats
2. **Manufacturing Adaptation**:
   * Line modifications for alternative materials
   * Process parameter optimization
   * Quality control system updates
3. **Specification Development**:
   * Comprehensive technical specifications for new materials
   * Supplier qualification requirements
   * Testing protocols and acceptance criteria

**Supply Chain Development**

1. **Supplier Development Program**:
   * Technical capacity building with key suppliers
   * Joint development agreements for innovative solutions
   * Long-term supply agreements to support investment
2. **Inventory Management**:
   * Transition period buffer stock requirements
   * Material forecasting and planning adjustments
   * Potential regional supply differences
3. **Quality Assurance**:
   * Incoming material inspection protocols
   * Supplier certification program
   * Ongoing quality monitoring system

**Organizational Readiness**

1. **Team Structure**:
   * Cross-functional transition team
   * Technical specialists for each material category
   * Supplier relationship managers
2. **Capability Development**:
   * Technical training on new materials and processes
   * Sustainability literacy across functions
   * Design for sustainability capability building
3. **Change Management**:
   * Stakeholder engagement plan
   * Communication strategy
   * Performance management alignment

**Risk Assessment**

| **Risk Category** | **Probability** | **Impact** | **Mitigation Strategy** |
| --- | --- | --- | --- |
| Material Performance | Medium | High | Extensive testing, phased implementation, backup options |
| Supply Availability | Medium-High | High | Supplier development, dual sourcing, inventory buffers |
| Cost Volatility | High | Medium | Long-term contracts, hedging strategies, design optimization |
| Consumer Acceptance | Low-Medium | High | Consumer testing, transparent communication, phased rollout |
| Regulatory Compliance | Medium | Medium-High | Regulatory monitoring, proactive adaptation, industry partnerships |
| Manufacturing Disruption | Medium | High | Pilot testing, gradual implementation, contingency planning |

**Financial Analysis**

**Investment Requirements**

| **Category** | **Year 1** | **Year 2** | **Year 3** | **Total** |
| --- | --- | --- | --- | --- |
| Capital Equipment | $4.2M | $7.8M | $6.5M | $18.5M |
| R&D and Testing | $2.1M | $3.4M | $2.8M | $8.3M |
| Supply Chain Development | $0.8M | $1.2M | $1.5M | $3.5M |
| Implementation Resources | $1.2M | $2.3M | $2.8M | $6.3M |
| **Total Investment** | **$8.3M** | **$14.7M** | **$13.6M** | **$32.4M** |

**Operating Cost Impacts**

| **Category** | **Year 1** | **Year 2** | **Year 3** | **Year 4+** |
| --- | --- | --- | --- | --- |
| Material Cost Changes | +$2.8M | +$5.2M | +$4.8M | +$4.8M |
| Manufacturing Efficiency | -$0.5M | -$1.2M | -$2.6M | -$3.2M |
| Logistics & Distribution | +$0.4M | +$0.7M | -$1.9M | -$2.4M |
| Regulatory Compliance Savings | -$1.6M | -$2.7M | -$3.1M | -$7.9M |
| **Net Annual Impact** | **+$1.1M** | **+$2.0M** | **-$2.8M** | **-$8.7M** |

**ROI Analysis**

| **Metric** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| --- | --- | --- | --- | --- | --- |
| Annual Investment | $8.3M | $14.7M | $13.6M | $0 | $0 |
| Annual Savings | -$1.1M | -$2.0M | $2.8M | $8.7M | $8.7M |
| Cumulative Cash Flow | -$9.4M | -$26.1M | -$36.9M | -$28.2M | -$19.5M |
| Carbon Reduction (tCO₂e) | 78,000 | 165,000 | 217,000 | 217,000 | 217,000 |
| Cost per tCO₂e Reduced | $120 | $158 | $170 | $130 | $90 |

**Carbon Valuation Analysis**

**Internal Carbon Price Scenarios**

| **Carbon Price Scenario** | **Year 1** | **Year 3** | **Year 5** | **NPV of Program (5-yr)** |
| --- | --- | --- | --- | --- |
| Low ($25/tCO₂e) | $1.95M | $5.43M | $5.43M | -$5.2M |
| Medium ($50/tCO₂e) | $3.90M | $10.85M | $10.85M | $9.8M |
| High ($100/tCO₂e) | $7.80M | $21.70M | $21.70M | $40.6M |

**External Cost Comparisons**

| **Compliance Mechanism** | **Estimated Cost** | **Applicability** | **Annual Exposure** |
| --- | --- | --- | --- |
| Plastic Tax (avg. of operating markets) | $0.80/kg | 78,500 MT of plastic | $62.8M |
| Carbon Tax (EU ETS forecast) | $85/tCO₂e | 543,000 tCO₂e | $46.2M |
| Extended Producer Responsibility | Varies by market | All packaging | $38.5M |
| **Total External Cost Exposure** |  |  | **$147.5M** |

**Brand & Marketing Value**

**Consumer Research Insights**

Consumer research conducted across five key markets (n=3,800) revealed:

* 82% of consumers are more likely to purchase brands with sustainable packaging
* 64% are willing to pay a premium (avg. 8%) for products with lower carbon footprint
* 76% consider plastic reduction important in purchase decisions
* 58% are more likely to recommend brands with visible sustainability initiatives

**Competitive Positioning**

| **Competitor** | **Carbon Reduction Target** | **Progress to Date** | **Key Initiatives** |
| --- | --- | --- | --- |
| Competitor A | 30% by 2025 | 18% reduction | rPET transition, bio-based materials |
| Competitor B | 50% by 2030 | 12% reduction | Light-weighting, material elimination |
| Competitor C | 25% by 2025 | 22% reduction | Recycled content, renewable materials |
| Competitor D | 40% by 2030 | 8% reduction | Design optimization, circular models |
| **Our Position (Current)** | **45% by 2030** | **7% reduction** | **Limited implementation to date** |
| **Our Position (Projected)** | **45% by 2030** | **40% reduction** | **Comprehensive material transition** |

**Brand Value Enhancement**

Based on brand valuation modeling, successful implementation of this program could:

* Increase brand value by 3-5%
* Improve consumer perception scores by 8-12 points
* Generate positive earned media valued at $12M-$18M
* Support premium pricing strategy with 5-8% price resilience

**Governance & Measurement**

**Program Governance**

1. **Executive Sponsorship**:
   * Chief Sustainability Officer (Executive Sponsor)
   * VP of Operations (Implementation Lead)
   * Chief Marketing Officer (Brand Integration)
2. **Steering Committee**:
   * Monthly review of progress against KPIs
   * Quarterly strategic direction review
   * Financial performance monitoring
3. **Project Management Office**:
   * Dedicated program manager
   * Cross-functional work streams
   * Regular reporting and performance tracking

**Key Performance Indicators**

| **KPI Category** | **Metrics** | **Measurement Frequency** | **Reporting Level** |
| --- | --- | --- | --- |
| Carbon Reduction | tCO₂e reduced, % of baseline | Quarterly | Executive Committee |
| Financial Performance | CapEx, OpEx, ROI tracking | Monthly | Steering Committee |
| Material Transition | % of portfolio converted | Monthly | PMO |
| Technical Performance | Material specifications, quality metrics | Weekly | Technical Teams |
| Consumer Impact | Brand perception, purchase intent | Quarterly | Marketing |
| Regulatory Compliance | Conformance to legislation | Quarterly | Legal & Compliance |

**Communication Strategy**

**Internal Stakeholders**

1. **Executive Leadership**:
   * Quarterly progress reviews
   * Strategic alignment sessions
   * Financial performance updates
2. **Functional Teams**:
   * Technical briefings on material transitions
   * Implementation roadmap updates
   * Capability building sessions
3. **Manufacturing Sites**:
   * Detailed implementation plans
   * Training on new materials and processes
   * Performance feedback loops

**External Stakeholders**

1. **Consumers**:
   * On-pack communication strategy
   * Digital content on sustainability journey
   * Transparent progress reporting
2. **Customers**:
   * Joint sustainability initiatives
   * Packaging transition roadmaps
   * Category management collaboration
3. **Investors & NGOs**:
   * Annual sustainability reporting
   * Science-based targets progress
   * Independent verification of claims

**Recommendations & Next Steps**

**Key Recommendations**

1. **Approve Phase 1 Implementation**:
   * Allocate $8.3M capital for Year 1 initiatives
   * Establish cross-functional implementation team
   * Initiate supplier development program
2. **Develop Detailed Technical Roadmap**:
   * Complete technical specifications for alternative materials
   * Finalize testing protocols and acceptance criteria
   * Develop manufacturing transition plans
3. **Strengthen Supply Chain Capabilities**:
   * Secure long-term supply agreements for critical materials
   * Develop supplier qualification program
   * Implement inventory management strategy
4. **Integrate with Brand Strategy**:
   * Develop packaging sustainability narrative
   * Create consumer communication assets
   * Align with broader sustainability positioning

**Immediate Next Steps**

| **Action** | **Responsible** | **Timeline** |
| --- | --- | --- |
| Phase 1 CapEx Approval | Executive Committee | June 2023 |
| Project Team Formation | VP Operations, CSO | June-July 2023 |
| Detailed Implementation Plan | Program Manager | July-August 2023 |
| Supplier Engagement Program | Procurement Director | July-September 2023 |
| Manufacturing Site Preparation | Operations Director | August-October 2023 |
| Communication Plan Development | Marketing Director | September-October 2023 |
| First Implementation Wave Launch | Program Manager | Q3 2023 |

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