



## Stilride Electric Scooter – Releasing the Full Potential of Flat Sheet Steel

<b>Member company</b>	<b>Outokumpu</b>
<b>Manufacturer</b>	<b>STILRIDE AB</b>
<b>Categories</b>	<b>original concept for production of or application of stainless steels; significant global market potential or reduction in operational costs; strong environmental improvement potential; reduction in routine maintenance costs; life-cycle costs lowest compared to competing materials</b>

### The Challenge

When you make a product you take a raw material and refine it to add value. Products where flat sheet steel are used as input material are often formed e.g. through roll forming, deep drawing, hydroforming etc. then joined together using various joining techniques. This has been the norm for centuries. Such techniques require investments in pressing tools and large machinery which often only pays off when very high-volume products are manufactured.

With Stilride we take advantage of the ancient origami technique (folding paper to a 3D object) to open up for complex designs by simply folding sheet into amazing 3D structures. Through the use of industrial origami we have the potential to reduce the number of parts needed for a product, reduce the need for joining of parts as well as creating a sustainable product based on stainless steel with



Picture courtesy of STILRIDE

unique shapes and forms.

At the same time the CO<sub>2</sub> levels are skyrocketing and climate change is a big problem. More scooters than cars are sold yearly and the old ones are more polluting than vans. Only 0.5% of the world can buy a car. Therefore we started out with the vision to build a sustainable electric scooter demonstrator of the technology. The mission is to create clean energy powered personal mobility devices through a flexible and sustainable production technology called industrial origami.



## Why?

STILRIDE wants to challenge the traditional view of manufacturing through the use of robotic industrial origami to fold structures from a flat sheet of metal true to the material's characteristics and geometric nature. The manufacturing technique developed for Stilride is centred around the ancient origami technique (folding paper to a 3D object). With this technique it is possible to achieve significant benefits compared to traditional forming technologies resulting in savings both in material use, processing through welding as well as labour costs.

## Needed Action

The idea was first realized in a research project and it has now taken the initial design of the STILRIDE electric scooter motorbike into a finished concept. In the process the project has demonstrated the method of designing and constructing using steel sheets as the raw material through industrial origami. To maximize weight reduction potential high strength stainless sheet material was chosen as the main construction material. This also meant that we had to overcome challenges related to folding of very high strength stainless steels. A methodology to locally heattreat the folding lines with laser was applied within the project.

The first prototypes of the STILRIDE electric scooter is now available to showcase. Next steps involve industrial pilot trials for complete automated production using the industrial origami manufacturing technique.

## Action Review

In 12 months STILRIDE has gone from concept to first prototype and in the process developed an alpha software version for enabling the digital value chain. By realizing the prototype we have analyzed the reduction of components. Compared to the industry leader in electronic scooters Niu, our chassi, reduced the number of components with approximately 75% and resulted in 25% lighter weight in comparison.



Pictures courtesy of STILRIDE



**Specific;** Designing and building a prototype e-scooter demonstrating the potential of the industrial origami manufacturing technique.

**Measurable;** Two demonstrator prototypes ready

**Achievable;** Piloted the production technology on prototypes and have resulted in strong KPIs (see outcome)

**Realistic;** Taken the technology from CAD to prototype

**Time-bound;** Within 12 months from start to finish

## Horizontal Expansion Capability

STILRIDE have successfully demonstrated an innovative way of processing metallic flat sheet material into complex geometries that would be costly to realize with traditional forming operations. It has the potential to create a new cost efficient value chain based on sheet metallic material that allows for manufacturers and mechanical engineering companies to design products to a substantially lower weight, using fewer components resulting in cost savings on material costs through large surface-to-volume ratios, high yield stresses and high fatigue resistance. The potential of this is huge for manufacturing in a more flexible way with metallic materials, especially for e-mobility and lightweight applications.



## Outcome

STILRIDE has in the product development of its electric scooter optimised the folding of flat sheet metallic materials for automated robotic manufacturing. This has resulted in a strong design DNA for an electric scooter made almost entirely in stainless steel.

Its process enables manufacturers and metal workshops to design structures containing remarkable physical properties that results in more lightweight

and cost-efficient products through flexible production for a circular economy. Resulting in lower manufacturing investment costs due to enabling tool-less production from metallic sheet material.

- In total we have shown that we can reduce weight with 25%
- We can decrease the number of components with 75%
- This will estimated create cost savings of 20 to 50%
- And decrease labor cost by 25-45% through less need for welding and riveting etc.

