

## How Innovative Startups Can Flourish In A Changing Cleantech Landscape

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Being a clean-tech startup was never easy.

Amid shifting political priorities, the support for clean-energy initiatives in the US is becoming more uncertain than ever, placing new strains on an already challenging innovation environment. A decade ago clean-tech was one of the rising disruptive industries attracting significant funding, but today the clean-tech landscape is particularly difficult for startups, especially hardware startups. How can startups flourish in today's changing clean-tech funding landscape?

Before we answer that, we can classify clean-tech startups in three broad categories (figure 1(A)) according to their impact, risk and maturity: Innovative and less capital-intensive startups that secure VC funding easily, disruptive startups with high risk and low maturity, and those that are unlikely to survive.

Disruptive startups with high risk and low maturity are most in need of support to develop and validate their innovations to become market-ready. Capital intensive startups, like those developing hardware, may bear higher risks initially that can be brought down in step-changes through validation and testing (Figure 1(B)).

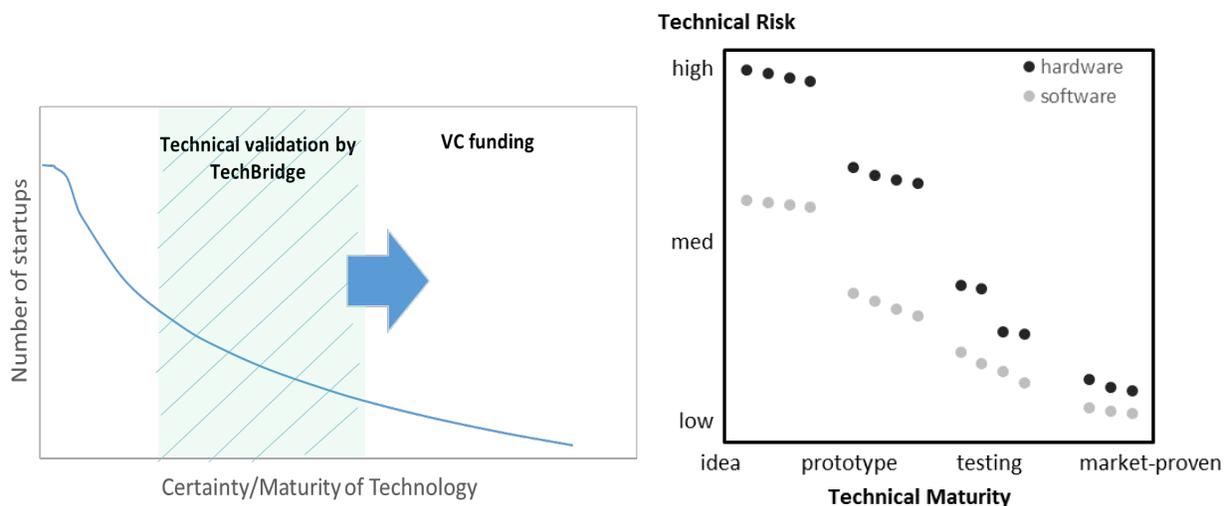


Figure 1: (A) Distribution of startups based on the certainty of their technology's merit, (B) Technical risk vs maturity trajectory for hardware and software startups

Prototyping and technology validation has been shown to reduce investor uncertainty and double the likelihood of investments and successful exits [1]. Large corporations and investors are attracted to energy startups that have demonstrated breakthrough technologies. To assess the impact of technical validation, we followed up on the progress and success of 41 startups that won various clean energy competitions, from a pool of more than 300 applicants. Winning teams received technical validation, incubation or mentorship services awards or a combination of these. The typical selection process included two rounds of written applications, followed by judging by an expert panel. The data were collected through Google Alerts and annual surveys.

Of the 41 startups analyzed, 15 received technical validation services (8 hardware and 7 software) and 26 received incubation and mentoring services (19 hardware and 7 software). Hardware startups receiving validation services had a 100% survival rate as compared to 70% for those receiving other services solely. Startups receiving validation services also secured 30% more funding within one year than startups receiving only incubation or mentorship services. There seems to be a correlation between validation and follow-on funding. This also benefits software startups with specific validation needs.

<b>Hardware startups</b>	<b>Validation services (8)</b>	<b>Other services (19)</b>
Companies receiving funding > \$1M in 1 year (%)	63%	21%
Companies receiving funding within 1 year (%)	88%	58%
Survival rate (1-7-year-old startups)	100%	74%

*Table 1: Summary of case study analysis of investments in hardware startups receiving different services*

Follow-on investment for hardware and software startups receiving validation services were similar (Fig. 2). In contrast, prior investment trends tended to favor non-hardware clean-tech startups. One possible explanation is that hardware startups benefit more from validation services since software is perceived as less risky. Failures can be addressed more easily with software updates than by large capital expense.

We also noticed that the total, average and median investments in tech-validated startups are considerably higher than those solely receiving other services. Since these startups were selected through industry sponsored Challenges, they got the opportunity to be advised by industry and market experts to help develop and test their technology to cater to the market needs. This can attribute to higher investments in these startups. Often, the funding required for validation services is difficult to secure without having demonstrated their merits. How can startups escape this Catch-22?

We can borrow insights from the successful German model of innovation as the German Mittelstand comprising small to medium-sized enterprises (SMEs) dominates the German business landscape. Several public institutions such as the Fraunhofer Network support the SMEs by helping to bridge the gap between research and industry through developing and commercializing innovations [2], [3]. Adopting a similar model in the US might help to revamp clean-tech innovations.

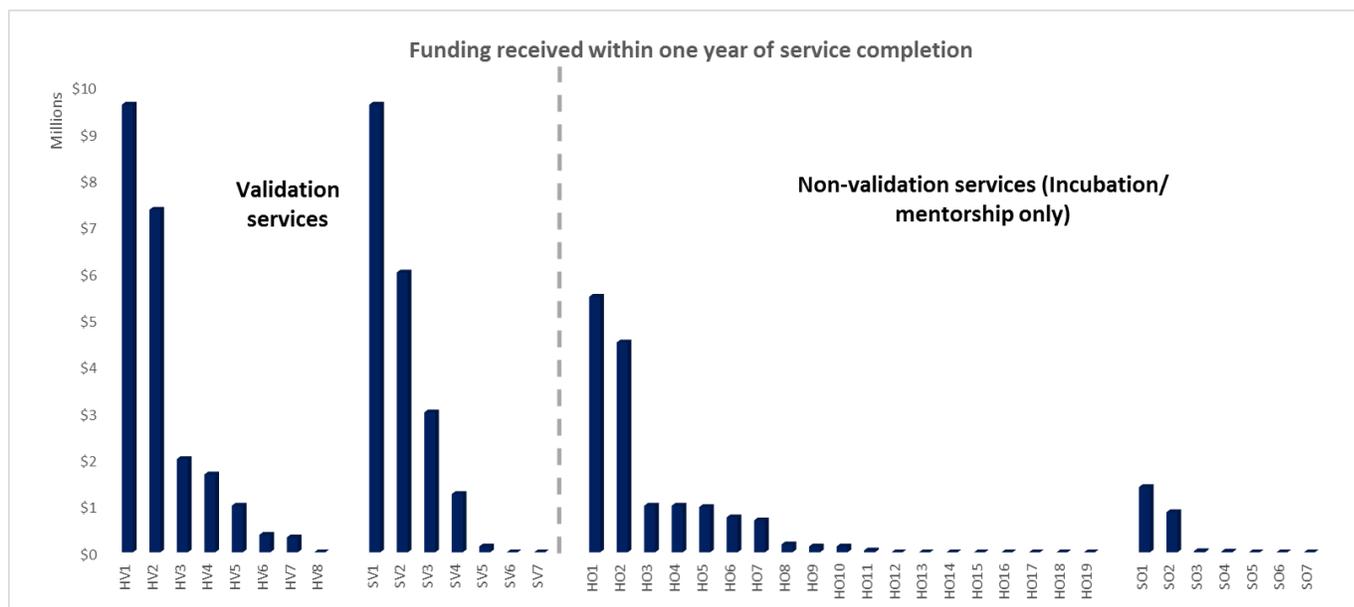


Figure 2: Raw data displaying funding received by all startups in the case study, within 1 year of service completion (HV: hardware startups receiving validation, SV: software tech receiving validation, HO: hardware tech receiving other services, SO: software tech receiving other services)

Some have argued that the VC model is not appropriate for cleantech and that government grants, corporate ventures and philanthropic investments are more effective [4]. Others suggest startups should partner with incumbents [5] and large corporations [6]. As the recent publication by B. Gaddy, V. Sivaram and F. O’Sullivan concluded [4], shared resources along with public and private support can help cleantech entrepreneurs cross the valleys of death. The recent ITIF report [7] refers to TechBridge as one of the “innovation orchard” models using a unique approach to enable innovation and facilitate commercialization of startups. Following up to these papers, we present a unique innovation model to support cleantech startups.

Fraunhofer is a classic example of a public-private partnership model that utilizes the idea of shared resources and technical expertise to help take promising technologies to market. This model has been successfully proven in Germany and TechBridge aims to cater to US startups. The TechBridge program strives to combine Fraunhofer’s technical resources, domain expertise and global network of research institutes to help US startups realize opportunities, identify markets and develop their technologies. Moreover, large corporations that seek to innovate can leverage such open innovation models to pursue disruptive ideas. Government and philanthropic organizations looking to invest in clean-energy, but lacking the technical expertise can also utilize this model to make the greatest impact with their investments. The high selectivity afforded through the competitive TechBridge Challenge in conjunction with the corresponding validation services sorts startups that are most likely to succeed, thus helping investors make better decisions.

As reported by BCG [8], speed in technology adoption, along with lean R&D, use of technological platforms and exploration of new markets are the four drivers for breakthrough innovation. Clean-tech innovation has a crucial role to play in sustainable development and Open Innovation models that support startups to refine, validate and commercialize their technologies can be a catalyst.

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