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No simple seat

A detailed CAD-based master model is key to improving the design/manufacturing process for seat trim covers.

New design software for seat trim covers enables automakers and their suppliers to work in a 3-D CAD environment that allows for full definition of the seat cover in a 3-D master model. (Ford)

While seats and trim covers might seem like a small matter compared to the rest of the automobile, they are the first things prospective buyers see when they open the door and are critical factors in the consumer's long-term comfort and satisfaction with the vehicle.

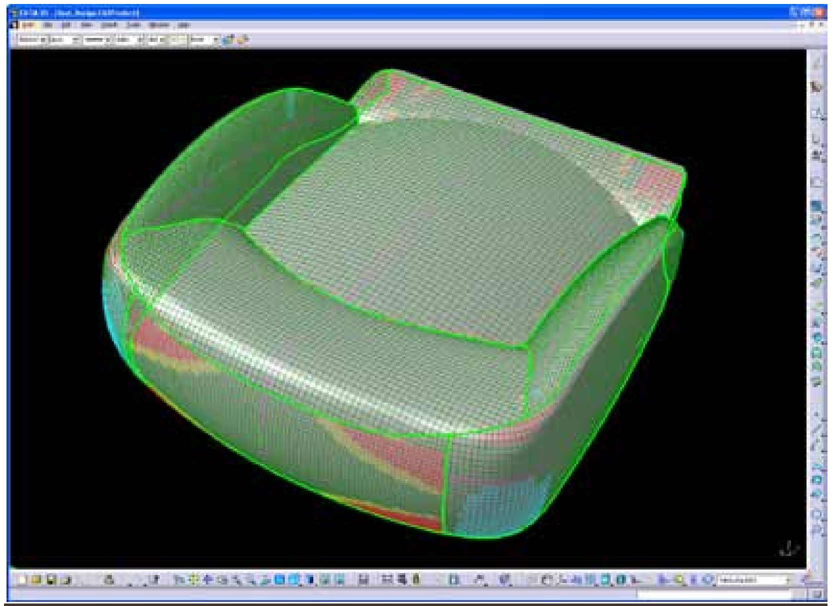
In fact, automotive seats represent the second highest cost vehicle component, and the trim cover is one of the most complex parts of the seat, with more than 5000 pieces of attribute data required to define a typical seat cushion backrest and headrest.

While it is critical for manufacturers to get their product to market as quickly as possible, it is not just about speed when it comes to seats and trim covers: They must also consider the aesthetic properties of the seat covers as that plays an important role in the buyer's decision.

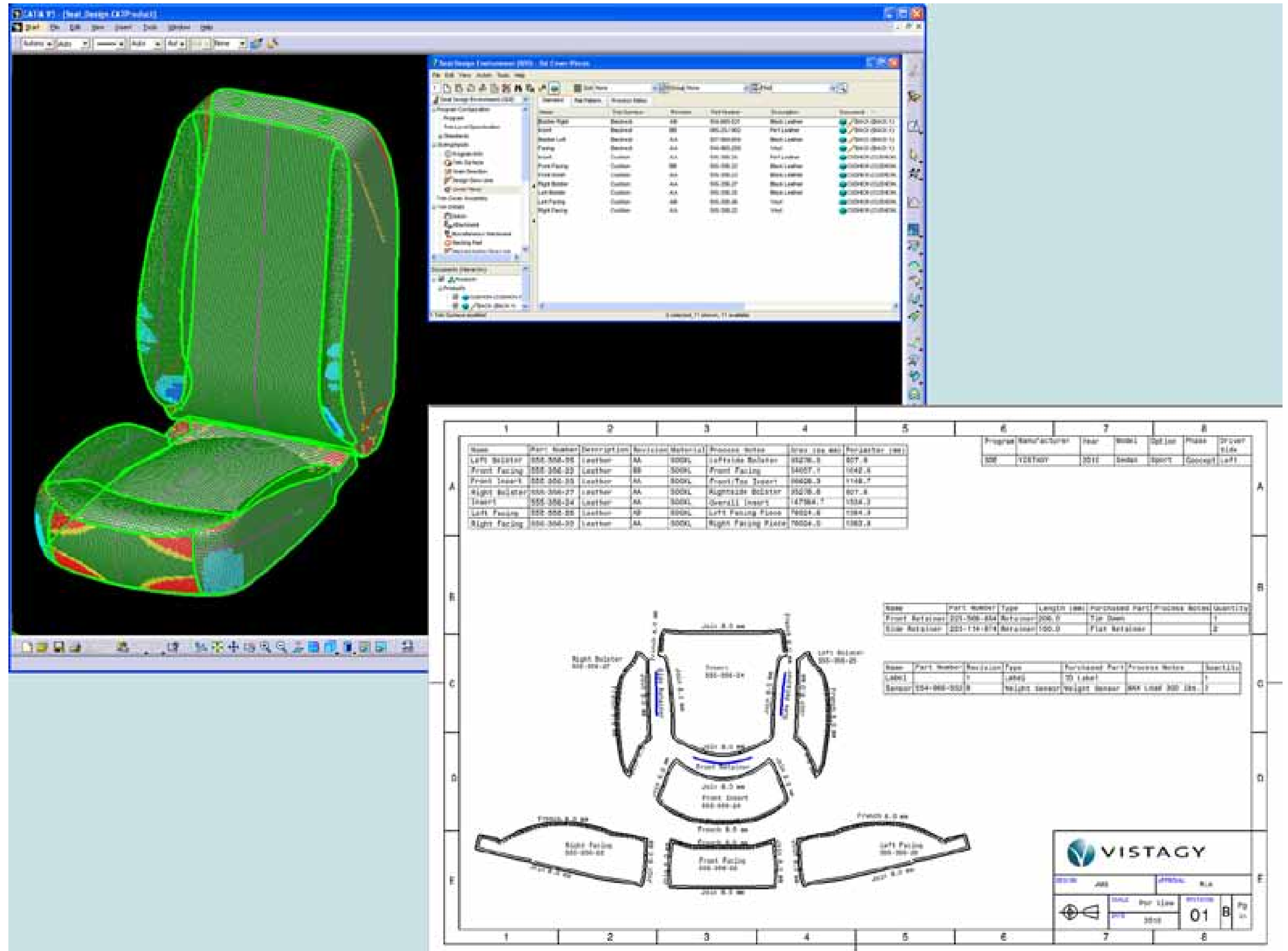
To get a quality, competitively priced product to market quickly, every seat trim cover manufacturer initially aspires to make a prototype quickly so it can identify product costs and producibility issues early in the process. All too often companies don't know what the seat cover trim will cost or if there will be manufacturability issues until they are already committed to a particular style. Getting feedback that can provide accurate insight early in the process provides options and is of great value to a company.

Unfortunately, most automakers and their suppliers are still using labor-intensive and outmoded methodologies for developing seat trim covers. The seat cover remains one of the few, if not the only, automobile component that is based on 2-D manual design processes.

Most parts of an automobile are made based on 3-D virtual modeling that can be used to directly generate data needed for manufacturing, such as NC or stamp parts. New design software for seat trim covers, such as **Vistagy**'s Seat Design Environment (SDE), makes it possible for automakers and their suppliers to work in a 3-D



Vistagy's Seat Design Environment (SDE) software generates producibility simulations that can be used to visualize where manufacturing problems will occur so they can be addressed early in the development cycle. The simulation shown here on an automotive seat cushion highlights where there is tension or stretching (cyan), mild wrinkling (yellow), excessive wrinkling (red), and areas where there are no manufacturing concerns (green).



A product simulation in SDE software is shown in the top left-hand corner and the resulting documentation is shown in the bottom right. After the designer completes the work, a master model enables him or her to automatically generate the engineering document, eliminating a step in the traditional manual process.

CAD environment that allows for full definition of the seat cover in a 3-D master model, which in turn makes the trim engineering more productive.

By introducing an industry-specific engineering software into commercial 3-D CAD systems, engineers are able to create a CAD master model that accurately and efficiently captures a complete digital product definition of the seat trim cover.

Creating a 3-D master model provides a seamless way to generate data needed for manufacturing or to share with suppliers and customers. By using this approach, one major automotive manufacturer was able to decrease the time it took to design and develop the first set of flat patterns for proof-of-concept seat trim covers by 87%.

Making the move to 3-D

The traditional 2-D based seat trim cover design/manufacturing process requires a significant amount of translation and verbal communication to transfer data between numerous people, departments, and software packages. Consider the number of people involved in the process: the stylist that creates the seat image, the craftsman who creates the patterns, the sewers and seat builders, and a variety of others.

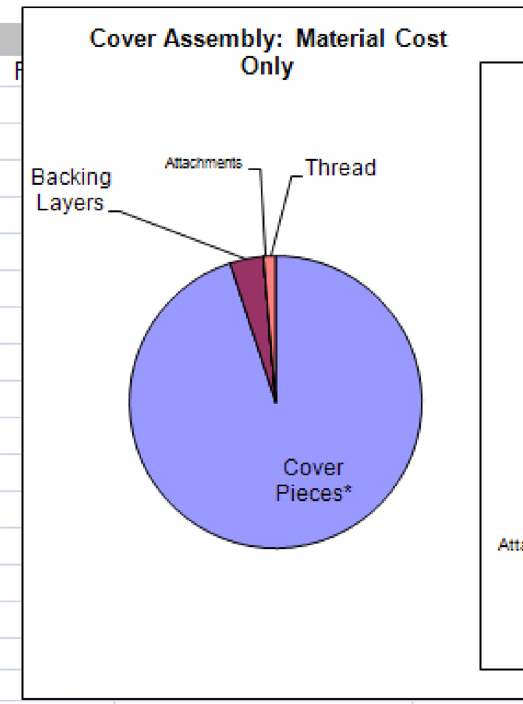
Since drawings, bill of materials (BOM), cost assessments, and sew instructions are developed manually, the process is time-consuming and error-prone. Perhaps the worst part is there is no early producibility or cost feedback on the design.

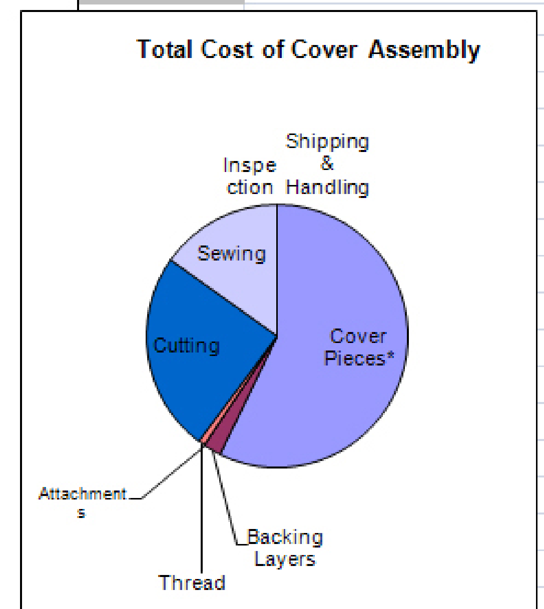
The process is further complicated by the need to manage so many bits of attribute data that is required for the trim definition, including information such as sew line definitions, materials, notes and specifications, stitch type, and colors.

For decades, manufacturers have been trying to develop an efficient method for capturing the more than 5000 bits of data within a CAD master model that can be used for the automatic generation of documentation and manufacturing data. The problem with current 3-D CAD systems is they provide the necessary geometry, but not a way to easily author the non-geometric data that is required to fully define a seat.

By using industry-specific software that is fully integrated into the CAD

Labor time and cost references				
		Cutting	Sewing	
Minutes per TMU		0.00060	0.00060	
Hourly rate - Manual ($/mn)		0.06	0.06	
Default cutting preparation time		100.00		
Inspection				
Note: Inspection costs of raw material are included in material costs (see "costs of base goods")				
Cutting				
Material Specification	Fabric 102	Fabric 101	Vinyl	F
Material Type	Cloth	Cloth	Vinyl	
Multiply cut (# of pieces)	10.00	10.00	10.00	
Cutting table length (yd)	4.00	4.00	4.00	
Table spread TMU	30.00	30.00	30.00	
Straight/curved ratio	0.50	0.50	0.50	
length/corner ratio (mm)	150.00	150.00	150.00	
Length/notch ratio (mm)	50.00	50.00	50.00	
Cutting speed - straight (TMU/mm)	0.30	0.30	0.30	
Cutting speed - Curved (TMU/mm)	0.50	0.50	0.50	
Cutting time - Notch (includes motion to next) (TMU)	30.00	30.00	30.00	
Cutting time - corner (includes motion to next) (TMU)	30.00	30.00	30.00	
Marking time per piece (TMU)	150.00	150.00	150.00	
Quality/panel checking time per piece(TMU)	150.00	150.00	150.00	
Numbering/sorting time per piece (TMU)	150.00	150.00	150.00	
Waste disposal time per piece (TMU)	150.00	150.00	150.00	
Number of pieces	3	1	1	
Perimeter (mm)	*4,176*	*1,542*	*2,223*	*6,194*
Preparation	300	200	100	400
Spreading	2	1	3	3
Cutting				
Straight distances	63	23	33	929
Curved distances	104	39	56	1,548
Notches	84	31	44	1,239
Corners	250.5381196	92.5277091	133.4068027	3716.265062
Marking/plotting	1800	600	600	2400
Quality/Panel checking	1800	600	600	2400
Numbering/sorting	1,800	600	600	2,400
Waste disposal	1,800	600	600	2,400
Number of patterns in assembly	9			
Total pattern perimeters (mm)	7,941.21			





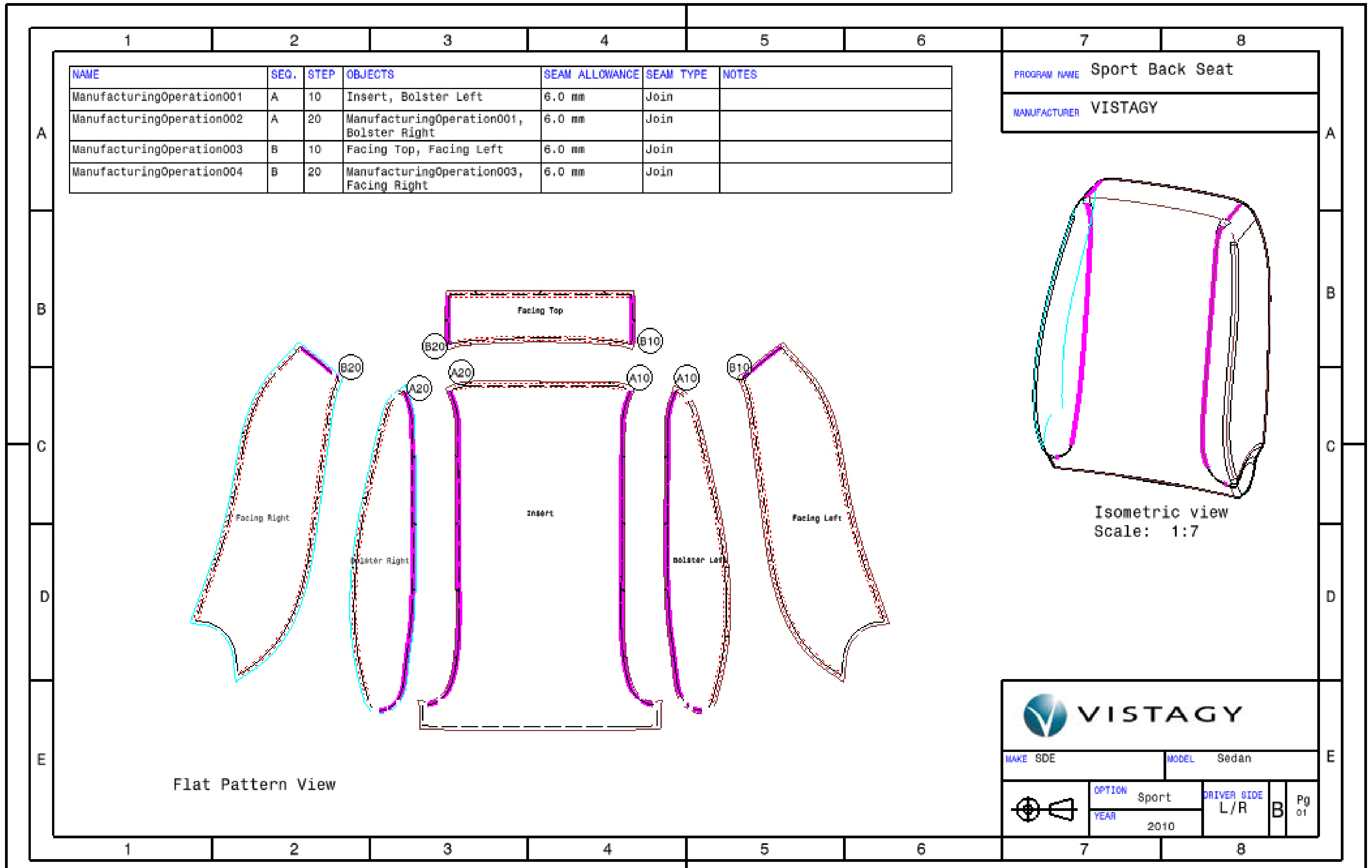
The master-model approach enables designers to automatically generate cost feedbacks so they can immediately understand the impact of changes to the design.

system, it is possible to capture all this data in a place that is tailored to the needs of the seat trim engineer. Creating a CAD-based master model eliminates the tedium of performing a multitude of low-value manual tasks—such as re-entering data, creating drawings, or manually generating flat patterns—thus permitting engineers to spend more time on designing and innovating.

Due to the complexity of seat design and the international nature of engineering teams, if a company wants to be competitive in the global automotive market, it must enable its engineering and design teams to easily author and share information and expertise. A common CAD-based interface for trim design makes it easier to have common engineering processes for sharing information, improvements, and best practices.

This issue is magnified in the supply chain where clear communication is critical. Currently, there is no efficient way for data to be exchanged between OEMs' Tier 1 and Tier 2 suppliers. Frequently, sketches and incomplete specifications are passed back and forth, forcing numerous iterations. Using a detailed CAD master model facilitates faster interaction between OEMs and suppliers by allowing more detailed data-driven communication about design and manufacturing challenges as well as costs.

Ultimately, the key to developing a more efficient process is providing a CAD-integrated environment where geometric and non-geometric information can be captured and linked within a single master model, allowing engineers and



A manufacturing assembly report created automatically in SDE describes the steps necessary to sew or assemble the seat cover. This step-by-step description provides the manufacturer with a good sense of the designer's intent, thus minimizing errors based on miscommunication or a lack of understanding.

other key stakeholders to efficiently create and modify trim cover product definitions and associated manufacturing and financial data.

Seeking a full definition

Many "objects" are needed to fully define seat trim components, such as materials, cover pieces, sew lines, stitches, notches, sew operations, hardware, and close outs. Each of these objects has numerous characteristics that must also be defined. In the end, each one of the more than 5000 unique pieces of data, most of which are non-geometric, is needed to fully define a seat cushion, backrest, and headrest trim cover.

Given the volume of information, it is also desirable for the master model to enable the automation of data collection as well as repetitive tasks, such as calculating seam lengths, defining retainers, simulating cover fit, and producing flat patterns. It should also deliver the final data in a variety of formats that can be easily customized for the specific needs of the entire product development and manufacturing teams as well as others in the enterprise, including finance, purchasing, costing, etc.

It is critical for the seat cover trim software solution to enable engineers to author a massive amount of new data without adding an undue burden to their current workload. Current CAD systems do not use the "language" of trim engineers, which can make CAD confusing. One way to alleviate this problem is by using the vocabulary of a seat trim engineer in the CAD interface so he or she can use CAD to create a master model that fully defines a seat trim cover.

A major benefit of 3-D master models is a reduction in engineering time. Since all engineering data is in a single location—the CAD model—engineers will spend less time looking for data. This solution automates the reuse of information so errors can be avoided and better decisions can be made. It also helps save time by automating manual repetitive tasks and providing engineering feedback earlier in the process, enabling more rapid optimization and streamlined communication.

A master model solution will also enable OEMs to develop trim-cover cost estimates early in the program timing, prior to physical samples and trim sourcing, and assure the design is within allowable cost targets. Sending a master model to the suppliers will reduce errors and time in the quoting process cycle.

Providing the means to efficiently design and manufacture seat trim covers will only increase in importance moving forward. To stand out from the competition, manufacturers will need to take advantage of industry-specific, CAD-integrated software.

The manufacturers that implement the master-model process will turn a laborious, trial-and-error process into an automated, streamlined methodology that will enable them to get to market ahead of the competition with lower development costs. AEI

Ed Bernardon, Vice President of Business Development at Vistagy, and James H. Wehrle, Owner of Wehrle-Wind Enterprises LLC, wrote this article for *AEI*.