CARE California Carpet Stewardship Program

MODELING TEAM UPDATE

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California Carpet Stewardship Program

An initiative of CARE:
Carpet America Recovery Effort

Submitted by:
Robert Peoples, Ph.D.
Executive Director
Carpet America Recovery Effort
(CARE)
100 South Hamilton Street
Dalton, GA 30722
bpeoples@carpetrecovery.org

Submitted to:
Rachel Machi Wagoner
Director
California Department of
Resources, Recycling and Recovery
(CalRecycle)
1001 I Street
Sacramento, CA 95814

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Summary

The CARE Modeling team continues to sort through a myriad of complex interacting data that affect commodity prices. The Covid 19 Pandemic upended every sector of our nation. Many manufacturing sectors which employed Post-Industrial, and Post-Consumer recycled products were completely shuttered for part of 2020. The automotive sector, for example, which utilizes millions of pounds of Engineered plastics from Post-Industrial and Post-Consumer commodities such as Nylon 6 and Nylon 66, shuttered their operations for almost 3 months. These actions not only placed tremendous strains on recycling operations in general, but also drastically affected Post-Consumer carpet recycling. Market outlets dried up virtually overnight. Additionally, as facilities reopened, Covid 19 safety restrictions and social distancing severely limited the pace of reopening. When industries began to reopen, commodity prices for materials such as Nylon 6, Nylon 66, and PP, were well below pre-pandemic levels. Polyethylene terephthalate (PET) did not experience the same price decreases, as those prices had already been very low due to an abundance of recycled PET materials in the marketplace.

Following the numerous "what if" scenarios analyzed in early 2020, before and after the start of the pandemic, the Modeling Team followed the same type of modeling analysis in 2021 using ever changing data in order to develop the proper actions to keep the Post-Consumer carpet recycling infrastructure intact and viable.

As a direct result of the modeling, corroborated by actual market evidence of tremendous price plunges, CARE launched an immediate and aggressive 2020 Covid Action Plan. These swift actions were instrumental in keeping the carpet recycling infrastructure intact and operational. The 2020 CARE Covid Action Plan meant the difference between insolvency and operational health for many recyclers. Failure was not an option as all the investments in infrastructure expansion would have been lost, setting the program back by years.

The Pandemic greatly exacerbated the deceleration of carpet sales as the economy went into a tailspin. Carpet sales were reduced by as much as 30% to 40 % for part of the year. As of this writing, carpet sales are still lower than pre Covid levels. Carpet sales are an

important factor since sales drive the revenue to fund the program and carpet sales are the largest factor in deriving discards which directly impact the recycled output and thus, the Recycling Rate.

The pandemic has extended into 2021 which dictated that CARE extend Covid 19 subsidies past 2020. Those temporary increased subsidies are still in force and are constantly monitored. As the economy reopens more fully and commodity prices increase, CARE's modeling team will review data on a continuous basis to determine the proper time for any subsidy modifications.

New unplanned developments appear to crop up almost on a weekly basis, such as the February 2021 Texas freeze which severely disrupted all chemical building blocks of plastics. Additionally, supply chain woes mounted world-wide for makers of everything from cars and clothing to home siding as port backlogs compounded problems for manufacturers already beset by pandemic disruptions. The worldwide shortage of computer chips has recently forced the shutdown of several automotive manufacturing plants around the globe, further exacerbating the situation for increased market demand.

Market prices for recycled products such as Nylon 6 and Nylon 66 have begun to rebound as demand is rapidly returning. Higher than anticipated oil prices in 2021 have added to tailwinds for prices beginning to return toward pre-pandemic levels; however, the complex issues described above are so volatile that all indications point to further volatility until the end of 2021.

Transportation has become a very significant increased cost in the total cost of recycling. Transportation costs have doubled, and in some cases, have tripled, causing significant additional cost burdens that have to be absorbed by either the Tier 1 Processor or the Tier 2 Manufacturer. Higher transportation costs are forecasted to remain at these levels for the foreseeable future. In 2019, truck transport averaged $1.55 per mile, whereas in 2021, average costs are now $3.50 per mile to $5.00 per mile. The modeling team has been studying this important new development to assess the impacts of these higher costs on Post-Consumer carpet recycling. Higher transportation costs are forecasted to last well into 2021 and 2022 and perhaps beyond. The modeling team will outline

recommendations in sections below to mitigate greatly increased transportation costs on the viability of the recovering carpet recycling infrastructure.

Finally, it is important to report the detailed communications between the Modeling Team and the Crowe Economic Analysis work group. As will be stated in a separate report, Crowe had determined once again that the CARE models are accurate and have been validated by the independent Crowe Team for setting subsidies and the required assessment.

Modeling Team Report – June 2021

Methodology

The overall modeling methodology remains identical to the previous reports presented to CalRecycle and that methodology is presented in **Figure A**. In our methodology the economic model (EM) is used to make price predictions for competitive Post-Industrial (PI) polymers and calibrated using actual market data input from Woods MacKenzie and market experts who directly trade in these commodities. The CARE proprietary cost conversion model (CCM) is used to make estimates of the costs of recovering Post-Consumer Carpet (PCC) materials. The Subsidy Justification Model (SJM) is used to determine the required subsidies for the PCC materials that would make them economically attractive relative to the competitive Post-Industrial materials.

The Financial Model (FM) brings together sales and outputs plus program and administrative expenses, to develop budgets and cash flow analyses and projections. The FM offers the ability to run scenarios to examine a variety of parameters and their impact on financial performance, while also tracking actual vs. budgeted performance. The FM is used to generate a good estimate of the actual cost per square yard (cost/yd2) to fund the Program on a monthly and quarterly basis. Finally, the FM allows analysis and tracking of the fund balance and reserve levels.

The SJM confirms that the subsidies satisfy the conditions to make PCC materials competitive in the marketplace and that the highest recyclable materials receive a subsidy that makes them the most attractive materials to recycle. This methodology remains

unchanged from our previous report, but the Covid 19 pandemic required extraordinary measures to be instituted in the form of temporary Covid subsidies in order to keep the recycling infrastructure from collapsing. These changes were instituted on a temporary basis and do not affect the permanent subsidies in place. Since being incorporated into the subsidy system, the temporary Covid subsidies have been constantly analyzed for effectiveness and need. The lingering effects of the Pandemic have continued to strain the viability of carpet recycling, which required lengthening the time frame of the temporary subsidies into 2021. Progress on full reopening of the Economy will dictate, to a large degree, any future changes to these subsidies.

A wide array of data serves as input for the modeling methodology. One of the key inputs is the CARE Cost Conversion Model (CCM) which forms the backbone of all the subsequent model elements. The CCM is an interactive cost system which models varying capacities, sales projections, input costs, etc. Without accurate recycling costs, required subsidies cannot be calculated. The independent work by Crowe has confirmed the robustness of the CCM as a tool to evaluate volatile market dynamics.

Figure A illustrates the analytical role of the Financial Model (FM) which examines cash flow, fund balance, fund reserve, and recycling rates by integrating assessments, SJM subsidies, sales projections, and recycling projections. Program financial viability is the central output of the Financial Model (FM). Results of the FM are updated monthly with actual reported numbers by company and then compared to budgeted forecasts. An interesting observation of the monthly exercise has shown the extreme volatility of the reporting on an individual company basis. At the same time, we have observed the overall consolidated reporting for key segments of the model are relatively close to budget. Since each company has a different weighting on the impact of reported outputs, it is difficult to predict any given result.

Figure A. Integration Role of the Financial Model
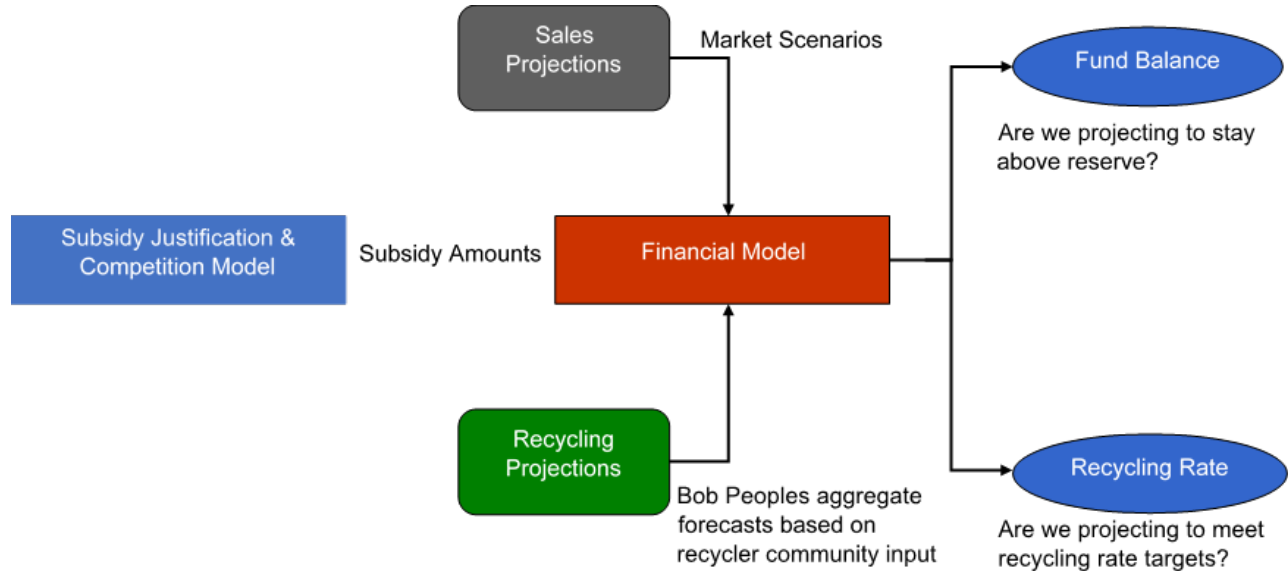
Methodology - Recommendations

The modeling approach was reviewed by Crowe LLP and, after consideration and dialog, we have implemented recommendations for improving the modeling methodology. One of the prime recommendations was to improve the representation of the costs of carpet collection and transportation in California. This was previously handled in the Cost Conversion Model (CCM) with a uniform cost of carpet acquisition.

As recommended by Crowe LLP, the carpet acquisition model (CAM) has been implemented as part of the CCM. It is a flexible tool that allows us to model the varying costs of carpet acquisition. This change has been made to the CCM to reflect carpet acquisition cost differences between rural sites as opposed to urban centers. This method also takes into account regional logistics cost differences. As a result, the CCM now reflects the various methods of collections.

It should be noted that the vast majority of carpet (>85%) that is currently processed does not come from CARE drop-off sites and therefore the CCM was not significantly biased by its exclusion in the earlier version for this source of material.

An important note, the current Models do not take into account the impact of rebond foam pad recycling. Pad recycling has remained a relatively stable source of income for carpet recyclers. Virtually every square yard of residential carpet collected for recycle is associated with a square yard of foam pad. CARE recyclers report their pad volume, and this is reported to CalRecycle in our annual report. Income from pad sales is integral to the overall financial health of recyclers and should be taken into consideration. Unfortunately, pad cannot be counted as recycled output despite the fact it is being diverted from California landfills.

Economic Model Results

The 2020 report outlined the economic crisis arising from Covid 19. The original predicted oil pricing for 2020, prior to the Pandemic, was much higher than actual 2020 oil prices. Covid lockdowns forced severe economic declines in all sectors of the Economy. The ensuing affects were in the form of historically low oil prices which trickled down to historically low commodities prices of recycled materials. **Table 1** and **Table 2** contrast Predicted vs. Actual oil prices in 2020.

Table 1: Expected Crude Oil Prices in 2020

Spot/Contract	Unit	Dec 2019	Mar 2020	Jun 2020
OPEC	Dollar per barrel	67.0	63.0	63.0
WTI	Dollar per barrel	64.5	61.6	62.8
BRENT	Dollar per barrel	70.0	66.0	67.0

Table 2: Actual Crude Oil Prices in 2020

| Spot/Contract	Unit	Dec 2019	Mar 2020	Jun 2020
OPEC	Dollar per barrel	63.8	28.7	37.1
WTI	Dollar per barrel	59.8	29.9	38.3
BRENT	Dollar per barrel	66.8	31.7	40.0

March 2020 was the defining month for the Pandemic and the defining month for the beginning of severe oil price declines. The drop was disastrous. WTI oil, which was $53

in February, declined to an average of $32 in March; almost 50% drop from the previous month. April 2020 breached a new low of $21.04.

Oil prices hit a historic low of $21 per barrel. In April 2020, and for short time, oil futures actually went into negative territory. Demand for energy, commodities, and goods in general nosedived as the economy went into lockdown. The auto sector, which is one of the largest end-users for recycled carpet materials, was shut down for 2 months and greatly reduced the demand for recycled commodities such as Nylon 6, Nylon 66 and PP, the constituents of recycled carpet.

Chart 1 is presented below and depicts 15-year oil price trends. Note that even during the great recession of the early 2000s, oil prices bottomed at $41 per barrel, which is 100% higher than the Covid-19 bottom we experienced in 2020. The steep and dramatically rapid decrease in oil prices caused a very rapid declines in all post-consumer carpet constituents, all of which are derived from oil. The rapid decline in commodities prices caused by the collapse of oil, posed a great threat to the carpet recycling infrastructure.
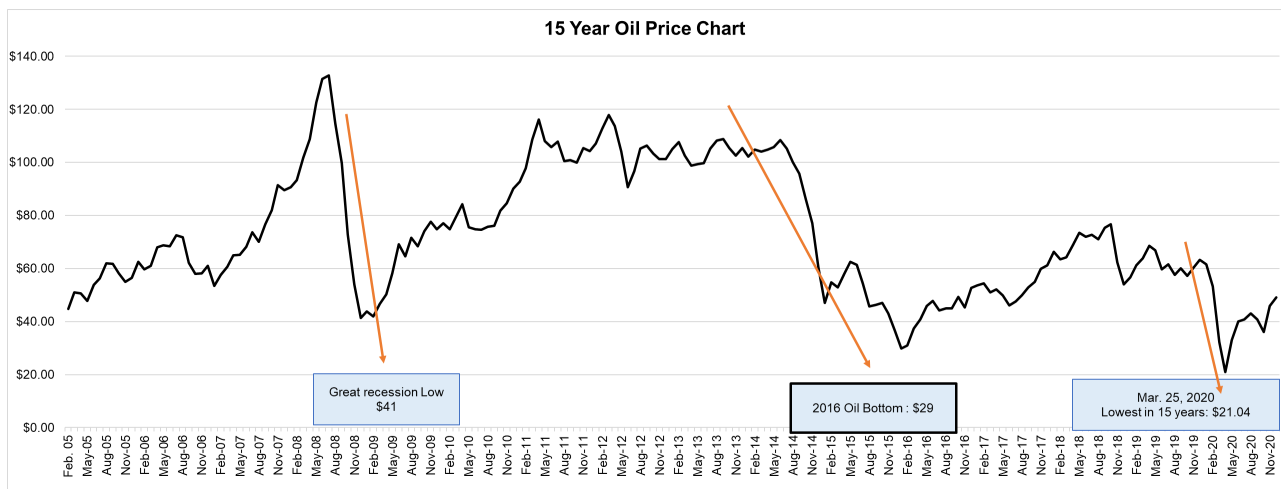
Chart 1: 15 Year historic Oil Trend

2021 Model Forecast

Table 3 below depicts projected oil prices as modeled in August 2020. At that time, Oil prices were predicted to rise in a steady manner from $37 per barrel. to approximately $49 per barrel. by mid-2021. The forecasted increase in oil prices was primarily driven by

the expected steady re-opening of the economy and resultant demands for energy from increased manufacturing activity, and increased travel.

Table 3: Projected Crude Oil Prices (2021)

Spot/Contract	Unit	Sep 2020	Dec 2020	Mar 2021	Jun 2021
OPEC	Dollar per Barrel	34.0	40.0	42.0	49.0
WTI	Dollar per Barrel	33.8	40.3	41.8	49.2
BRENT	Dollar per Barrel	37.0	43.0	45.0	52.0

Oil prices, highlighted in **Table 4**, show actual prices for crude oil at end of the first quarter of 2021. Actual oil prices have exceeded forecasted prices in the first quarter of 2021. The combination of steady re-opening of the economy combined with pent-up demand for goods and services has kept oil demand slightly higher than expected. Additionally, for the 2nd year in a row, a rash of Force majeures in the commodities sector for Nylon, has artificially kept prices higher than expected as supply has been constrained. Adding to Force Majeures, winter storm Uri devastated Texas along with most of the state's Oil processing infrastructure, further constraining supplies, of not only plastic commodities used in Carpet, but also, most other plastics. These artificial and unexpected disruptions should wane in the coming months of 2021. However, full economic activity and continued world tensions are expected to keep oil in the range predicted by the model.

Table 4: Actual Crude Oil Prices-End of Q1 -2021

Spot/Contract	Unit	Sep 2020	Dec 2020	Mar 2021
OPEC	Dollar per Barrel	39.6	46.7	64.0
WTI	Dollar per Barrel	39.6	47.1	64.3
BRENT	Dollar per Barrel	40.6	49.7	67.0

Historically, in an average economy, oil prices play a large role in determining plastic commodity prices. Oil largely determines Prime Virgin prices, which then determines Post-industrial prices, which in turn, set Post-Consumer prices.

Demand for commodities that are the constituents of carpets were reduced, for a brief time, by as much as 80% to 90% during the pandemic. The Auto/Transportation sector,

which utilizes the majority of high value plastics in the U.S., was closed for 2 months. Although the Auto sector opened again in Mid-July 2020, the pace of production was dramatically lower than pre-Pandemic levels. New procedures and processes due to safety and health concerns, resulted in slower production. This situation was exacerbated by portions of the country still being in lockdown causing disruptions in supply chains.

In our 2020 report we projected that "Historic low oil prices combined with unprecedented lack of demand due to the Pandemic have driven prices down to historic lows". It is currently our thesis that "Normal levels" will not return until the 3rd quarter of 2021. It appears that our modeling of "normal levels" was fairly accurate when originally predicted in 2020.

Table 5 below outlines forecast oil prices into the first quarter of 2022. It predicts much higher levels of economic activity as exemplified by higher and steadier oil prices. The GDP Growth forecast for 2021-2022 has been revised to 10.1%. It assumes that the second wave of the pandemic will begin to subside by mid-May 2021. Mass inoculations of millions of people in the U.S. and around the world should allow this forecast to be fairly accurate. However, we also know "shots in arms" is slowing and the pandemic remains a challenge in many parts of the world.

Table 5: Forecast Crude Oil Prices: 2021-2022

Spot/Contract	Unit	Jun 2021	Sep 2021	Dec 2021	Mar 2022
OPEC	Dollar per Barrel	65.0	65.0	67.0	62.0
WTI	Dollar per Barrel	65.1	64.8	66.9	61.8
BRENT	Dollar per Barrel	68.0	68.0	70.0	65.0

Unemployment in April 2021 appears to be approximately 6% to 6.5% and is returning toward more normal levels. Several Federal Stimulus programs, which began in 2020 and culminated in 2021 with a third stimulus of $1.9 trillion, have injected trillions of dollars into an ailing economy, helping businesses and households stay solvent, aiding both demand for goods and services and unemployment.

The unprecedented Covid actions taken by CARE in 2020 follow in the footsteps of the unprecedented actions taken by the Federal Government to return our economy to normal

status. It has not only taken trillions of dollars, but it has also taken over 1 year to return the economy to what we consider 80% back to "Normal".

Just as the faltering economy needed stimulus, it became evident that swift stimulus action by CARE was needed in 2020 to make certain that carpet recycling stayed solvent. As a result, in April 2020 temporary Covid action plans for recyclers were approved by the SPC and put in place that same month.

The impact of the pandemic quickly affected prices across the board for all commodities, devastating the price structure of all recycled materials. Demand, in some commodities was reduced by as much as 80%. Pre-Covid prices were no longer sustainable in the marketplace. A small increment of increased demand began to return in July 2020, but that increment was very low, and pricing was far below pre-pandemic levels. **Table 6** highlights PCC carpet commodity prices at various times before the pandemic and after the pandemic. It illustrates the drastic rapidity of price declines immediately after the Pandemic.

Table 6 shows that PCC prices were very steady for over a year. Although not shown in this table, PCC prices in September 2018 were almost identical to January 2019; therefore, for almost 2 years PCC pricing of carpet materials was extremely stable.

It also shows that the month after the pandemic was declared (April 2020), prices dropped precipitously. For example, Nylon 6 Tier 2 plunged by 33% ($0.20 per pound.) from pre-pandemic prices. Nylon 66 Tier 2 prices actually dropped further (39%); however, Nylon 66 prices were already fairly high prior to the pandemic, so its price decline did not have as great an impact on recyclers.

By July 2020, a new PET category was added called "PET Pellets". This new PET category was a result of CARE's collaboration with one of the largest recyclers in California. Development activities included technical, and customer development for a new PET product for Eastman Chemical Company to be used in Carbon Renewal. CARE Capital and Product Development Grants were keys to this effort. Development of this product category greatly aided the California PCC recycling rate in a year when the entire economy was in a lockdown.

Table 6: Pre and Post Pandemic Post Consumer Carpet (PCC) Market Prices

PCC Materials	Jan 2019	Aug 2019	Jan 2020	Apr 2020	Jun 2020	Jul 2020	Jan 2021	Mar 2021
Nylon 6-Tier 2	$0.60	$0.60	$0.55	$0.40	$0.38	$0.38	$0.45	$0.55
Nylon 6-Tier 1	$0.25	$0.25	$0.25	$0.25	$0.25	$0.25	$0.25	$0.32
Nylon 66-Tier 2	$0.90	$0.90	$0.65	$0.55	$0.55	$0.52	$0.70	$0.95
Nylon 66-Tier 1	$0.25	$0.25	$0.25	$0.25	$0.25	$0.25	$0.33	$0.40
PET - Pellets	NA	NA	NA	NA	NA	$0.03	$0.03	$0.03
PET- Tier 2	$0.37	$0.37	$0.27	$0.15	$0.15	$0.20	$0.26	$0.17
PET - Tier 1	$0.25	$0.25	$0.25	$0.20	$0.20	$0.20	$0.20	$0.20
PP - Tier 2	$0.25	$0.25	$0.17	$0.05	$0.10	$0.20	$0.18	$0.30
PP -Tier 1	$0.00	$0.00	$0.00	$0.00	$0.00	$0.05	$0.07	$0.13

Table 7 below shows the standard subsidies in place vs. the added Covid subsidies applied in March 2020.

In all cases, price declines shown in column "Total Covid Price Drop", caused by Covid-19, were only partially offset by the Covid Action Plan increases shown in Column "Covid Action Plan Add". For example: As Table 7 illustrates, the price drop for Nylon 6 was $0.22 per pound. but the increased Covid Action Plan subsidy was only an additional $0.15 per pound, which did not fully cover the drop in commodity prices from Pre to Post Pandemic.

Table 7: Standard Subsidies vs. Jul. 2020 Added Covid Subsidies

Material	Standard Subsidies	Subsidies After Action Plan	Total Covid Price Drop	Covid Action Plan Add.
Nylon 6-Tier 2	$0.25	$0.40	$0.22	$0.15
Nylon 6-Tier 1	$0.15	$0.15	$0.00	$0.00
Nylon 66-Tier 2	$0.25	$0.28	$0.35	$0.03
Nylon 66-Tier 1	$0.15	$0.15	$0.00	$0.00
PET-Tier 2	$0.40	$0.40	$0.17	$0.00
PET-Tier 1	$0.10	$0.15	$0.05	$0.05
PP-Tier 1	$0.10	$0.15	$0.10	$0.05
PP-Tier 2	$0.35	$0.40	$0.15	$0.05

Cost Conversion and Subsidy Justification Models

The CARE CCM is the backbone of estimating recycling costs associated with processing PCC. CARE is the only source for such information at this time. CARE CCM model will be compared to those obtained by the Crowe Economic Study due mid-year 2021.

The SJM (Subsidy Justification Model) was developed by CARE in order to accurately subsidize Recyclers according to 1) Type of product recycled, 2) The cost of recycling the various types of products, and 3) The price of competing materials in the marketplace. The price of competing materials in the marketplace determines the level of subsidies needed. The SJM integrates these 3 main elements.

The SJM reflects the constant changes in commodity prices of raw materials (PET, Nylon, PP) that compete against Post-Consumer carpet materials. Those competing materials are typically, but not always, Post-Industrial materials in each material category. **Table 8** reflects the subsidy level that existed in July 2020 after the Covid adjustments.

Table 8: SJM as of July 2020

Table 8	Subsidy Justification Model - Effective July 1 2020										
	B	C	D	E	F	G	H	I	J	L
	Competitive Materials	PCC Discount	PCC Materials	PCC Carpet Conversion	15% Return	Conv. Cost Plus	SubsidyReq'd to Incentivize	PCC Materials Subsidy[6]	Subsidy Difference[4]	New SubsidyTotal
	Market Price		Market Price	Cost[2]	Conv. Cost[3]	Return	PCC Materials	Table 8A		APPROVED
Formula >>			B-C		E*0.15	E+F	G-D	Actual Present Subsidies	I-H (Indicated by CCM and SJM)	Approved by SPC 7-20-20
Nylon 6-Tier 2	$0.48	$0.10	$0.38	$0.70	$0.11	$0.81	$0.43	$0.250	-$0.18	$ 0.40
Nylon 6-Tier 1	NA	NA	$0.25	$0.33	$0.05	$0.38	$0.13	$0.15	$0.02	$ 0.15
Nylon 66-Tier 2	$0.62	$0.10	$0.52	$0.70	$0.11	$0.81	$0.29	$0.25	-$0.03	$ 0.28
Nylon 66-Tier 1	NA	NA	$0.25	$0.33	$0.05	$0.38	$0.13	$0.15	$0.02	$ 0.15
PET-Pellets	$0.20	$0.10	$0.03	$0.43	$0.06	$0.49	$0.46	$0.35	-$0.11	$ 0.51
PET - Tier 2	$0.20	$0.10	$0.10	$0.70	$0.11	$0.81	$0.71	$0.35	-$0.36	$ 0.40
PET - Tier 1	NA	NA	$0.20	$0.30	$0.05	$0.35	$0.15	$0.10	-$0.05	$ 0.15
PP - Tier 2	$0.22	$0.10	$0.12	$0.45	$0.07	$0.52	$0.40	$0.35	-$0.05	$ 0.40
PP -Tier 1	$0.15	$0.10	$0.05	$0.30	$0.05	$0.35	$0.30	$0.10	-$0.20	$ 0.15
PC4	$0.02	$0.10	-$0.08	$0.05	$0.01	$0.06	$0.14	$0.17	$0.03	$ 0.17

Column L shows the present subsidies in force, which include the Covid Action Plan. However as shown below in **Table 9** below, market pricing for PCC products shown in column D, has increased steadily over the past few months as the economy regains its footing and demand for products are increasing. Although the trend is very positive for commodities pricing, volatility will still be present until clearer picture of the pandemic is in view.

Table 8 and Table 9 are identical in subsidy payments in each commodity category since table 9 reflects subsidies after Covid action in April 2020. Those Covid subsidies have not been lifted at this point. The primary differences between Tables 8 and 9 are in Column D "PCC Materials Market Price". Table 9 demonstrates that prices of PCC commodities have inched up closer to Pre-Covid levels.

Table 9: SJM as of April 2021

	B	C	D	E	F	G	H	I	J	L
Table 9	Competitive Materials Market Price	PCC Discount	PCC Materials Market Price	PCC Carpet Conversion Cost[2]	15% Return	Conv. Cost Plus Return	SubsidyReq'd to Incentivize PCC Materials	PCC Materials Subsidy[8] Table 8A	Subsidy Difference[4]	New SubsidyTotal APPROVED
Formula >>	All Prices in this column are Post Industrial prices	B-D	Actual PCC Market price		E*0.15	E+F	G-D	Actual Present Subsidies 1	(I-H) Indicated by CCM and SJM	Approved by SPC 7-20-20
Nylon 6-Tier 2	$0.70	$0.15	$0.55	$0.70	$0.11	$0.81	$0.26	$0.40	$0.15	$0.40
Nylon 6-Tier 1	$0.50	$0.18	$0.32	$0.33	$0.05	$0.38	$0.06	$0.15	$0.09	$0.15
Nylon 66-Tier 2	$1.20	$0.25	$0.95	$0.70	$0.11	$0.81	-$0.15	$0.28	$0.43	$0.28
Nylon 66-Tier 1	$1.00	$0.55	$0.45	$0.33	$0.05	$0.38	-$0.07	$0.15	$0.22	$0.15
PET - Pellets	$0.25	$0.22	$0.03	$0.43	$0.06	$0.49	$0.46	$0.51	$0.05	$0.51
PET- Tier 2	$0.36	$0.19	$0.17	$0.70	$0.11	$0.81	$0.64	$0.40	-$0.24	$0.40
PET - Tier 1	$0.12	-$0.08	$0.20	$0.33	$0.05	$0.38	$0.18	$0.15	-$0.03	$0.15
PP -Tier 2	$0.40	$0.10	$0.30	$0.45	$0.07	$0.52	$0.22	$0.35	$0.13	$0.40
PP -Tier 1	$0.25	$0.12	$0.13	$0.30	$0.05	$0.35	$0.22	$0.15	-$0.07	$0.15
PC4	$0.02	$0.10	-$0.08	$0.05	$0.01	$0.06	$0.14	$0.17	$0.03	$0.17

Highlighting Nylon 6-Tier 2, indicators show that prices have rebounded from $0.38 per pound. in July 2020 to $0.55 per pound. in April 2021. By glancing at table 6, one can see that the average Nylon 6 Tier 2 pricing for almost 2 years was $0.60 per pound. This would seem to suggest that we are getting closer and closer to "Normal" economic activity.

It could be argued that pricing has rebounded far enough to warrant removal of Covid Subsidies; however, as outlined earlier, some of the rebound is due to temporary product constraints from Force Majeures and the unprecedented winter storm that devastated Texas. Removing subsidies too early without fully understanding the impacts of these events, would be imprudent.

Additionally, a factor that began affecting the entire supply chain pertains to the doubling or tripling of transportation costs. This huge additional recycling cost has now become almost as large as the Covid effect. Transportation costs have become the "New Covid" marketplace burden.

Beginning in 2020, transportation rates began to increase, and that trend continues today. Freight costs are now affecting overall transactional pricing for recyclers, as either the Tier 1 Processor or the Tier 2 Manufacturer must absorb dramatically higher logistics costs. As an example, freight rates averaged $0.02 per pound. (local) to $0.10 per pound. (Long distance). Today's rates have more than doubled. It is not unusual to experience

rates of $3.90 to $5.00 per mile for freight haulers.   Freight for a 200-mile trip is approximately $1000. A 500-mile trip could be as high as $2000. Cross country freight costs from California to potential East Coast Tier 2 Manufacturers are approximately $7500. A cross country haul is now almost $0.15 per pound. more expensive than in 2019. Many times, it has been difficult for processors to even schedule timely freight appointments as driver and rig shortages abound, causing delays in production and revenues. The model and integration teams have been discussing the impact of this new cost component as it affects recycling costs for the Post-Consumer recyclers. All indications and analyses indicate that this new dynamic will be permanent for the foreseeable future. This new transportation paradigm was greatly accelerated by the Pandemic by the new concept of shipping everything, big and small, to the consumers' door. The demand for shipping goods and services has outstripped the capacity to fill those needs.

Despite all the foregoing development and events, we are still hopeful, as the Economic Model demonstrates, that the need for the Covid actions will subside by the end of the 3rd Quarter of 2021; however, the need to keep in place the temporary subsidies instituted in April 2020 may need to be in place longer due to transportation issues. As always, the situation will be constantly monitored for appropriate action.

Economic Model Price Predictions: 2021 and Long-Term Trend.

The year 2021 will be remembered as the Re-opening year, as the U.S. Economy, as well as the world's economies began getting back to normal. The pandemic has forever changed the structure of work. The world has discovered new ways to work from home for many in corporate and other jobs. Business travel for meetings will forever be changed as Zoom and Microsoft Teams software allows virtual meetings for many business meetings. Travel is coming back but in a more modified and austere form. The Pandemic created tremendous pent-up demand for housing, home related products from flooring to appliances and this will bode well for the economy and demand for products.

Demands for oil derived products such as plastics, chemicals, etc., are the primary driver responsible for the pricing demand of oil. The requirement for energy production being

the second. Our Economic forecast appears to be robust for the next few years and portends fairly stable oil prices.

A permanent new global trend has emerged in the past year. The rapid adoption of BEV's (Battery Electric Vehicles), will keep the demand for oil at a high level for the foreseeable future. The forecast for rapid adoption of electric vehicles could portend a much-reduced need for oil derived energy needs due to the obsolescence of ICE (Internal Combustion Engines); however, we already see major initiatives from entities around the world. By 2035 China has already mandated that by 2035, only EVs will be sold as new vehicles. GM has vowed that by 2030, all new vehicle sales will be EVs. The UK has set 2030 as a date where all new vehicles sold will be EVs. California's new executive order signed September 23, 2020, would ban the sale of new vehicles that are powered by internal combustion engines, including gasoline, diesel, and hybrid electric vehicles. The need for power to meet the charging demands for millions of EVs will increase almost logarithmically from 2% today to over 50% in the next 15 years. Therefore, the need for energy from our electric grid will increase the demand for oil and will keep oil prices relatively high. It is estimated that, of the 3 sources used for electricity generation, coal, natural gas and petroleum, Oil accounts for 39%.

Since oil accounts for almost 40% of the energy input needed for Electric power, oil prices and therefore, commodities prices for carpet materials made from oil feedstocks, should remain stable, barring geopolitical, natural disasters, or other unforeseen events. **Figure B**. below outlines Energy Grid estimated needs which directly correlate to increased oil demand.

Estimated U.S. capacity if 66% of all cars are EVs by 2050

Gigawatt electric capacity needs to double to power 186 million light-duty EVs in 2050
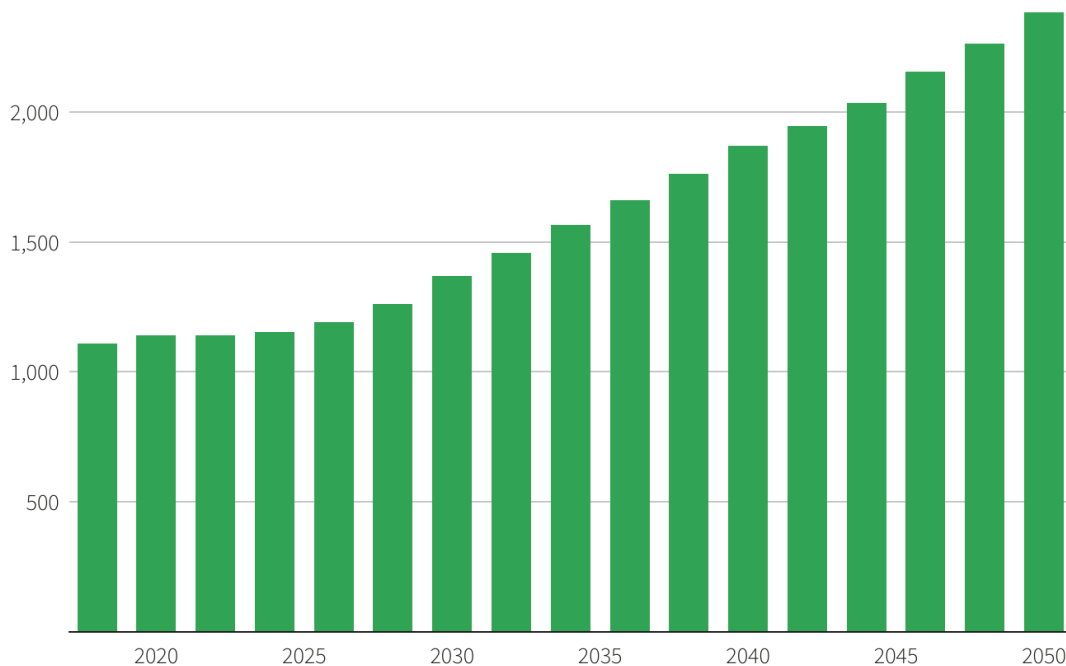
Note: Capacity in GW is rounded; 2018 is the base case, all other years estimated; data assumes the share of electricity also increases for space and water heating, industrial curing needs by 2050, but vehicle electrification dominates incremental demand growth
Source: The National Renewable Energy Laboratory's Electrification Futures Study, Jan 2021

Figure B. Estimated Electric Grid Capacity Needs

Based on our Economic Model, we have the following ranges for the prices of virgin, post-industrial and then post-consumer prices throughout 2021

Table 10 below uses the Economic Model (EC) to predict prices of commodities. The expected median price for oil in 2021 is predicted to be $67 per barrel. The Median oil price is used in our models.

Table 10: Commodity Prices based on Oil as of Mar 31, 2021

| Commodity	Unit of Measure	Type	Low Forecast	Median Forecast	High Forecast
Oil	*Dollar per barrel*	*WTI Crude*	*54*	*67*	*80*
Nylon 6,6	Cents per pound	Virgin	134	152	172
Nylon 6,6	Cents per pound	Post Industrial	110	125	142
Nylon 6,6	Cents per pound	Post-Consumer	102	107	113
Nylon 6	Cents per pound	Virgin	100	108	118
Nylon 6	Cents per pound	Post Industrial	66	72	78
Nylon 6	Cents per pound	Post-Consumer	52	56	61
PET	Cents per pound	Virgin	54	56	57
PET	Cents per pound	Post Industrial	33	34	36
PET	Cents per pound	Post-Consumer	15	15	15
Polypropylene	Cents per pound	Virgin	74	84	94
Polypropylene	Cents per pound	Post Industrial	37	42	47
Polypropylene	Cents per pound	Post-Consumer	29	31	33

Comparing Table 10, generated by the Economic Model above, to Table 9 (SJM April 21), we can readily see that the Economic Model predictions 2021 prices for carpet recycled commodities (N6, N66, PET, PP) are extremely close to today's prices. The EC prediction seems to indicate sustained economic activity. If the EC prediction proves to be correct, we can see that commodity prices for recycled carpet materials will have bounced back and sustained themselves at or above pre-pandemic levels.
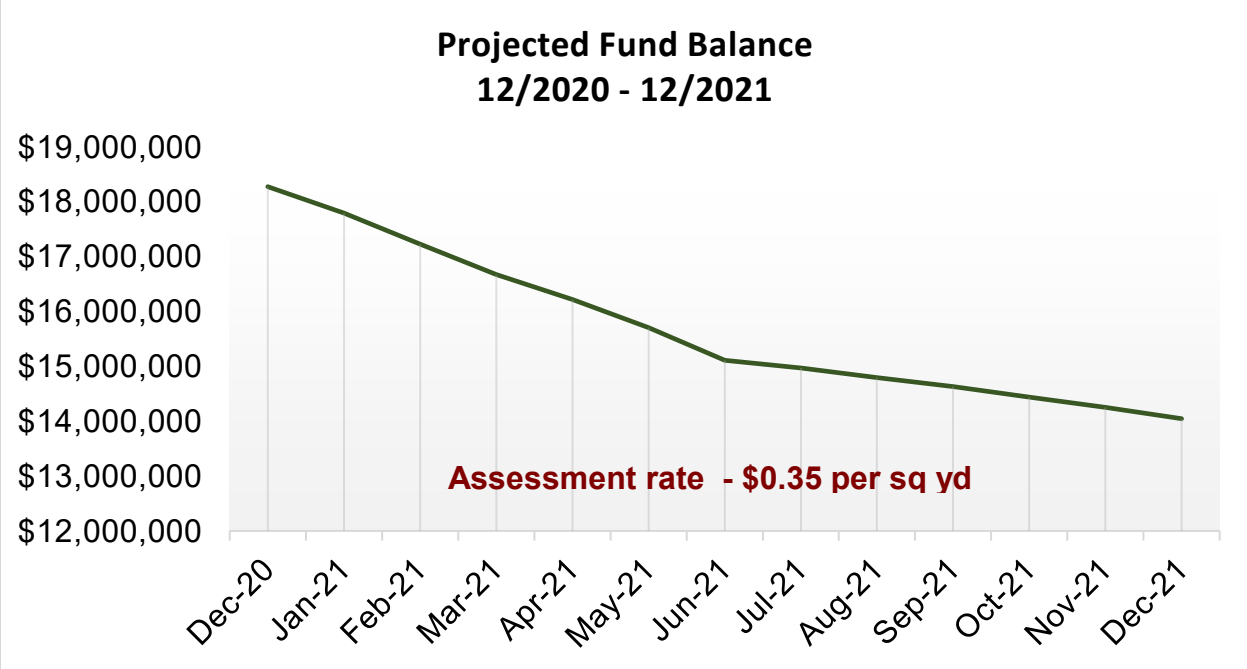
CARE Financial Model Results

The projected pounds of output and recycling rate for 2021 are shown in **Chart 2**. While the effects on recycling carpet were largely unknown in 2020, the fog has now cleared, and it appears that our modeling scenarios have been very effective and accurate in projecting the impacts of the pandemic. It must be noted that the timely Covid actions of

April 2020 were extremely critical. By the time the April 2020 Covid actions were taken, the pandemic which began with lock-downs in March 2020, had already taken a toll or recycling demand and pricing. The 2020 Modeling report shows that, the September 2020 projected recycling rate was 24.5%. But due to the pandemic, the recycling rate fell to slightly over 21%. Two months after the April action, the recycling rate began to steadily climb. It is worth reiterating that this increase occurred at a time of the most severe economic crisis in a decade.

It is the opinion of the modeling team that Charts 2, 3 and 4 indicate the likely trajectory over the bulk of 2021.
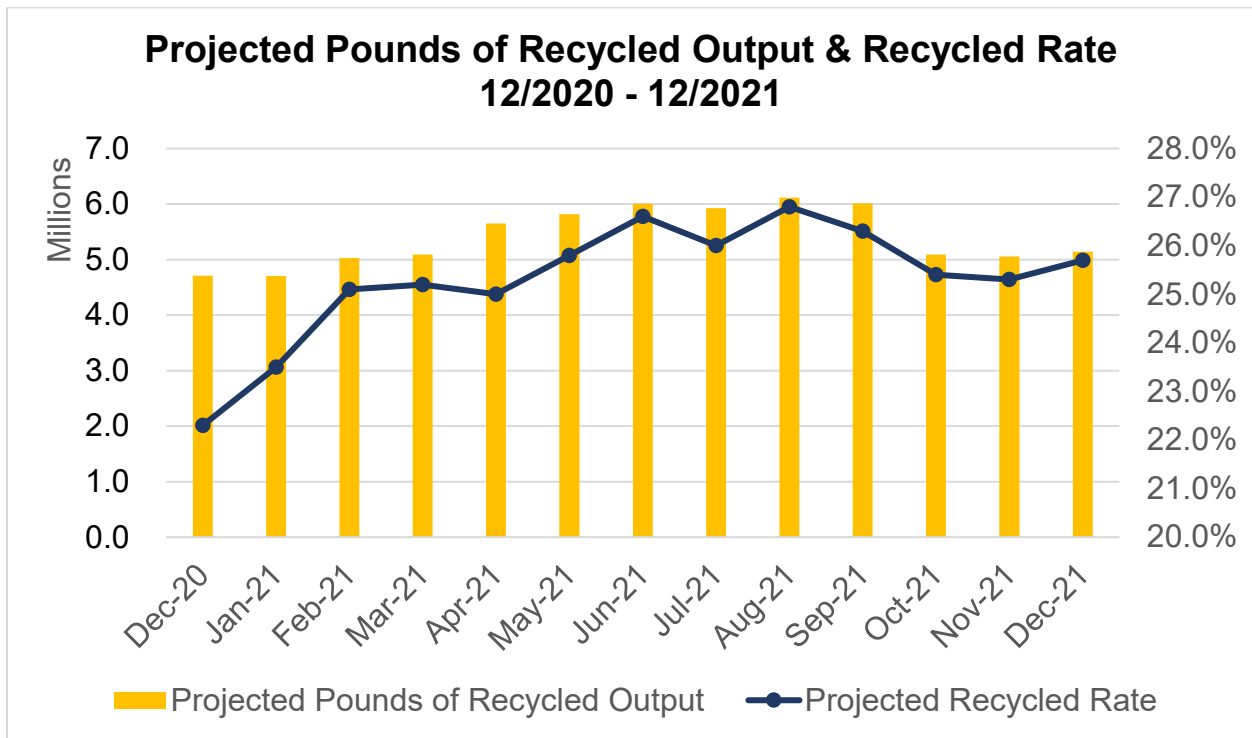
Chart 2: Recycled Output & Recycling Rate Projections

Projected Fund Balance
12/2020 - 12/2021

Assessment rate - $0.35 per sq yd

Chart 3: Projected Fund Balance

Projected Pounds of Recycled Output
12/2020 - 12/2021

Assessment rate - $0.35 per sq yd
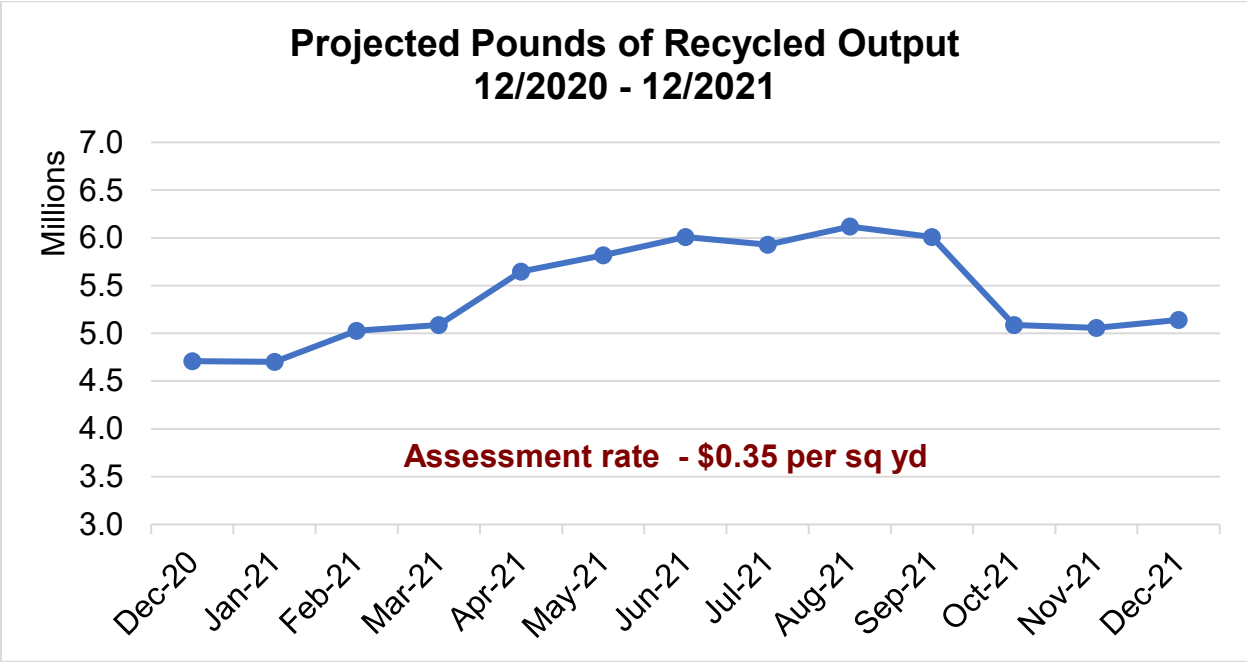
Chart 4: Projected pounds Recycled Output

Conclusions

CARE concludes that many uncertainties still exist, and the future is still somewhat cloudy, however, Covid-19, which was the preeminent issue in 2020, is now largely in our rearview mirror. Force Majeures, Geopolitical events, etc., will always be short term disruptions. A more stable economic picture leads us to believe that our model is sound.

CARE anticipates continued economic pressures to exist thru mid-2021. As a result, market volatility makes projections much more problematic. Layered upon this is the greatly increased cost of transportation and the uncertainty of the unknown trajectory of virus spread as well as the current surges being seen around the world and their concomitant impact on the global economy.

1. CARE believes the model contained herein is the most accurate case that represents the next 12 months.
2. Covid Action temporary subsidies instituted in April 2020, were crucial to save the Post Consumer recycling industry during the Pandemic. Lack of demand for recycled materials in combination with pricing erosion threatened to totally disrupt the industry.
3. The short term Covid adjustments instituted in 2020 are now under review and CARE is modeling the effects and impacts of removal and/or steady elimination.
4. Transportation costs and logistics continue to strain the recycling infrastructure. Model discussions are being held in order to properly account for this new phenomenon. Although the need for Covid relief has subsided, transportation costs increases have taken its place.
5. The current assessment is sufficient to fund the plan through the end of December 2022.
6. The large oil volatility experienced in 2020 is not expected to be severe over the next 24 months portending a much more stable environment for commodities.
7. CARE is in the process of harmonizing and integrating the present CCM, SJM, into the Crowe findings.

The CARE July 2020 subsidy adjustment was the 3rd action in a series taken by CARE in response to the Covid-19 Pandemic. Adjustments to these temporary measures are being considered.

The CARE subsidy levels outlined in Table 7 column L are still in effect.

CARE expects volatility and uncertainty to continue into 2022 as the pandemic remains a force and has exacerbated global markets and supply chains. Thus, assumptions made for modeling purposes are more challenging than normal.

Learning from the most recent work include:

a) Creation of the Integration Team (Economic Analysis, Modeling, Differential Assessment) provides an internal check on the reasonableness of assumptions used in the model and enhances all efforts.

b) Creation of the Integration Team has also increased the visibility of key parameters and assumptions and provided enhanced confidence in the work of all teams.

c) Covid action Plan subsidies had a major positive impact on the recycling industry's ability to remain viable during the pandemic.

d) The duration of the pandemic has been longer than anticipated and remains a major factor for all model analyses.

e) Volatility is greater than normal and making assumptions used in the model work is more challenging.

f) The current assessment is sufficient to see the Plan through the end of term, December 2022. This has been validated by the work of Crowe on the Economic Study.

g) CARE remains the leading authoritative source of post-consumer carpet materials intelligence and supply chains, technologies, markets, and pricing.

Acknowledgments

The work reported herein is the result of a number of contributors. CARE would like to recognize those contributions and thank them for their efforts:

Mr. Frank Endrenyi, Chairman of the Modeling Team, Marketing Collaborative LLC

Mr. Michael George, Client Manager, Aprio

Dr. Matthew Realff, Chaired Professor, Chemical & Biomolecular Engineering, Georgia Institute of Technology

Crowe Team, led by Wendy Pratt, Managing Director, Crowe LLP

End Report

Appendices

The following items are provided for persons with Accessibility needs. If additional support or information is required, please contact us in writing by emailing infoca@carpetrecovery.org with the subject line: Accessibility Support: Spring 2021 Modeling Team Update Report.

1.0 Figures

Figure A. Integration Role of the Financial Model

Figure A is a visual flowchart of the central analytical role of the Financial Mode. A rectangular box titled Financial Model is placed in the center of the space. There are three boxes and two ovals (Fund Balance and Recycling Rate) surrounding this box. Each box includes connector lines that highlight informative text. The first three boxes show what elements are used to analyze a wide array of data from capacity surveys, sales projections, recycled output trends, Tier 1 and Tier 2 outputs, costs and estimates subsidies which make up the Financial Model. This then used to examine the Fund Balance, the reserve and the Recycling Rate which are represented by oval shapes located to the right of the Financial Model box.

Located to the left of the Financial Model box is a rectangular box titled "Subsidy Justification and Competition Model". There is a straight connector line with a right facing arrow indicating the data feeds the Financial Model box. This includes the text "Subsidy Amounts".

Next, located above the Financial Box, is a rounded box titled "Sales Projections". An elbow connector, with a downward pointing arrow indicates the data feeds the Financial Model box. This includes the text "Market Scenarios".

Located below is a rounded square box titled "Recycling Projections". An elbow connector with an upwards pointing arrow, indicates the data feeds the Financial Model box. This includes the text "Bob Peoples' aggregate forecast based on recycler community input".

Finally, the rectangular box titled "Financial Model" shows a right facing split elbow connector with one connector feeding into the Oval titled "Fund Balance". This includes the text "Are we projecting to stay above reserve?". The secondary elbow connector feeds the oval titled "Recycling Rate" and includes the text "Are we projecting to reach recycling rate targets?".

Figure B. Estimated Electric Grid Capacity Needs

Year	Projected Gigawatts Needed
2018	1,108
2020	1,139
2022	1,139
2024	1,154
2026	1,190
2028	1,262
2030	1,371
2032	1,459
2034	1,565
2036	1,661
2038	1,765
2040	1,867
2042	1,947
2044	2,032
2046	2,152
2048	2,260
2050	2,383

Note: Capacity in GW is rounded; 2018 is the base case, all other years estimated; data assumes the share of electricity also increases for space and water heating, industrial curing needs by 2050, but vehicle electrification dominates incremental demand growth. Table Data Source: (Murphy, et al., 2021), Chart Source: (Groom & Bellon, 2021)

2.0 SJM Tables

To arrive at the New Subsidy Total (SJM Proposed), a series of calculations are made beginning with the Discounted Materials Market price (Competitive Materials Market Price less a PCC Discount).

The PCC Carpet Conversion Cost is then multiplied by 15 percent (based on reasonable return and shipping negotiations). The product is then added back into the PCC Carpet Conversion Cost resulting in a Convenience Cost plus Return value. That value is then subtracted from the PCC Materials Market Price to arrive the Subsidy Required to Incentivize PCC Materials value. To arrive at the difference between the two figures: PCC Material Subsidy (Actual Present Subsidies) versus Subsidy Difference (as indicated by the CCM and SJM), the Subsidy Difference is subtracted from the Actual Present Subsidies. This figure is used to evaluate proposed changes as the New Subsidy Total and is identified as the SJM Proposed (as indicated by CCM & SJM).

Approved New Subsidy Totals are approved by the SPC and may be greater or less than the SJM proposed subsidy total. Tables 8 and 79 show the summary data of the calculations for the years 2020 and 2021. Table 8 is provided as a comparison.

Table 8: SJM as of July 2020

Material	(B) Competitive Materials Market Price	(C) PCC Discount	(D) PCC Materials Market Price	(E) PCC Carpet Conversion Cost	(F) 15% Return Conversion Cost	(G) Conversion Cost Plus Return	(H) Subsidy Required	(I) PCC Material Subsidy (Actual Present Subsidies)	(J) Subsidy Difference (Indicated by CCM and SJM)	(L) New Subsidy Total Approved by SPC 7-20-20
Nylon 6-Tier 2	$0.48	$0.10	$0.38	$0.70	$0.11	$0.81	$0.43	$0.25	- $0.18	$0.40
Nylon 6-Tier 1	n/a	n/a	$0.25	$0.33	$0.05	$0.38	$0.13	$0.15	$0.02	$0.15
Nylon 66-Tier 2	$0.62	$0.10	$0.52	$0.70	$0.11	$0.81	$0.29	$0.25	-$0.03	$0.28
Nylon 66-Tier 1	n/a	n/a	$0.25	$0.33	$0.05	$0.38	$0.13	$0.15	$0.02	$0.15
PET - Pellets	$0.20	$0.10	$0.03	$0.43	$0.06	$0.49	$0.46	$0.35	-$0.11	$0.51
PET- Tier 2	$0.20	$0.10	$0.10	$0.70	$0.11	$0.81	$0.71	$0.35	-$0.36	$0.40
PET - Tier 1	n/a	n/a	$0.20	$0.30	$0.05	$0.35	$0.15	$0.10	-$0.05	$0.15
PP - Tier 2	$0.22	$0.10	$0.12	$0.45	$0.07	$0.52	$0.40	$0.35	-$0.05	$0.40
PP -Tier 1	$0.15	$0.10	$0.05	$0.30	$0.05	$0.35	$0.30	$0.10	-$0.20	$0.15
PC4	$0.02	$0.10	-$0.08	$0.05	$0.01	$0.06	$0.14	$0.17	$0.03	$0.17

Table 9: SJM as of April 2021

Material	(B) Competitive Materials Market Price [Post-Industrial Prices]	(C) PCC Discount	(D) PCC Materials Market Price [Actual]	(E) PCC Carpet Conversion Cost	(F) 15% Return Conversion Cost	(G) Conversion Cost Plus Return	(H) Subsidy Required	(I) PCC Material Subsidy (Actual Present Subsidies)	(J) Subsidy Difference	(L) New Subsidy Total Approved by SPC 7-20-20
Nylon 6-Tier 2	$0.70	$0.15	$0.55	$0.70	$0.11	$0.81	$0.26	$0.40	$0.15	$0.40
Nylon 6-Tier 1	$0.50	$0.18	$0.32	$0.33	$0.05	$0.38	$0.06	$0.15	$0.09	$0.15
Nylon 66-Tier 2	$1.20	$0.25	$0.95	$0.70	$0.11	$0.81	-$0.15	$0.28	$0.43	$0.28
Nylon 66-Tier 1	$1.00	$0.55	$0.45	$0.33	$0.05	$0.38	-$0.07	$0.15	$0.22	$0.15
PET - Pellets	$0.25	$0.22	$0.03	$0.43	$0.06	$0.49	$0.46	$0.51	$0.05	$0.51
PET-Tier 2	$0.36	$0.19	$0.17	$0.70	$0.11	$0.81	$0.64	$0.40	-$0.24	$0.40
PET - Tier 1	$0.12	-$0.08	$0.20	$0.33	$0.05	$0.38	$0.18	$0.15	-$0.03	$0.15
PP - Tier 2	$0.40	$0.10	$0.30	$0.45	$0.07	$0.52	$0.22	$0.35	$0.13	$0.40
PP -Tier 1	$0.25	$0.12	$0.13	$0.30	$0.05	$0.35	$0.22	$0.15	-$0.07	$0.15
PC4	$0.02	$0.10	-$0.08	$0.05	$0.01	$0.06	$0.14	$0.17	$0.03	$0.17

3.0 Charts

Table Chart 1: 15 Year Oil Price Chart

Year/ Month	January	February	March	April	May	June	July	August	September	October	November	December
2005	Not Captured	$44.82	$50.94	$50.64	$47.83	$53.89	$56.37	$61.89	$61.69	$58.19	$55.04	$56.43
2006	$62.46	$59.70	$60.93	$67.97	$68.68	$68.29	$72.45	$71.81	$62.12	$57.91	$58.14	$60.99
2007	$53.52	$57.56	$60.60	$65.06	$65.16	$68.19	$73.60	$70.13	$76.76	$81.97	$91.34	$89.52
2008	$90.69	$93.39	$101.84	$108.76	$122.63	$131.52	$132.83	$114.57	$99.66	$72.69	$53.97	$41.34
2009	$43.86	$41.84	$46.65	$50.28	$58.15	$69.15	$64.67	$71.63	$68.35	$74.08	$77.55	$74.88
2010	$77.12	$74.76	$79.30	$84.18	$75.62	$74.73	$74.58	$75.83	$76.12	$81.72	$84.53	$90.01
2011	$92.69	$97.91	$108.65	$116.24	$108.07	$105.85	$107.92	$100.49	$100.82	$99.85	$105.41	$104.23
2012	$107.07	$112.69	$117.79	$113.67	$104.09	$90.73	$96.75	$105.27	$106.28	$103.41	$101.17	$101.19
2013	$105.10	$107.64	$102.52	$98.85	$99.37	$99.74	$105.26	$108.16	$108.76	$105.43	$102.63	$105.48
2014	$102.10	$104.83	$104.04	$104.87	$105.71	$108.37	$105.23	$100.05	$95.85	$86.08	$76.99	$60.70
2015	$47.11	$54.79	$52.83	$57.54	$62.51	$61.31	$54.34	$45.69	$46.28	$46.96	$43.11	$36.57
2016	$29.78	$31.03	$37.34	$40.75	$45.94	$47.69	$44.13	$44.88	$45.04	$49.29	$45.26	$52.62
2017	$53.59	$54.35	$50.90	$52.16	$49.89	$46.17	$47.66	$49.94	$52.95	$54.92	$59.93	$61.19
2018	$66.23	$63.46	$64.17	$68.79	$73.43	$71.98	$72.67	$71.08	$75.36	$76.73	$62.32	$53.96
2019	$56.58	$61.13	$63.79	$68.58	$66.83	$59.76	$61.48	$57.67	$60.04	$57.27	$60.40	$63.35
2020	$61.63	$53.35	$32.20	$21.04	$33.01	$40.06	$40.87	$43.12	$40.86	$36.15	$45.84	$49.01

Table Chart 2: Recycled Output & Recycling Rate Projections

Month / Year	Projected Pounds of Recycled Output	Projected Recycled Rate
December 2020	4,710,204	22.3%
January 2021	4,701,934	23.5%
February 2021	5,027,934	25.1%
March 2021	5,088,239	25.2%
April 2021	5,646,683	25.0%
May 2021	5,817,521	25.8%
June 2021	6,008,106	26.6%
July 2021	5,928,450	26.0%
August 2021	6,118,064	26.8%
September 2021	6,010,335	26.3%
October 2021	5,087,975	25.4%
November 2021	5,056,283	25.3%
December 2021	5,142,842	25.7%

Table Chart 3: Projected Fund Balance

Month / Year	Projected Fund Balance Forecast
December 2020	$18,274,506
January 2021	$17,793,007
February 2021	$17,225,188
March 2021	$16,672,154
April 2021	$16,215,256
May 2021	$15,705,053
June 2021	$15,110,237
July 2021	$14,971,556
August 2021	$14,794,663
September 2021	$14,631,856
October 2021	$14,440,689
November 2021	$14,253,276
December 2021	$14,045,919

Table Chart 4: Projected pounds Recycled Output

Month / Year	Projected Pounds of Recycled Output
December 2020	4,710,204
January 2021	4,701,934
February 2021	5,027,934
March 2021	5,088,239
April 2021	5,646,683
May 2021	5,817,521
June 2021	6,008,106
July 2021	5,928,450
August 2021	6,118,064
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