Report 9.3
Market oriented guidelines for business development

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1. **EXECUTIVE SUMMARY**

The main purpose of this report is to elaborate a business plan of a company that is able to enter into the market and exploit the results of the Design4Energy (D4E) project under market circumstances. This company may be a joint venture established by D4E partnership or any other market actor that gains the rights of exploiting the outcomes of the project.

Each potential “owner” of the D4E products as well as future partner alliances need to be guided on how to enter into the market after the end of the project.

The content included below aims to be something of a “cook book” for all those interested in creating a new business or expanding their current businesses based on the results obtained in our project.

Considering the business development implications of this report, it is extremely important to take into consideration and establish clear links with report 9.2 which has focused on developing the business model around the D4E Platform. Indeed, the potential marketable products and services that will be described in this section must naturally correspond to and satisfy the identified needs of target markets and end users through the pains and gains analysis (task 9.2 of D9.2) while also maintaining a certain level of logic and accountability for the potential limits and barriers that were defined by the PEST analysis (task 9.3 of D9.2).

Moreover, report D10.4 First version Exploitation plan was also taken into consideration as it delivers a description of potential strategies for the exploitation of the D4E products and services.

The first section of this report will go over the potential database of products and services that can be created from the D4E software environment and with defined delivery processes and potential revenue streams. Precise aspects of the value proposition will be integrated as well as certain operational considerations and guidelines for a minimum viable product.

The following part will focus on providing a picture of the evolution of the potential target markets for the specified services and products in the prior section. The goal of this here is to provide more refined and quantified information on potential end users and market segments of interest than has been given before namely in terms of BIM adoption rates in order to truly understand the first pool of potential users. Potential market penetration rates and revenue levels emanating from the business guidelines provided in this report will also be estimated. Moreover, the competitors of the designated products in the previous section will be explored.

The third main section will focus on giving market guidelines in terms of potential marketing and sales strategies for business development relevant to the specified product and service types from latter parts. This section will provide new market information and advice mainly in terms of segmenting and pricing D4E based services and products.

A brief part on more operations focused guidelines will be developed with research and development activities and intellectual property mechanisms that are applicable in this particular case for a potential spinoff or business venture by one of the project partners or future partners.

Finally, the last section will provide financial projections of a potential business venture around D4E results and outputs following the market and operational guidelines specified in all previous sections.
2. **INTRODUCTION**

2.1 **Purpose and target group**

As the previous report has defined a value proposition and a business model according to Alex Osterwalder’s Value Proposition Canvas, the main purpose of this report is to provide more detail and established guidelines from a market based and operational point of view in order to provide support to develop business activities from the project. As we focus on these market oriented and operational guiding principles for business development of D4E results and outputs, it is extremely important that focus be maintained on plausible executable business scenarios. In order to do this, it was decided that providing a case where an actual product is launched to market would be efficient at communicating some of these exigencies. Therefore, this report starts out by mentioning the plethora of products and services that could be derived from the D4E project which will enable in later parts the description of the operational and market driven guidelines to develop a business around these.

According to these defined features and products, sections on market size and requirements, marketing strategies with inputs on competitor positioning and pricing, as well as operational roadmaps for product development will be explored in order to highlight a set of recommendations for business development activities for the D4E project and partners as well as future partners or external parties.

The final section will go through the projections of potential financial gains from taking to market the product and services suite based on D4E described in the first section and according to the information and guidelines provided through the report.

2.2 **Contributions of Partners**

Table 1 shows the contributions of different partners in this report. However, it is important to know that, the brainstorming and discussions in different Telcos and meeting with other project partners and external stakeholders brought significant values in the development of report.

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<td>SYM, GSM</td>
<td>3, 4, 5</td>
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*Table 1 Partners’ contributions*

2.3 **Baseline**

The development of this report highly relies on the project outcomes and reports:
- D8.3 Final evaluation report presenting the competition results.
- D9.1 Scenarios and customers analysis report: This report established the scenarios and identified the potential customers for D4E methodology and platform.
- D9.2 Business Model and value proposition: The business model and value proposition developed in this report provides the solid foundation for the development of current report.
• D10.4 The first exploitation plan: This report provides the exploitation strategies and overall direction for the design of current guideline.

• D10.6 Training material, courses and workshops deployment: the identified list of service and products were created and made available for D10.6, then were further structured and categorized, based on this database, 4 courses were developed.

2.4 Relations to other activities

The development of this business guideline will benefit the establishment of exploitation ideas of each partner, contribute to the future exploitation activities and the conversation between partners who are interested to set up the future alliance. On the other hand, in the development of the final version of exploitation plan, several aspects from this report were taken into account, enabling the consortium to set up a long-term planning.

At the meantime, the established methodology for business development from this guideline and the detailed steps will serve as part of business opportunities course which are developed in D10.6.
3. **DESCRIPTION OF THE PRODUCT**

### 3.1 The Design4Energy platform

The D4E Platform was developed with the aim of spreading awareness and creating a methodology around energy efficiency issues among building owners and involved parties in the building lifecycles, and integrating these stakeholders in the pre-design phase of their projects whilst also taking into consideration the growing needs for new and cost effective tools geared towards AEC practitioners that enable them to respond to new regulations such as the Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings [1] and the growing demand for green buildings in general.

The product in question is a cloud computing based solution available online similar to any Software-as-a-Service (SaaS) product. Its purpose is to allow practitioners of the AEC industry to integrate energy efficiency calculations and objectives at the earliest phases of new building design as well as further down the life cycle in an easy way.

This should enable the following set of objectives:

- Integration and involvement of clients within this process creating continuity in relationships and better long term customer loyalty
- More informed decisions in terms of energy performance and building design
- Better dematerialized interaction processes between all stakeholders involved limiting the carbon footprint of early design stages
- Creating an unparalleled source of energy efficiency related information and knowledge for green building design through databases of projects, neighborhood data, geographical and weather inputs as well as materials, equipment and technologies.

Taking these aims into account the following processes and tools organized along the building life cycle are achieved in the course of the Design4 Project:

*Figure 1 Processes and tools organized along the building life cycle*
In order to create business value from D4E, it is necessary to establish a certain amount of operational guidelines and developments necessary to create a Minimum Viable Product around D4E outputs and increase service features from there. In order to quickly obtain feedback from the market and then adapt the D4E platform efficiently, two versions of the product will be launched. One initial version which performs automated energy simulations with a set of additional features facilitating customer interaction and a second more advanced version which integrates some of the more complex features of the platform with additional databases. The following figure demonstrates this two stage product roll out. Pricing and strategy around each of these will be further detailed later in this document.

![Figure 2 Product Launch Phases and Features](image)

As mentioned before, we will mainly focus on the products and services aspects geared toward the AEC customers. Nevertheless, considering the universal use of information levels and layers by other potential customers, for instance the fact that architects and governments or materials and equipment companies will all extract value from similar datasets, it is possible to create a more universal and complete version of the platform in its second iteration by focusing on a precise set of databases. Moreover, the first iteration of the platform will be exclusively compatible with REVIT but later on expanded to the following BIM environments:

- Aecosim
- Allplan
- Archicad

For the software to perform the most important features related to integrated design, it will be necessary to have databases and libraries dedicated towards materials and building components, building information in the neighbourhood and then energy systems. These databases will be classified as the BIM components database, the building database and the technology database. By including these we ensure ourselves of the reliability of integrated simulation capabilities and create appeal in the product for already most potential AEC users.

This platform aligns itself perfectly with the European Union’s focus on seizing and leveraging opportunities presented through new digital technologies to create economic growth and positive social changes with the creation of a Digital Single Market (DSM) [2]. One of the prerequisites for the success of the DSM is to promote the creation of digital technologies in all sectors. Moreover, this initiative is particularly geared towards the growth
of small and medium sized enterprises which is, as we will see later, one of the focal points for D4E given its characteristics and competitive advantages relative to existing solutions. Currently, SMEs invest very little in information and communication technologies. The European Union through the DSM initiative would like to create a favorable environment for such enterprises to benefit from the increased efficiencies, business opportunities and lower costs brought about by digital technologies of all kinds. D4E presents itself as a perfect candidate to lead this new industrial revolution for cloud computing within its designated segment. In fact, as part of DSM initiatives and measures for digitizing the European industry, the European Cloud Initiative [3] was put in place. This initiative focuses on providing the foundations for the creation of an intensely competitive data and knowledge industry within Europe. D4E can greatly benefit from this to achieve competitiveness against potential rival products as one of the main aspects of the European Cloud Initiative is to provide high-bandwidth networks and the supercomputing capacity necessary to effectively access and process large datasets stored in the Cloud. Despite these provisions initially being targeted towards the scientific community, over time the public sector and industry will also be able to optimize their operations through these systems enabling cost reductions of data storage and high performance processing with supercomputing. Therefore, the current environment is extremely favourable towards innovations such as the D4E Platform and reciprocally the program has the potential to add its piece of the puzzle in leveraging the true potential of digital and cloud computing technologies in a sector containing many opportunities for important positive social impacts such as the mitigation of climate change.

3.2 Services to the product

3.2.1 Research and development support activities

Support activities for the effective launch and development of D4E will have to focus mainly on supporting the expansion of the three main databases explicated in the previous section. Indeed, as the user base grows so do their inputs. Moreover, considering how dependent the appeal of the platform is in terms of the development of these databases and mainly the one linked to neighbourhood data, it is important that the team of developers behind the application adapt the cloud infrastructure appropriately in relation to the amount of information, cycles and activities being performed at once and cost considerations. Currently, it is estimated that during the first year a set of medium sized virtual machines will be able to support the platform and that during the second year larger virtual machines will be needed. Precise capacity definition is not possible at this time considering the multiple factors that come into play when performing such tasks.

3.2.2 Future Services to be developed

The future services refer to the features of the platform that will have to be investigated as possible additions down the line in order to broaden the market and appeal of D4E. These possible implementations are numerous. They relate to possible integration of interior design features and enhancement in detail design phase to the D4E platform, features that may be interesting for governmental institutions looking for reliable and broad data sources for support in the study, definition and implementation of relevant regulation as well as more advanced business intelligence tools for material, equipment and service providers and companies. Indeed, green issues and approaches are now currently being adopted within the realm of interior design and integrating this within the D4E platform would be in line with the ethos of the platform. Moreover, considering the European Union’s directives for more efficient buildings, the D4E platform could be used as a tool for optimizing related policies on
a narrow scope through the study of neighbourhood data trends. Finally, the last and one of the most interesting opportunities for future development of the platform is to integrate a tool that is capable of providing more advanced and detailed market reports and business intelligence for the companies that use the platform as a promotional vehicle or marketing apparatus. Indeed, as the platform acquires more users and the databases increase, extremely valuable and well organized market information will be contained within the databases. Such information might concern regional and neighbourhood level penetration rates of certain products or even brands, or neighbourhood consumption trends in terms of relevant products and retrofitting. To develop these new services, it will be necessary, similar to the support of the product features contained in the Minimum Viable Product, to adapt cloud infrastructure in terms of the new app and service functions as well as database necessities.

Furthermore, as D4E keeps evolving, it is important that relevant plug-ins and compatibilities are developed in order to expand the potential user base of the software. One such development should be the development of a Sketchup plug in. Indeed, the open source 3D design software is used by many architects in the very early design phases.

As mentioned before, other such compatibilities will have to be expanded towards other BIM environments such as the following:

- Aecosim
- Allplan
- Archicad

### 3.3 Specific benefits of Design4Energy products for customers

#### 3.3.1 Benefits by different target groups

In this section we will review the plausible benefits and values to AEC customers brought about by the general list of product applications described above.

The D4E Platform provides value to AEC practitioners as it tackles some of the obstacles and difficulties in green building design experienced by these actors as described in the PEST analysis and the pain and gains section of report 9.2. Such obstacles involve the lack of knowledge on part of architects on how subsystems and components affect energy use on the short and long run as well as the cost intensity and inefficient processes implied by green building design due to expensive software and third parties intervening in the process with simulation being performed after the design is produced. Furthermore, it is urgent and essential to tackle these hurdles as the regulatory framework of the European Union is aiming for more efficient buildings over the course of the next 3 years with milestones in zero energy buildings set in 2018 for all public buildings and 2020 for all buildings.

The platform offers value to its users in the form of cost savings, saved time, increased levels of expertise required by future regulation and enhanced communication and interaction through the vectors of client relationship, information management, project management, knowledge availability and processing, performance and cost advantages, and education (described in section 5.1 of D9.2). Ultimately, it is a cost-effective way for complying with future regulatory standards, introducing more efficient processes to clients and stakeholders by fostering more involvement at all levels of the life cycle and on the other hand lowering future O&M costs for building owner as shown by the following figure.
The informational aspect of the cloud computing solution is also extremely valuable for all layers of the construction industry and perhaps beyond. This includes a neighbourhood database with information on buildings within a neighbourhood block and their energy efficiency levels and build characteristics, technology database with information on energy systems and a building components and materials database. Beyond the undeniable benefits of integrated design described in the previous paragraphs, if these databases are well populated they can provide an incomparable source of market information for equipment providers, construction companies including larger ones and architects. Indeed, D4E could deliver market information in terms of geographic, product and segmental market size, general market share and penetration rates as well as per product, product performance per zone, identification and anticipation of geographic market trends and much more. This business intelligence and big data cluster is extremely valuable for players of all sizes wanting to position and optimize their operations in given zones.

**Products and services for architects.**

The most straightforward exploitable product from the D4E software environment would be one geared towards architects. Indeed, the platform provides insights on energy efficiency domains at different steps of the building life cycle. Therefore, it has the potential for important value creation in this regard. A software environment regrouping the entirety of processes accessible by such professionals with databases on materials, technologies, neighborhood data and data on other projects enabling integration of energy efficient themes at early pre-design stages of the building process as well as further down the line with optimal retrofit solutions. As it has already been mentioned in early phases of the document, this would enable gains in efficiency (fast feedback on the different design options), lowered costs due to time savings and the ignorance of additional energy experts, future regulatory compliance, new customers and increased satisfaction. An important aspect to this service in order to achieve the two last gains would be to successfully integrate a virtual work and meeting space in order to interact with the customers and integrate them at these earlier stages of the design process and listen to some of their more specific demands without having to physically move as much.

In addition, as the architect can be involved not only in the design, but in the operation and maintenance phase, a longer cooperation can be established that may result in additional
income on the long run.

Products and services for engineers and construction companies

Similarly, engineers and construction companies, especially those specializing in efficient building design and retrofits could benefit from the same software environment as the one described above for architects. Indeed, this could facilitate communication with building owners wanting to optimize energy efficiency or perform retrofits as well as improve the quality of the expertise being delivered towards these customers. The most efficient solutions in terms of neighborhood location and other such data along with depreciation schedules and costs of certain pieces of equipment and system could be established.

Products and services for equipment providers and building material companies

Considering the potential for equipment providers and building material companies to contribute to the materials and systems databases of the D4E cloud environment, there are many opportunities for creating a product or service around the promotional potential of the platform. Indeed, not only does the platform offer an interesting avenue to push and promote products and services, it also provides unparalleled business intelligence and geomarketing opportunities for such stakeholders with an interface similar to that of other GIS systems. These companies may be interested in a different product offering than other AEC practitioners as they are probably not as interested in the actual design tools included in D4E.

Products and services for building-buyers and project owners

As the platform leverages value from integrating building buyers and project owners in all phases and specifically early pre-design phases of construction, it is important that products and services be architectured around their needs as well. The most important element in doing this is to craft a virtual workspace where they can truly monitor building design, energy consumptions and other important KPI’s related to the project and to which they have set particular objectives. It is important to efficiently transmit the cost saving potential of certain building configurations in the pre-design phase when selecting different design options and of certain retrofits down the line. By this mean the project owner can save time and money, and reduces the need for modifications in the later phase of design and construction (thus the risk of “bad surprises” is reduced).

Products and services for governments and lawmakers

Another potential product and service which could be of great value, notably for the European Union, and based on the D4E infrastructure relate to potential government and law-making applications. Considering its multi-layered neighbourhood data system, D4E has the potential of regrouping an impressive wealth of data in a well-structured spatial manner. Such information can be extremely useful for optimizing policies around green building design and increased energy efficiency programs which ultimately will have positive socio-economic impacts. For instance, rather than creating general guidelines or setting universal objectives for the building industry to reduce its footprint on the environment, certain local or regional government bodies could use the D4E Platform to identify those neighbourhoods that are the least or the most efficient, rank them by needs and craft neighbourhood specific guidelines in order to achieve better compliance standards with the Union’s zero energy buildings initiative.

Products and services for education and academics

The D4E cloud computing platform could also lead to the creation of products and services that are completely geared towards education, academics and transfer of knowledge. It is completely imaginable that as such, the tool could be used by an expert to teach architects, whether aspiring or already certified, the basics of green building design, a segment of the industry that will inevitably grow in the European Union and will need to be taught
considering the goals that have been set for 2020. Beyond the simple platform, services in the form of seminars and teaching clinics could be considered for the platform.

### 3.3.2 Importance of Value Chain vs. Business Eco-system

One of the most important aspects of the products and services described above are their potential to revolutionize the industry by taking the traditional value chain approach of performing business, where each industry stakeholder intervenes unilaterally in his or her areas of specialization on the value chain or building life cycle, to a business ecosystem model where interaction between all stakeholders acting in different areas is made possible and where they all affect each other. Moreover, this ecosystem opens doors for actors to intervene at more levels of the life cycle rather than their original specialization and create longer term relationships with their clients by offering more services during different life cycle phases of their building. In relation to the sector in question, generally relationships are characterized as one time ad-hoc interactions for different areas of the value chain. For instance, a home or building buyer will pay an architect to design his or her house and find another one 10 years down the line for retrofit duties or modifications. Through the D4E cloud computing solution and the virtual meeting and workspace element, the architect who initially designed a house can keep in touch with his customers down the line for retrofitting and also interact with engineers and construction companies in performing these duties creating extremely efficient and centralized workflows and communication around projects at different points in the life cycle. Moreover, the project data, which was not necessarily accessible in the previous value chain model for practitioners intervening at different points in the life cycle of a building, will also be centralized. The availability of such information should render processes more efficient as architects and engineers will be able to intervene at any given time knowing exactly what prior tasks have been performed. As a result, commercial interaction with customers are lengthened ultimately increasing revenue, and interaction and communication with other practitioners in the industry is made easier giving way to new commercial opportunities and alliances. For instance, an architect through the design aid of the platform may notice the need for a special type of material and may get in touch with a relevant expert in a certain geographic zone. Similar interactions for retrofits and maintenance can be imagined. On the long run, it can be imagined that D4E also includes interior design features, a discipline which today is also being optimized and reinvented with the influence of energy efficiency and green building design. This could once again be the case of an architect or other practitioner intervening at multiple areas in the value chain.

As we move on through this document, we will explore the potential commercial and financial implications of taking to market a subset of these products and services in order to truly establish market and operational guidelines for business development around D4E. This approach was decided as it is generally execution which ultimately matters in launching new and innovative products.

### 3.4 Weak Points

The current main weak point that exists with the D4E platform is the necessary threshold amount of users and information in the databases to make the product relevant and efficient. Therefore, it is important to quickly reach a critical amount of contributors and users in order for the integrated design interface and all available database information to be as updated and complete as possible.

The low adoption rates of cloud computing technology amongst AEC professionals might be a serious weakness for the D4E Platform. Indeed, successfully diffusing the platform implies setting new standards and behaviours amongst our target market.
As seen in D9.2, green building design is still seen as being part of the realm of larger construction companies and projects and only applicable in the higher end markets. Despite the upcoming legislations that will incentivize even smaller companies to take into consideration green issues, it may be extremely difficult to gain traction with the D4E Platform due to this persistent vision at least in the early implementation phase.

### 3.5 SWOT Analysis of the Design4Energy products and services

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Integration of architects’ clients (like building owner) in design process opening more possibilities for inputs in terms of ROI’s and desired KPI’s</td>
<td>• The software needs further adjustments and development in order to enter the market</td>
</tr>
<tr>
<td>• Cost effective</td>
<td>• Integration of software and cloud computing solutions in a reluctant sector is difficult</td>
</tr>
<tr>
<td>• Lesser needs for third party intervention</td>
<td>• Software is not pertinent without a critical mass of users. Traffic must be created extremely rapidly</td>
</tr>
<tr>
<td>• Integration of Climate Data, Geographic data and Neighbourhood data</td>
<td>• Exclusivity stigma of green building design</td>
</tr>
<tr>
<td>• Time saving</td>
<td>• The system required large libraries and data, which is an effort and time consuming task.</td>
</tr>
<tr>
<td>• Better relationship management with customers no matter their geographic situation</td>
<td></td>
</tr>
<tr>
<td>• Automatically updated</td>
<td></td>
</tr>
<tr>
<td>• Ease of use</td>
<td></td>
</tr>
<tr>
<td>• More precise, pertinent and correct energy audits</td>
<td></td>
</tr>
<tr>
<td>• Possibilities for non-energy profiles to create simulations on energy consumption</td>
<td></td>
</tr>
<tr>
<td>• Client can know O&amp;M cost in the early design phase.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Democratizing integrated building design amongst AEC practitioners</td>
<td>• Non-adoption within sector that is not changing its behaviour.</td>
</tr>
<tr>
<td>• Receiving traction from EU zero energy building goals and other legislation</td>
<td>• Change in goals and regulation on construction.</td>
</tr>
<tr>
<td>• Create traction amongst university students and future practitioners</td>
<td>• Other software preferred by stakeholders</td>
</tr>
<tr>
<td>• Leverage partner resources for promotion of platform</td>
<td>• Reluctance of stakeholders to share information in order to keep exclusivity on knowledge regionally</td>
</tr>
<tr>
<td>• If platform democratizes on the long run, it can become an important policy tool for governments in terms of climate change, efficiency and sustainable construction systems</td>
<td>• Inability to appropriately achieve interoperability between file formats</td>
</tr>
<tr>
<td>• Increasing Use of Building performance analysis and BIM for Small Retrofit Projects</td>
<td></td>
</tr>
</tbody>
</table>
4. Market Analysis

In order to analyse the market situation behind the D4E product two main specificities of them must be highlighted:

1. Key market: D4E’s main target market revolves around AEC practitioners and externally related companies. Within this market small and medium sized architectural firms and consultancies will be mainly targeted as well as energy experts and auditors.
2. Contribution: The product provided will be a cloud computing platform offering a novel integrated design solution with energy efficiency matters taken into consideration at all stages of the building life cycle by regrouping data from a variety of sources ranging from architects’ and builders’ past projects in a certain geographic area, to neighbourhood energy grids and climate systems. Moreover, the solution will also contain an interface for project management applications and leads opportunities.

D4E is geared towards different customer groups or sub markets within the architectural, engineering and construction industry. Indeed, the platform is valuable for segments ranging from architects and small sized construction companies as well as equipment providers. As stated in the previous report 9.2, our initial main market of focus will be architectural firms and practices containing less than 6 staff members as the main necessities have been identified in their field and important traffic can come from these users. However, the platform is also relevant for the different engineers, technicians and energy experts involved in the building design process during early stages as well as later during retrofit operations. Moreover, construction equipment companies and wholesalers selling products and services are a very important target market as they can use the product for marketing which would also enable the platform to achieve initial cash inflow. Furthermore, a swift overview of the construction market within Europe will have to be performed as more momentum in this sector means more construction and renovations and therefore increased potential for the D4E platform. When exploring each segment, it will also be necessary to understand the level of BIM integration within their activities as the D4E platform serves as an extension to these software.

Considering the fact that this project is the result of European cooperation brought about by the Union’s funding for research and innovation program, the first geographic markets of focus will be the Europe 32 group of nations.

The following sections will therefore give a detailed analysis of the previously mentioned segments in order to establish the total value of our target markets while also defining the main future trends. Furthermore, an analysis of D4E’s main competitors within these segments will be performed in order to establish the competitive advantages that differentiate it.

4.1 Target Market

4.1.1 Swift Overview of the European Construction Market

Currently and as demonstrated by the following chart 2-2 from the AEC’s Architectural Profession in Europe in 2016 Sectoral Study [7], the size of the construction sector in Europe 32 which embodies output at all stages of the building lifecycle is estimated at 1939 billion euros. Despite not being at the 2100 billion euro high of the 2007-2008 years before being it was hit by the financial crisis, the construction market is still on a soft upward trend since the year 2013. In fact, a rise of about 5% is recorded in 2014 to 2016 [7]. Moreover, the most
important countries within the sector are the UK, France, Germany and Italy accounting for more than half of the market size.

Globally, these figures are encouraging for the sector. Moreover, as the economy slowly recovers in the European 32, so does demand for private housing which is likely to be an important area for D4E’s success considering the smaller budgets implied by these projects and therefore the need for more cost-effective solutions.

![Figure 4 Change in construction output in EU32, 2006-2016](image)

**BIM Adoption rates in the European Construction Sector**

Determining the adoption rates of BIM within the European construction market is extremely important in order to understand the potential of the D4E project as the platform serves as an extension to potentiate these design technologies and our target customers are therefore adopters or future adopters. According to the McGraw Hill Construction report, *The Business Value of BIM in Europe*, in 2010 already 36% of the industry in general had adopted BIM in the UK, French and German market representing the largest construction markets in Europe [8]. Moreover, in recent years, the European Union has been taking steps to support the growth of BIM adoption rates within the construction sector in the EU-28. Indeed, it was decided in 2014 through the adoption of the European Union Public Procurement Directive (EUPPD) [9] that all the 28 European Member States may encourage, specify or mandate the use of BIM for publicly funded construction and building projects in the European Union by 2016. Furthermore, certain countries such as the UK, Denmark and the Netherlands already require the use of BIM for publicly funded building projects. Considering the political momentum behind BIM technologies, their already considerable adoption levels 7 years ago and the fact that BIM software is still considered to be the most advanced technology in building design, current and future adoption levels within the industry seem to provide a very good base for growing the D4E platform.

### 4.1.2 SME construction companies: engineers, technicians and energy experts

In the case of D4E, SME construction companies intervening in the early building design phases and for retrofitting activities are of interest. The European construction sector is dominated by such small sized companies with 91.9% of the 3 million enterprises in the sector being composed of less than 10 employees [10].

Furthermore, the EU has imposed strict targets on energy efficiency for 2020 and 2030 with
particular regulations surrounding the housing and building industry which inevitably has impacted the industry and certain specializations. With buildings being responsible for 40% of energy consumption and 36% of CO₂ emissions the EU Energy performance of Buildings Directive was created with the following main objectives [11]:

- Energy performance certificates are to be included in all advertisements for the sale or rental of buildings
- EU countries must establish inspection schemes for heating and air conditioning systems or put in place measures with equivalent effect
- All new buildings must be nearly zero energy buildings by 31 December 2020 (public buildings by 31 December 2018)
- EU countries must set minimum energy performance requirements for new buildings, for the major renovation of buildings, and for the replacement or retrofit of building elements (heating and cooling systems, roofs, walls and so on)
- EU countries have to draw up lists of national financial measures to improve the energy efficiency of buildings.

Consequently, these measures should spawn a category of construction and engineering expert companies providing energy auditing services in order to comply to these new regulations and incentives for energy efficiency in new design as well as existing buildings. This is a great opportunity for D4E as it offers an easy way for many construction companies and possible experts to offer such services in different geographic areas at a lower cost. Moreover, the retrofitting market is planned to grow up to 56.166 billion euros by 2020 in Europe according to a Pike Research report [12]. Considering the increased demand for such approaches and D4E’s capabilities in optimizing retrofit solutions according to desired KPI’s, the platform presents itself as a viable cost effective solution to deliver service within this growing market.

4.1.3 Small and medium sized architectural practices within the Europe

As mentioned before, several studies performed focusing on SMEs within this sector of the AEC industry have determined that there is a necessity of optimizing processes and workflows to reduce budgets and to be able to deliver more quality projects in less time. In the current market, there is no platform which offers ease of use and can provide the architects with some indications of the predicted energy performance of the building, especially during the early design phase and especially for smaller firms with more limited budgets and resources. Focusing on these smaller architectural practices with less than 6 staff members is very interesting for D4E as they make up a majority of the European market as represented by the following figure which was also included in D9.2. [7].

![Figure 5 Chart of practices analysed by size in Europe [chart 3-3, ACE 2016 [2]]](image-url)
Moreover, the architectural sector seems to be a promising one in terms of its general growth trends as exemplified by the AEC’s Architectural Profession in Europe in 2016 Sectoral Study. Indeed, many indicators are promising for the growth of the sector and therefore the potential success of D4E. As shown by Error! Reference source not found., the number of architects throughout the Europe 32 group of nations has been growing at a steady pace moving from a little under 500,000 practitioners in 2008 to 600,000 practitioners in 2016 [7]. Moreover, adoption rates of BIM technology amongst these practitioners are going to be increasing in the coming years as will be mentioned in our market trends section later, offering encouraging prospects for the spread of the technology.

Figure 6 Change in estimated number of architects in EU32, 2008-2016

This growth in the amount of architects, despite being encouraging, is accompanied by a decrease in number of practices to 170,000 as shown in the following figure between 2014 and 2016 [7]. More architects and less practices seems to indicate a potential shrinking trend of our SME target market.

Figure 7 Change in estimated number of practices in EU32, 2008-2016

Nevertheless, this effect is mitigated by the combination of facts that revenues emanating from the sector have picked up again (Error! Reference source not found.), and that by extrapolating on multiple data charts from the AEC report, we can see that an estimated 60% of industry revenues still come from SME’s of less than 6 individuals in staff with 1 staff practices standing for a little under 6 billion euros in revenue (Error! Reference source not found.). Moreover, SMEs of less than 6 staff members still represent 95% of the amount of practices around Europe or to be more precise 161,500 practices [7].
Another important consideration for the success of D4E within this segment is the service types that are performed by all practices, indicating potential need or not of the platform. The following figure illustrates this repartition [7].
According to the *Architectural Profession in Europe in 2016 Sectoral Study* 62% of architects services are related to building design. This is good news for the D4E platform as it offers significant advantages in this sector with its integrated design solutions especially when taking into consideration the EU’s goal of zero energy buildings by 2020 and the fact that most architects have blamed the lack of appropriate technology, tools and knowledge to tackle these objectives [1].

In addition to the prior point and as supported by the following table, private housing dominates the sector [7]. Considering the lower budgets of some of these projects compared to those such as offices, it is likely that D4E will bring a lot of value to architects working on these smaller projects which are more constricted by budgets and are therefore more in need of cost and time saving solutions.

![Table 2 Market share and involvement by building sector](image)

### 4.1.4 BIM adoption rates among architects, engineers and contractors

In order to properly evaluate the market potential for segments interested in using the D4E platform as a design and retrofit aid, we must evaluate the level of diffusion of BIM technologies amongst these experts. According to a McGraw Hill Construction Smartmarket report, *The Business Value of BIM in Europe*, adoption levels for these three segments is of 46% for architects, 37% for engineers and 23% for contractors (Error! Reference source not found.) [8]. This is encouraging as almost half of architects in Western Europe seem to have adopted BIM processes for certain tasks. It is important to keep in mind that these countries represent the highest adoption averages within Europe and that pan-european averages are therefore lower. Moreover, adoption levels must be contrasted with levels of expertise and actual usage and applications of BIM technologies within each segment. As seen in the following table, among the 46% of architects in Western Europe using BIM, 42% are using the technology to create their own models rather than analysing existing ones [8]. This is very interesting for the D4E platform as new models imply less available data and most likely even less data on energy simulation and energy costs. Therefore, the cloud computing solution could provide the perfect tool for obtaining further information on models with ease and at a low cost.
Moreover, from a market size perspective in relation to the core market segment of D4E, these percentages mean that more than 72000 architects in Western Europe had adopted BIM processes in 2010. Considering the growth rates in adoption and support from the European Union, these numbers are even more considerable today. If we were to apply these percentages to 2016 industry statistics on architects and practices throughout Europe, this would mean that in Western Europe alone, more than 80000 architects would be using BIM software in 2016 [7] [8].

Moreover, as determined initially in this report, the first iteration of the D4E platform will be specifically targeted towards architects. Therefore, to get a precise idea of our launch market size, it is necessary to observe precisely the number of architects in each of our geographic areas, then the number of architects using BIM and then the number of architects using REVIT since this is the environment that our platform will initially be adapted to. In terms of the actual countries, the consortium has made the decision to initially orient efforts on a set of Western European nations where BIM adoption rates are the highest in order to maximize the potential of D4E. These include the UK, Germany, France and Spain. We are able to perform more detailed market estimations for each of these by combining different sources of information, namely the ACE’s 2016 report, McGraw Hill Construction’s Report on the Business Value of BIM, the NBS report, the Arch Vision Survey and Architosh reports to establish initial adoption rates of BIM and market penetration rates of BIM along with the growth rate of BIM adoption and compound annual growth rate of the architectural sector which enable projections in market size over a three year time span. The following tables represent the quantification of our launch markets and their forecasted evolution over time starting in 2019 which is predicted to be the potential launch year.
Table 3 Launch Markets Size

In the tables above, BIM adoption rates refer to the amount of architects in the total national market using BIM and REVIT penetration rate refers to the total amount of these BIM users using Autodesk REVIT. The last column of each table represents the total amount of REVIT users per geographic market and a total is then calculated per year. Therefore, in the first year we are contemplating a market of 27436 architects and predict that this number will increase to 41514 in the third year demonstrating a potent market.

It is extremely important to factor in that our potential market will be greater than these numbers as geographic markets will be expanded and software compatibility increased after the launch of our initial product version.

4.1.5 Construction equipment companies and equipment wholesalers

Construction equipment companies and wholesalers represent an important potential segment for the D4E platform as the promotional potential which can be developed around this segment can be used to limit potential cash flow problems that can emerge at the initial implementation phase when only a small quantity of paying users is acquired.

According to McKinsey’s Re-engineering construction equipment: from operations focused to customer centric report from 2016, the European construction equipment industry amounts to 35-40 billion euros in revenue and is characterized by an important amount of OEMs with most stakeholders being of small size and intervening as regional specialists (Error! Reference source not found.). Moreover, interrogated OEMs believe that their revenues will grow between 5-6% in the 5 coming years up to 2020 [13]. This is rather good for D4E as considering the geographical data and library contained within the platform; it can be very interesting for such OEM manufacturers to promote their services to other practitioners working on projects within their area.
Moreover, the information provided by D4E enables them to identify the needs of their potential clients precisely offering them unprecedented market data. As mentioned by the McKinsey report, the construction equipment industry is moving from an operations focused based model to a customer centric based model. Indeed, most OEMs noted increased importance of aftermarket services, higher demand for customized applications, increasing environmental regulations and revolutionary new technologies as some of the most important sources for reaching their predicted increases in revenue [13]. D4E tackles many of these issues as it is geared towards integrating energy efficiency and tackling sustainability challenges while offering perspectives for a geographic and project oriented segmentation of customers who may be looking for specific and more custom services.

4.2 Total Market Valuation

The market valuation we are interested in is that of software and computer technology within the segments that we have described before. In general, information technology adoption within construction sectors has been sluggish. As represented by the following graph coming from KPMG’s study Building a Technology Advantage; Global Construction Survey, 64% of construction companies in EMEA (Europe, Middle East, Asia) regions are either behind the curve in terms of integration or industry followers [14].
This lack of vision in technology integration within the industry has somewhat hampered the growth of the market. Nevertheless, with current programs such as the ones promoted by the European Construction Technology Platform, higher standards in information technology across the industry should begin to appear.

According to McKinsey’s article, *Imagining Digital Construction for the Future June 2016*, construction sector companies spend yearly a little less than 1% of their revenue to invest in new information technologies [15]. Therefore, if we extrapolate from our previous segment study and this percentage we can value the 2016 revenue from new construction related IT purchases in Europe at around 19 billion euros within the Europe 32 [7]. Furthermore, if extrapolated to the architectural market only, this number would fix itself at 170 million euros yearly [7]. This is very conservative as this 1% is averaged over the whole construction industry with groups working at different scales, i.e. the cost of new software will represent a higher percentage for architectural practices compared to large construction companies.

Despite, low levels of adoption this still represents lucrative revenue opportunities. One aspect that must be factored in by the D4E marketing team is that this estimated yearly revenue for the industry seems to be mainly generated by the larger companies which have the budgeting capabilities to obtain expensive software licenses [14]. Therefore, the D4E platform will have to be priced accordingly in order to spark adoption of information technology and software solutions by the smaller players that are targeted in this case.

### 4.3 Construction and architectural market trends

The macroeconomic and regulatory environment within the construction and architectural industry seem to have created optimal market trends for the development of D4E. Indeed, on the one hand, information technology and software solutions should progressively begin to expand. On the other, the EU's push for more green and sustainable building solutions will foster more adoption of multi-level solutions on part of all stakeholders.

#### 4.3.1 BIM prospectives

In McKinsey’s report, *Imagining Construction's Digital Future; June 2016*, one of the mentioned main future developments is more integration at the design level with 5-D building information modelling or BIM [14]. Indeed, as seen in the adoption rates previously mentioned in our market analysis, the construction industry has yet to fully adopt BIM platforms that contain project planning, design, construction, operations, and maintenance. Consequently, stakeholders of construction projects do not have access to an integrated, real-time view of project design, cost, and schedule.

Nevertheless, the rise of BIM has been occurring progressively and with the push of government regulation, the technology should become a standard throughout the industry given the advantages in ROI and efficiency that are generally associated with it. Indeed, it has been found that 75% of those that adopted BIM reported a positive return on their investment and shorter project life cycles and savings on paperwork and material costs [15].

#### 4.3.2 Green Building Design

As the regulatory environment around nations of the European Union continues to favour Green Building Construction and retrofit solutions [1] and as the long-term cost benefits of exploitation begin to clarify, it is expected that green building design will experience steady growth during the coming years. In Europe, companies having with 60% of their portfolio being centered on green building design projects are expected to increase by 27% from now until 2018 [16]. The following figures represent the levels of green building activity of concerned companies in two of D4E’s major potential markets [16].
As demonstrated by above figure, activity around green building design is clearly expected to pick up in the coming years.

4.3.3 General Trends

Furthermore, as mentioned in prior sections dedicated to construction equipment sales, the industry is moving from an operations focused model to that of a customer centric based model with more emphasis being given towards customized solutions for clients with a focus on aftermarket services and offering new technological advancements [13].

Looking at these trends, it seems that the D4E Platform benefits from and provides an answer to all of the identified trends in the market. The increased adoption rates of BIM only signify a growing market base for D4E. Moreover, this combined with the growth of green building activities means that solutions will have to be found to integrate such considerations within BIM technologies. Finally, with the possibility to use the virtual meeting and working space leading to more personalized solutions and approaches to client problems as well as the possibility to promote products regionally through the databases, D4E is potentially a great solution for construction companies to become more customer-centric.

4.4 Profile of Competitors

In order to fully understand the market, it is also necessary to perform a competitor benchmark in relation to the potential tool that could be developed from the D4E project outputs. This section will first start out by analysing the direct competitors that D4E is faced with. Namely, the energy simulation add-ons provided by the main BIM software in the market. Moreover, the two main competitors identified in energy simulation and consumption estimates will also thoroughly be explored. Then, indirect competitors will be identified specifically in the project management and customer involvement space as it is believed that this represents one of the major advantages of the platform. The objective here is not to
enumerate all competitors but the main ones in order to understand what is on offer in the market, what are the pricing mechanisms and how are others positioned.

4.4.1 Direct Competitors

Currently, direct competitors to D4E are offered by the actual BIM software companies with which we plan to establish compatibility. Nevertheless, crucial differences exist in between their offerings and the D4E platform especially as the second iteration of the product is brought to market. The main competitors in question are listed below along with a list of the main shortcomings of each one of these add-ons in relation to D4E, granting the platform crucial competitive advantages.

<table>
<thead>
<tr>
<th>Archicad Energy Simulator</th>
<th>Aecosim</th>
<th>Insight 360</th>
<th>Allplan AX3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Weather data is manually inputted</td>
<td>• Focused on public infrastructure</td>
<td>• Absence of Neighborhood data</td>
<td>• Focused on German Market</td>
</tr>
<tr>
<td>• Ashrae Standards</td>
<td>• Ashrae</td>
<td>• Absence of Virtual Meeting</td>
<td>• Separation of Residential and non-residential</td>
</tr>
<tr>
<td>• Absence of Neighborhood data</td>
<td>• Absence of Neighborhood data</td>
<td>• No interoperability suite</td>
<td>• Costly</td>
</tr>
<tr>
<td>• Absence of Virtual Meeting</td>
<td>• Absence of Virtual Meeting</td>
<td>• No energy Matching/onsite Energy Ratio</td>
<td>• Absence of Neighborhood data</td>
</tr>
<tr>
<td>• No interoperability suite</td>
<td>• No interoperability suite</td>
<td>• No technology ranking</td>
<td>• Absence of Virtual Meeting</td>
</tr>
<tr>
<td>• No energy Matching/onsite Energy Ratio</td>
<td>• No energy Matching/onsite Energy Ratio</td>
<td>• No technology ranking</td>
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</tr>
<tr>
<td>• No technology ranking</td>
<td>• No technology ranking</td>
<td></td>
<td>• No energy Matching/onsite Energy Ratio</td>
</tr>
</tbody>
</table>

Table 4 Direct Competitors

• **Archicad Energy Simulator**

This add-on is Archicad’s equivalent to D4E. The product can provide energy simulations on some of the inputted BIM models. Nevertheless, it possesses major limitations. Firstly, weather data needs to be manually inputted making the process more sluggish, non-automated and requiring more training which is one of the reasons expressed in other sections on why green building design acts in popularity especially for smaller construction processes. The established KPI’s within the software environment are focused on the North American ASHRAE standards rather than European certification schemes. Finally, the software does not provide the set of features present within D4E which truly integrate the customers and clients from the pre-design phase and onwards. Indeed, through the virtual meeting one of the main objectives of D4E is creating awareness and involvement at early building lifecycle phases. Another major drawback compared to the D4E platform is the lack of neighbourhood data which will pave the road for benchmarking and optimizing design solutions with respect to their surroundings and environment.

• **Aecosim**

Aecosim’s direct competitor to D4E is more focused on public infrastructure work such as subways, train stations and the like. Therefore, this add-on is more systems focused and is not directly targeted to small architectural practices in the same way D4E is, but rather focuses on large scale projects which in any case will also make extensive use of dynamic energy simulation software such as TRNSYS and Design Builder, described in the following section. Moreover, the add-on possesses some of the same limitations as Archicad’s offering such as
the focus on ASHRAE standards, the absence of virtual meeting and neighbourhood data.

- **Allplan AX3000**
  Allplan’s AX3000 is particularly focused on the German market and certification standards of that geographic region. Moreover, the software is extremely costly with each licence coming in at over 5000 euros and multiple licences must be bought for residential and non-residential market applications making it a segmented and non-integrated product. Finally, similar to all other competing product mentioned above, AX3000 lacks the features for enhanced customer engagement and neighbourhood data.

- **Insight 360**
  Insight 360 is Autodesk’s energy simulation add-on for their REVIT software. This is the most important threat that the D4E platform is faced with as far as direct competitors go for a particular set of reasons. Firstly, this add-on is compatible with REVIT which our launch product will be focused on, automatically making it one of the solutions D4E must directly compete with. Moreover, all other preceding products generally provide energy simulations and scenario analysis of BIM models albeit in a rather non-integrated and automated fashion. Indeed, some inputs are still necessary and rather complex. In the case of Insight 360, energy simulation is automated and integrated with possibilities for scenario comparison. D4E still differentiates itself at multiple levels. The projected databases that will be developed for D4E should provide a more complete data environment in terms of the neighbourhood, technologies, systems and materials and thus the possibility to obtain important KPI’s such as the onsite energy ratio which gives information on energy surpluses and possibilities for programs such as demand response. Moreover, similar to the other preceding products, Insight 360 does not provide a virtual meeting platform at the level planned for D4E. Clients simply observe the outputs in energy simulation of certain designs rather than having an option generator driven by KPI’s such as desired return on investment levels or energy savings.

What is also important to take into consideration here is that with the interoperability suite and future developments coming in, the D4E platform will be able to be used as an add-on by stakeholders using any which one of these softwares.

### 4.4.2 Energy simulation competitors

Another set of competitors for the D4E platform are found in dynamic energy simulation software packages. Although when using this approach simulation requires a lengthy and complicated input process, it still represents one of the current modes of functioning within the market for obtaining equivalent outputs to D4E and must thus be explored extensively as well. We will focus on two of the biggest energy simulation software environments: Design Builder and TRNSYS.

**DesignBuilder**

*Features*: DesignBuilder is a software solution which offers 3D modelling features for three distinct segments: Energy Assessors, Architects and Engineers. The product is offered in a series of different packages for each segment containing a different combination of modules at different price points as seen below [17]:
Table 5 Features of DesignBuilder

<table>
<thead>
<tr>
<th>Modules:</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Energy Assessor</td>
<td>Architectural</td>
<td>Engineering</td>
</tr>
<tr>
<td>Essential</td>
<td>Plus</td>
<td>Essential</td>
</tr>
<tr>
<td>3-D Modeller</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Visualization</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Certification</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Simulation</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Daylighting</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>HVAC</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Cost</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>LEED</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Optimization</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Scripting</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>CFD</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Table 6 Prices for different package of DesignBuilder

<table>
<thead>
<tr>
<th>User</th>
<th>Package</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Assessor</td>
<td>Essential</td>
<td>699 €</td>
</tr>
<tr>
<td>Architect</td>
<td>Plus</td>
<td>1,299 €</td>
</tr>
<tr>
<td>Engineer</td>
<td>Essential</td>
<td>1,399 €</td>
</tr>
<tr>
<td></td>
<td>Plus</td>
<td>2,299 €</td>
</tr>
<tr>
<td></td>
<td>Essential</td>
<td>2,299 €</td>
</tr>
<tr>
<td></td>
<td>Plus</td>
<td>2,999 €</td>
</tr>
<tr>
<td></td>
<td>Pro</td>
<td>4,799 €</td>
</tr>
</tbody>
</table>

Pricing: Pricing per licence for the product is divided per segment and package as seen in the following table [17]:

Strategy and positioning: DesignBuilder seems to be heavily marketed towards engineering and technical profiles. Despite being one of D4E’s competitors, it does not encapsulate the same ease of use of the platform in question and must be updated on a more regular basis which complicates the use of the software.

Trnsys Transient System Simulation tool

Features: Trnsys is a simulation interface for energy systems within buildings. The software presents itself through the following suite of tools [18]:

- TRNSYS3D
  TRNSYS includes TRNSYS3D - a plugin for SketchUp™ that allows the user to draw multizone buildings and import the geometry (including building self-shading and internal view factors for radiation exchange) directly from the SketchUp interface into the TRNSYS Building environment.

- TRNBuild
  TRNBuild is an interface for creating and editing all of the non-geometry information required by the TRNSYS Building Model. This allows the user extensive flexibility in editing
wall and layer material properties, creating ventilation and infiltration profiles, adding gains, defining radiant ceilings and floors, and positioning occupants for comfort calculations.

- **TypeStudio**
  TRNSYS includes a Fortran environment and a graphical interface that allows users to quickly develop new Types, writing them, compiling them, and including them in simulations all without the need to purchase any kind of third party Fortran compiler or worry about compiler project setting compatibility.

- **TRNEdit**
  The TRNSYS environment still includes TRNEdit, a full-featured text editor for writing and viewing TRNSYS input and output files and for running parametric TRNSYS simulations.

- **TRNSED**
  TRNSED allows users to develop customized graphical interfaces for specific applications and then distribute those applications to non-TRNSYS users. These "web-page like" TRNSED applications allow non-TRNSYS users to change system parameters, run simulations, and process output without having to learn the intricacies of the entire TRNSYS Environment.

**Pricing:** Pricing is performed with discounts for multiple user licenses. The following table gives an overview of their price policies [18]:

<table>
<thead>
<tr>
<th>Version</th>
<th>Commercial Price</th>
<th>Educational Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRNSYS 18 (new purchase)</td>
<td>$5060* (single user license)</td>
<td>$2530* (10 user license)</td>
</tr>
<tr>
<td></td>
<td>$8580* (5 user license)</td>
<td>$4220* (20 user license)</td>
</tr>
<tr>
<td></td>
<td>$10110* (10 user license)</td>
<td>$5060* (30 user license)</td>
</tr>
<tr>
<td></td>
<td>$11580* (20 user license)</td>
<td>$5790* (40 user license)</td>
</tr>
<tr>
<td></td>
<td>$12640* (30 user license)</td>
<td>$6320* (50 user license)</td>
</tr>
<tr>
<td></td>
<td>$13160* (40 user license)</td>
<td>$6740* (60 user license)</td>
</tr>
<tr>
<td></td>
<td>$13690* (50 user license)</td>
<td>$7110* (70 user license)</td>
</tr>
<tr>
<td>Upgrade from version 17.x</td>
<td>$2530* (single user license)</td>
<td>$1265* (10 user license)</td>
</tr>
<tr>
<td></td>
<td>$4290* (5 user license)</td>
<td>$2110* (20 user license)</td>
</tr>
<tr>
<td></td>
<td>$5055* (10 user license)</td>
<td>$2530* (30 user license)</td>
</tr>
<tr>
<td>e-Shipping</td>
<td>$20 (Download installs with PDF)</td>
<td>$20</td>
</tr>
</tbody>
</table>

*Table 7 Pricing of Trnsys*

Strategy and positioning: Trnsys is clearly positioned towards engineering profiles. To properly exploit the software, it is necessary to have knowledge of energy modelling and specially, FORTRAN programming language which makes this tool not as accessible for users with less technical backgrounds or with less experience in energy simulation.

### 4.4.3 Indirect competitors in the customer relationship management space

One of the great advantages and objectives of the D4E platform beyond integrating energy efficiency within the value equation for building design is its integration of a virtual workspace to interact with different stakeholders around a construction project including the building owner or commissioners themselves. This is directly related to the business eco-
system model mentioned earlier. A certain set of project management tools establishing such contacts and interactions are present on the construction market.

A particular example of this is the Buildertrend application which enables enhanced communication, collaboration, and documentation around construction projects. As such, the software divides itself in four main sections, the pre-sale process with bid requests, estimates and the like; project management with daily logs, to do lists etc., financial tools and customer management. Pricing for Buildertrend is original as it focuses on a monthly subscription of 99$ with a quota for only one project. Any additional projects increase the subscription rate [19].

Moreover, another indirect competitor to D4E is the web application Box which is specialized in cloud sharing and Storage. The application is geared towards multiple different industries including the construction industry with a specific interface which enables file sharing and collaboration between different actors and stakeholders. One of the specificities of this product is its ease in use at the job site. In terms of pricing, basic business users must pay 12$ a month per user making it a competitive offering considering the quality and capital fuelling the offering [20].

Despite such applications offering a compelling product, D4E should be able to compete efficiently as these applications are devoid of the more advanced design capabilities of D4E with BIM compatibility. This is important, as having the customer seeing the actual design evolve rather than simply establishing a digital communication channel is much more informative in terms of following projects for the buyers.

### 4.5 Competitive advantage of Design4Energy tool

The following table illustrates the main features of D4E and the main competitors mentioned in the prior section. This comparative product features table is helpful in identifying potential sources of competitive advantage for the D4E platform faced with these two companies.

<table>
<thead>
<tr>
<th></th>
<th>D4E</th>
<th>TRSYS</th>
<th>DesignBuilder</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target group</strong></td>
<td>SME Architectural Practices, SME Construction companies and energy auditors involved in early stage design Construction equipment companies</td>
<td>Energy systems engineers.</td>
<td>Energy Assessors Architects Engineers</td>
</tr>
<tr>
<td><strong>Target scope</strong></td>
<td>Initially targeting AEC companies throughout Europe.</td>
<td>Internationally based energy modelling practitioners and engineers.</td>
<td>Internationally based energy modelling practitioners and engineers.</td>
</tr>
<tr>
<td><strong>Needed competencies</strong></td>
<td>Simplified interface with no need for programming or complicated model inputs.</td>
<td>Expertise in energy modelling, better with Fortran programming language, C and C++</td>
<td>Complications in needed depths of inputs for modelling.</td>
</tr>
<tr>
<td>D4E</td>
<td>TRSYS</td>
<td>DesignBuilder</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>--------------------------------------------</td>
<td>---------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Update system</strong></td>
<td>Cloud based computing implies no need for updating software. Plugin will be needed to connect with authoring tool.</td>
<td>Updates issued for software at important cost.</td>
<td>Updates issued for software at important cost.</td>
</tr>
<tr>
<td><strong>Geographic and neighbourhoo d data</strong></td>
<td>Neighbourhood and geographic data could be update centrally by the project team.</td>
<td>No neighbourhood data.</td>
<td>No neighbourhood data.</td>
</tr>
<tr>
<td><strong>Materials and systems database</strong></td>
<td>Updated and accessible materials and systems database thanks to cloud computing.</td>
<td>TRNBuild allows the user extensive flexibility in editing wall and layer material properties, creating ventilation and infiltration profiles, adding gains, defining radiant ceilings and floors, and positioning occupants for comfort calculations. Moreover, the software integrates basic HVAC equipment, hydrogen fuel cells, solar thermal and electric technologies and thermal storage.</td>
<td>Library of materials and energy efficiency systems is periodically updated. Possibility for editing technology options before simulation.</td>
</tr>
<tr>
<td><strong>Integrated modelling capabilities</strong></td>
<td>Integrated modelling with interoperability and integration of energy efficiency at early design stages through BIM process with ranking of alternative designs according to KPI’s, only need to model the building once.</td>
<td>TRNSYS contains TRNSYS3D - a plugin for SketchUp™ that allows the user to draw multi-zone buildings and import the geometry. Nevertheless, interoperability between design input and energy efficiency optimization scenarios is inexisten.</td>
<td>Plugins for DesignBuilder exist where files are imported via gbXML file format. However, the import process is always problematic and even much complicate than remodelling the building, furthermore, interoperability between design input and energy efficiency optimization scenarios is inexisten.</td>
</tr>
</tbody>
</table>
### 4.5.1 Competitive Mapping of D4E against direct competitors TRNSYS and DesignBuilder.

To perform a competitive mapping of D4E against its main competitors, it is necessary to first establish the main criteria along which they will be mapped. Considering the previous table and issues expressed by our main target users, SMEs within the architectural sector, it seems as though the following set of criteria are the most decisive market drivers:

- Cost effectiveness/ price
- Ease of use
- Streamlined Process
- Virtual meeting and Customer involvement
- Precision in simulation
- Informational database

From our previous comparative table, we obtain the following figure to represent the positioning of D4E and its competitors along these principal market drivers.

<table>
<thead>
<tr>
<th></th>
<th>D4E</th>
<th>TRSYS</th>
<th>DesignBuilder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication interface with end user</td>
<td>Interface to involve all stakeholders regardless of geographic location and streamline the communication process especially with buyers and building owner. More importantly, the platform enables to synchronize the screen and show the building design simultaneously.</td>
<td>Geared towards engineers and modelling with no client or stakeholder communication interface. TRNSED tool still allows creation of web page like interface where parameters can be changed and simulations can be run even if not a TRNSYS user.</td>
<td>Geared towards engineers and modelling with no client or stakeholder communication interface.</td>
</tr>
<tr>
<td>Pricing</td>
<td>Free month for Signup 60€ monthly for a Basic subscription 120€ monthly for a premium subscription 2500€ for Enterprise program information on pricing given in section 5</td>
<td>5060$ for a single user licence. Discounts for students with 2530$ for 10 users. Possibility to pay for online courses</td>
<td>699€-4799€ for a single licence depending on user profile and package chosen. Possibility for student discounts Possibility to pay for online courses</td>
</tr>
</tbody>
</table>

*Table 8 Comparative Product Features*
Competitive Mapping

As reflected by this figure, D4E is more competitive in terms of cost, ease of use, streamlined process and project management and buyer involvement. Indeed, the cost for using the solution will be set at more affordable levels than that of TRNSYS and DesignBuilder. This is due to positioning considerations which will be explored in the corresponding section in marketing strategy. TRNSYS and DesignBuilder seem more positioned towards larger practices and enterprises as reflected by their pricing discount policies. Indeed, they grant significant discounts for purchases of licenses for multiple users clearly favouring bigger companies. Moreover, considering the needs in programming or detailed inputs for simulation by both solutions which imply extensive knowledge of energy efficiency systems, D4E’s simpler interface is a clear competitive advantage when targeting SME architectural practices. On top of this, the lesser need for engineers and technicians to perform simulations on designs in latter phases results in a more streamlined process and saved time for architects. Finally, with TRNSYS and DesignBuilder both being interfaces more dedicated to engineers, they do not have the same advantages in the client relationship potential brought about by D4E’s virtual meeting interface. BIM solutions and architectural design software so far has done extremely well at integrating additional layers of information in the design process and centralizing them. Nevertheless, the client is generally excluded from this process, completely eliminating possibilities for discussing potential cost saving investments in materials, structure and equipment on the long run, leading to today’s traditional contract based model of interaction rather than one focus on adding value.

The informational value and potential of D4E compared to these two competitors is in a league of its own. There are no such tools present in the market that is able to centralize data on houses in a certain neighbourhood in turn informing the architect and customers on potential design and equipment features capable of bringing about important levels of energy efficiency and ROI’s. The integration of a dynamic database on equipment and material performance is also extremely informational and provides a lot of potential value for optimizing choices at the pre-design level and also during modernization and retrofit operations.

With this in mind, D4E still being at its infancy stage, there is a clear lack of community and users around the product which is extremely handicapping as databases for geographic, neighbourhood and material information are dependent on these users. Efficient strategies to...
cope with this shortcoming will have to be developed in the company's marketing strategy. Ultimately, the differences between D4E and its two main competitors boil down to positioning. Both competitor softwares are positioned in price and features towards engineers and energy efficiency technicians belonging to larger practices and organizations who work on large scale construction projects where more precision and complete control over the simulation process is needed.
5. MARKETING STRATEGY

Despite having seen that the D4E Platform truly offers interesting advantages and benefits to its target segments in the prior sections, a product or service only goes as far as its marketing and commercial strategy will allow it to. It is important to define this section taking into consideration the usual limitations brought about by start-ups such as limited budgets, irregular cash flows and lack of reputation. This section will be useful in defining a set of guidelines emanating from market necessities for business development around the D4E project.

Marketing Strategy As mentioned in the introductory section of this report concerned with giving the reader a description of the product that was to be created around the D4E project and KERs, the strategy for commercialization will be a two phase launch with an initial product providing an extremely simple environment in order to accelerate the entry to market providing early product feedback from early users and minimal cash flow entry at the early phases while time is still being spent developing a more complete version of the software capable of integrating all the exploitable results achieved during the project at a larger scale. Taking this strategy into consideration, it can be assumed that the amount of potential target segments will broaden itself as the product features widen themselves over time. The main target segment from the beginning and throughout the development of different product iterations will be small to medium practices in the architectural sector as the outputs of the project directly target their needs and foster their adoption of green building approaches. Further down the line, databases such as the technology database can be of interest to other segments such as construction equipment, materials and systems providers. All relevant segments are detailed in the following section.

5.1.1 Market segmentation

SME Architects

Our first and main market segment is SME architectural firms and practices. As a threshold level to differentiate the SMEs, we will target precisely those firms containing less than 6 staff members representing 95% of practices in the market and an estimated 60% of output. The reason why this segment is so interesting for our product is because these firms generally work with smaller budgets and have a need for optimizing processes and workflows to reduce budgets and to be able to deliver more quality projects in less time all whilst tackling the future challenges of green building and EU building regulations. As seen in the competitive advantages section, the D4E platform is planned to come in at a cheaper price than any other equivalent software and is easier to use with a streamlined process making it attractive for a segment that is not as familiar with energy efficiency simulations and requirements.

SME Construction companies: engineers, technicians and energy experts

Another one of our target segments are the SME construction companies that intervene in design phases of the building life cycle as well as for retrofitting jobs. As seen before, the technical profiles within this segment may be more directed to D4E’s main competitors described previously. However, considering the low budget constraints of smaller companies and the fact that the cloud computing platform can present results in an innovative way towards customers with the presentation of a ranking of solutions according to KPI’s and through direct communication channels via the app improving the customer relationship process in speediness and general quality, it can be assumed that a small portion of these firms and notably those performing retrofit duties will be attracted towards the product.

Construction equipment companies and equipment wholesalers
Another last segment that will be targeted by the D4E platform is the construction equipment companies and wholesalers sector. This customer segment will however be tackled differently. Indeed, rather than trying to promote the actual use of the platform to these segments, it will be necessary to try and communicate the potential for this segment to use D4E as an arena for their products and services to be used by more architects and builders. As explained in the section on market analysis, these professionals are more and more adopting client centric approaches to doing business with increased levels of customization in services, aftermarket services and use of the latest technologies. All of these goals could be partially achieved through the D4E platform with the filter of acute geographic and project type targeting enabling the said companies to offer services, products and latest technologies that are relevant to the particular situation of potential clients. Indeed, these stakeholders could pay for defined fees in order to have their products, components, etc represented within the corresponding D4E databases, ultimately promoting them towards architects, homebuilders, HVAC engineers and the like.

5.1.2 Market Launch Strategy

The foundation of this cloud computing software application lies in the fact that architects are searching for quick, cheap and easy solutions to offer green building design inputs for their clients. In order for these architects to initially trust and use the app, the key benefits such as those related to economic and efficiency gains will need to be well communicated.

One approach to the marketing strategy could be the strategy of a viral loop. The name viral loop originates from viruses and how it is shared with other people. The basic idea is that the concept will be spread exponentially due to each customer sharing the concept within a group of relevant stakeholders for our product. In order to make the application spread through this strategy it is important to create incentives for the customers to share it with others. Hence, D4E needs to create some kind of benefit for the customer. One way could be to start unlocking features of the platform for customers who share it. By unlocking features the overall usage of the application will be increased and thus also the feedback. One approach could be to unlock the Premium or Enterprise features for a time period and thereby get the customer accustomed to the new features which may result in a premium subscription down the line if the platform performs at its expected levels.

5.1.3 Beta Version

Currently, D4E has invited external users and is setting up a Community of Practices (CoP). Thus, external users are invited and we will give them access to our platform and then obtain their feedback. Our minimal viable product will be based on this initial structure with the implemented modifications according to the feedback received. An important limitation of the platform so far is that geographic and neighbourhood data is limited to the inputs of developers and with the absence of users contributing to the database it is hard for the solution to expand in relevance and use geographically around the European market. As has shortly been mentioned in the section dedicated to market analysis, we will focus the initial launch of the D4E platform in Western European nations where generally BIM adoption levels are higher and where partners have more affinities and networks. For this reason, our focus is brought towards Germany, France, the UK and Spain. In order to successfully launch within these markets, developers will be obliged to populate the relevant databases for the main cities in order to create value in the product. Nevertheless, as the product gains traction in these areas additional geographic zones will be detailed by developers in order to expand geographically and capture more and more cities and markets. Moreover, to speed up the process of creating a growing database of projects, technologies and especially neighbourhoods and geographic data around Europe, D4E will have to create promotional approaches towards architectural associations, universities and companies in important cities.
where lack of data impedes the platform from performing at desired levels. This will create growing clusters of users in these undocumented zones progressively contributing towards the D4E platform’s databases without additional need for internal developers to come and input data.

5.1.4 Internal marketing duties

Most marketing duties explicated in the previous paragraphs must be performed in house by someone familiar with scientific, architectural and academic communities, fairs and conferences. Indeed, the ability to properly interact with all levels of the market segments described above, digitally and face to face will be decisive. In fact, the ideal profiles would be professors or individuals having experience with architectural chairs in important European universities able to leverage already existent networks combined with high levels of industry credibility.

When addressing this building block, the D4E project has to determine how to connect the value proposition with customers. In the D4E project the touch point that plays an important role in customer engagement is – communication. It serves several functions, including:

- Raising awareness among customers about the product and services of the D4E project,
- Helping customers evaluate a D4E project Value Proposition,
- Allowing customers to use specific modules of the D4E project,
- Delivering Value to customer
- Providing customer support

5.2 Sales Strategy

Establishing a pertinent sales strategy is crucial as it impacts the way D4E will communicate and reach its end users down the line. To optimize the sales strategy, the channel strategy must first be established.

5.2.1 Direct Sales Strategy and Model

D4E’s channel strategy has been specified in the previous report 9.2. As a cloud computing solution offered on the internet through its own proprietary website, D4E’s distribution strategy could be qualified as a zero-level channel with direct company to end user sales and revenue generation.

This means that sales happen with no intermediary implying a need to find avenues to engage end users directly in order to drive them to the D4E website and convert free users to paying users. As mentioned before, sales leads will be tackled through direct engagement with networks containing our potential end users, i.e. universities, associations, scientific and industry conferences, social media, etc. Strategies to attract users must then be devised. The approach that seems most viable for the moment and could help the software expand in more than the original cities of the current version could be to unlock the pro or enterprise features for a certain time period and for specifically targeted geographical influencers within the AEC sector. Direct engagement with the relevant scientific community through European fares and expos as well as digital marketing opportunities will be pursued.

5.2.2 Advantages of chosen strategy

Many advantages emerge through this direct sales model:
**Strong customer relationships**

Direct sales give a small business the ability to build and manage its own personal relationships with its customers and deliver more client specific levels of service. This allows a business the opportunity to engage in multiple interactions with a target consumer.

**Coordination with multiple business strategies**

Because a small business using the direct sales model has a working hand over its sales force, it can coordinate sales efforts with other levels of the organization. For instance, the business can ensure that the sales representatives interacting directly with customers use similar marketing language and presentation as its advertising campaigns. Moreover, it is then easier to pursue more than one business strategy with more control over tasks and objectives of each sales person.

**Cost and price control**

A business using the direct sales model has a significant degree of control over its pricing and distribution. As a result, the business has greater capability to verify that its products are competitively priced. Prices are not set by a third party as could happen with intermediaries. The business is also able to ensure the individuals representing its products or services are knowledgeable and effective.

Another crucial element of sales is to establish an approach towards managing the incoming sales data from the sales team in order to assess whether employed strategies are working. As a young company, D4E only has limited CRM and ERP needs and could therefore go through an open source service such as Odoo which even provides technical support for deployment of their solution and can easily scale up according to your needs.

**5.3 Revenue sources and pricing**

One of the key concepts for the successful development of the D4E Platform is the diversity of revenue streams. This feature will solidify the business case and will avoid the cash trough phenomena in the early stage phases of these kinds of business models.

In the following section we have defined immediate revenue sources which will be used immediately and within our financial projections at the end of the document as well as future revenue sources that must be explored down the line.

**5.3.1 Immediate revenue sources**

1. **Subscriptions**

Monthly subscription will be the base of the revenue especially in early stage launching of D4E Platform. However, a yearly subscription with the possibility of having infinite users will also be offered.

That being said, it should evolve to more advanced sources of revenue. From the upside of recurring revenue to higher growth rate and customer lifetime value (CLV), the benefits are unbeatable, especially if we put on the table all the pros, and cons.

2. **Upsells**

“Upsell” is the generic term for anything that improves both customer value and expenditure.

Upselling existing customers is more profitable too. Therefore, upselling should be the base of growth for the deployment of the D4E Platform and more importantly, an additional layer of margin.

Common ways to “upsell” customers will consider
· More Storage, Speed, or Data
The main purpose is to increase the level of service appropriate for some customers with an increase in cost. This strategy will fulfill customer demand at a reduced marginal cost and therefore will impact positively in efficiency and cost.

· New Versions
Although it is a natural progression in the D4E Platform, it will bring a considerable amount of risk in terms of service disturbance. Due to that it is of vital importance to plan in advance the change of version.

The charge to the customer for the new versions will be based in an increase in value from a qualitative or quantitative perspective.

· Program Upgrade
The most obvious way to upsell with the D4E Platform will be to promote the advantages of higher priced subscription programs.

3. Customer Service, tutorials and teaching
Customer service is one of the key pillars of D4E Platform development, but it is expensive. Charging for customer service is foreseen as an additional revenue stream. This service considers not only servicing the software, but also to coach and train customers in the issues associated with the software.

A retainer fee will be considered for customer support and it should evolve to consulting services in the future.

4. Setup Fees
A setup fee is a good way to validate clients but it will be based in true value. The fee will be kept to a minimum with the main objective of customer filtering.

5.3.2 Future Revenue Sources

5. Affiliate Sales
Affiliate sales will be implemented in later stages, and if successfully implemented could be a major lever to lower marketing cost and enter in new markets without a great effort. Customers who succeed with affiliate marketing will remain within D4E Platform and will help to decrease the churn rate.

The affiliate sales program has to be considered carefully in order to avoid failure in marketing actions in adjacent markets. Training of affiliates will ensure a positive outcome of the action.

6. APIs
An API or application program interface is a means of making D4E Platform to work with other software applications. Some developers will pay API fees, eyeing the potential of D4E Platform integrated with their applications and their needs.

The development of API should be envisaged in a later stage of implementation of the Platform. Care will be taken in order to avoid development cost overruns or support cost over the expected benefits.

7. White Label Licensing
Licensing will be an additional source of sales. The issuance of licenses will be planned in advance in order to avoid pitfalls in the future.
8. Advertising

D4E Platform should have room for advertisement. The platform will be a great showroom for equipment and material suppliers, contractors or even service suppliers.

It is important to stress the value rendered by the platform by being one stop place to gather information. It has to be emphasized the value for the user since he will be able to find target group for RFQ but also for the contractor or supplier since D4E Platform will be a perfect showroom to expose himself to a very focused demand.

The way advertising is displayed will be considered in order to avoid annoyance for the users. Freemium models will be the main focus of advertising.

5.3.3 Competitor Pricing Models and Levels

To establish the precise planning of different revenue sources and levels of product, it is necessary to consider many different factors and fine tune aspects of our product. Firstly, competitor prices must be taken into account in combination with the type of positioning we are trying to achieve. Indeed, our solution will have to be priced at a friendlier level than the potential competitors. Moreover, as subscription based models are generally most efficient and at the core of SaaS products, this approach will be used and the different user levels that will be promoted must be defined precisely by feature. Finally, the amount of money that SME architectural design firms spend on this type of software will have to be estimated in order to fix a price which reflects our main clients’ reservation rate for this type of solution. Thus, our price strategy is based on the supply side focusing on the predicted value of the product on the market, and the cost side have to be set in the second phase to create a reasonable cash-flow. In order to determine the price from a supply side point of view we will mainly observe the market prices of our competitors and similar software programs.

We will first start by observing TRNSYS and DesignBuilder’s pricing model in order to understand what the actual monetary amounts specified next stand for.

**TRNSYS**

<table>
<thead>
<tr>
<th>What is sold</th>
<th>License options</th>
<th>License terms</th>
<th>Payment methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>Individual</td>
<td>Perceptual</td>
<td>(Up-front)</td>
</tr>
<tr>
<td>Support</td>
<td>Group</td>
<td>Fixed-term</td>
<td>True-up</td>
</tr>
<tr>
<td>Run-time software</td>
<td>Concurrent</td>
<td></td>
<td>Pay as you go</td>
</tr>
<tr>
<td>Application access on web</td>
<td>Enterprise/ Site</td>
<td></td>
<td>Financing</td>
</tr>
<tr>
<td>Source code</td>
<td></td>
<td>Trial</td>
<td></td>
</tr>
</tbody>
</table>

*Attributes of software pricing (Nayak (2006) and Steele (2003))*

Table 9 Pricing model of Trnsys

TRNSYS is selling a run-time software as well as services and support with license deals for individuals as well as quantity discounted packages. The license term is perpetual with upfront payments although updates are expensive and regular. Moreover, TRNSYS sells libraries and add-ons as extras for considerable price as will next be seen. Pricing levels within this framework are contained in the following table [18]:
TRNSYS

- License Purchase:
  - $5060 (single user license)
  - $8580 (5 user license)
  - $10110 (10 user license)
  - $11580 (20 user license)
  - $12640 (30 user license)
  - $13160 (40 user license)
  - $13690 (50 user license)
- Discounts for students with 2530$ for 10 users.
- Possibility to pay for online courses
- Upgrades
  - $2530* (single user license)
  - $4290* (5 user license)
  - $5055* (10 user license)
- Additional libraries range from 210$ to 630$

Table 10 Pricing level of Trnsys

DesignBuilder

<table>
<thead>
<tr>
<th>What is sold</th>
<th>License options</th>
<th>License terms</th>
<th>Payment methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>Individual</td>
<td>Perceptual</td>
<td>Up-front</td>
</tr>
<tr>
<td>Support</td>
<td>Group</td>
<td>Fixed-term</td>
<td>True-up</td>
</tr>
<tr>
<td>Run-time software</td>
<td>Concurrent</td>
<td></td>
<td>Pay as you go</td>
</tr>
<tr>
<td>Application access on web</td>
<td>Enterprise/Site</td>
<td></td>
<td>Financing</td>
</tr>
<tr>
<td>Source code</td>
<td>Subscription</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trial</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Attributes of software pricing (Nayak (2006) and Steele (2003))

Table 11 Pricing model of DesignBuilder

DesignBuilder, similar to TRNSYS, sells support and service function as well as its run time software solution mainly towards individuals on a subscription based system. Payment is upfront for the annual fixed term in question. The following table contains pricing levels within the model characteristics [17].

DesignBuilder

- License Purchase:
  - 699€-4799€ for a single licence depending on user profile and package chosen.
- Subscription based annual service
- Possibility for student discounts
- Possibility to pay for online courses
- 1399€-2299€ for Architect’s package depending on version

Table 12 Pricing level of DesingBuilder
It has been observed previously that two of D4E’s major competitors have price levels oscillating around the 5000 euro level for one license with important discounts for bulk purchases highlighting the competitive positioning of these software pieces in the market towards larger players.

5.3.4 Pricing of Compatible BIM Software and Architectural Add-ons

To achieve a sense of market prices and readiness to pay for D4E on part of potential clients, it is extremely important to observe the prices of the BIM software that are compatible with D4E in order to proportionally price the platform as an add-on to these. The following table contains annual subscription prices for one user.

<table>
<thead>
<tr>
<th>Software</th>
<th>Autodesk Revit</th>
<th>Allplan</th>
<th>AECOsim</th>
<th>Archicad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>6600€</td>
<td>5995€</td>
<td>3900€ per annum</td>
<td>3000€</td>
</tr>
</tbody>
</table>

*Table 13 Annual subscription prices of different BIM software*

Finally, the cost of plug-ins and add-ons relevant to the architectural industry such as Enscape and Lumion are 679$ per annum for the former and between 1499€ and 2999€ for full software purchase with the latter.

5.3.5 User levels

As mentioned earlier in the introduction of this section, a subscription based business model seems to be the most appropriate for most SaaS applications. In the case of the D4E products and services that could be developed, two subscription levels could be developed with different progressive product capabilities and launch dates. One service level, referred to as Pro from now on, would provide a very basic version of the product which could be swiftly launched to market. The other service level, referred to as Enterprise would be launched later after developers have time to perform the needed work to guarantee stability and data scaling of all D4E KERs. These two user levels have to be well segmented in order to correspond to precise profiles and also open opportunities for upsells throughout the software ecosystem.

<table>
<thead>
<tr>
<th>Target Market Segments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AEC Practitioners</strong></td>
</tr>
<tr>
<td><strong>Pro</strong></td>
</tr>
<tr>
<td>• Energy assessment for building design.</td>
</tr>
<tr>
<td>• Integrated collaborative design review.</td>
</tr>
<tr>
<td>• Decision support.</td>
</tr>
<tr>
<td>• Project Management</td>
</tr>
<tr>
<td>• Online Gaming</td>
</tr>
<tr>
<td><strong>Enterprise</strong></td>
</tr>
<tr>
<td>• Option generation for building design,</td>
</tr>
<tr>
<td>• Technology database</td>
</tr>
<tr>
<td>• Neighbourhood module</td>
</tr>
<tr>
<td>• Energy matching in neighbourhood context.</td>
</tr>
<tr>
<td>• Lighting simulation</td>
</tr>
</tbody>
</table>
• Monthly based single licence subscription
• Plug-ins for Sketchup, ArchiCAD etc.
• Interoperability Suite
• Yearly based unlimited licence program

Table 14 User levels of D4E

Important assumptions:
- All service levels must offer the possibility to upload to main databases considering that D4E’s neighbourhood data element which offers an unparalleled competitive advantage to the software depends on user contributions in this regard.
- Single user license for monthly subscription program with only one email allowed per subscription and unlimited users for Enterprise license.
- When first signing up, a free month as a basic user is granted in order to demonstrate the basic abilities of the cloud based software and create incentives and traction for users to convert into paying users.
- In order to feed the viral loop and to stay true to the sales and marketing strategy stipulated before, promotions such as a month as a Pro user could be given for every ten signups sponsored under your name.

5.3.6 Estimation of reservation price of target customers for D4E

Pricing strategies within the market are either perpetual or fixed-term subscription based. Considering that software solutions with perpetual terms are updated extremely regularly, they are not a one stop purchase as the updates are priced highly as well. In the case of D4E, it seems that the most efficient pricing strategy would be centred on a monthly subscription based individual license with upfront payments for the case of our pro offering. This short term fixed period would not discourage potential customers of purchasing a subscription considering how new the product is and the uncertainty that surrounds it with important upfront yearly commitments whilst also taking into consideration the potential dips in activity experienced by SMEs in the AEC industry, especially in green building demand. Moreover, since the Pro level subscription would be used as an introductory product iteration it is only logical to price it on short term periods enabling try outs by potential users. Fixed term annual subscriptions with unlimited user license will also be offered through our Enterprise offer with more options available. These types of users should pick up in popularity as the usage rates of D4E pick up and the product is more known. Furthermore, consulting around support and tutorials are also being explored. The following table summarizes the chosen framework:

<table>
<thead>
<tr>
<th>What is sold</th>
<th>License options</th>
<th>License terms</th>
<th>Payment methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
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<td>Subscription</td>
<td>Trial</td>
<td></td>
</tr>
</tbody>
</table>

Attributes of software pricing (Nayak (2006) and Steele (2003))

Table 15 Pricing model of D4E
In terms of the actual established prices for D4E’s products and services, different prices must be established for our different user profiles and length of subscriptions. Moreover, it is necessary to quantify prices for consultation services and tutorials. The following tables contain the preliminary offer upon which future financial projections of this document will be performed. The prices have been set according to available competitors, the perceived value of the product and the upcoming regulations within the EU which should increase demand for such solutions.

<table>
<thead>
<tr>
<th></th>
<th>Pro</th>
<th>Enterprise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly Subscription</td>
<td>50€</td>
<td>x</td>
</tr>
<tr>
<td>Yearly Subscription</td>
<td>x</td>
<td>1000€</td>
</tr>
</tbody>
</table>

Table 16 Price for different user levels

Consulting

Free for Basic users to access Webinars and tutorials
100€ for 1 day conference or campus trainings

Although our yearly prices are more expensive than average plug-ins, the fact that D4E actually impacts pre and final design output and delivery of projects rather than being a simple rendering tool for marketing purposes makes it stand in a different category in terms of its value towards users. The yearly price remains considerably lower than buying a license for either TRNSYS or DesignBuilder since they imply unlimited amounts of users and do not require paying for libraries and plug-ins as well as extensive tutorials. In comparison to Buildertrend’s 99$ per month for one project pricing scheme, D4E remains more than competitive. Moreover, our monthly subscription options enable to attract architects who may not be ready to commit to a full year or perhaps do not have the immediate need considering the current configuration of the green building design market. This is in direct relation to the needs of the market segment we are initially trying to penetrate.

As part of our marketing strategy mentioned above with a limited free period to try out the platform, a “signup” option will be available for a month or two in order to demonstrate the capabilities of D4E and create incentives for subscriptions.

5.4 IP, Patents, Copyrights, Brands

Intellectual property rights relate to trademarks, patents, domain names, database rights and copyrights that are registered in order to protect your design, expressions, brand and innovations against external copying of the product or unauthorized use of identity materials. In this case, the intellectual property methods for protecting the D4E brand and environment will be discussed rather than the intellectual property matters relating to the actual ownership structure between consortium partners of the platform.

Below is a list of the most common types of intellectual property rights, how they relate to the D4E Platform and if registration will be required. The registration and management of our
intellectual property rights will be included in our external services cost through third party legal services providers.

**Copyright**

Intellectual property rights within the European Union Directive 2009/24, which harmonizes protection mechanisms in the field of computer programs between member states, focuses on copyright protection. In the software sector, this type of protection is granted under the terms that the product’s source code is an original literary work. Therefore, for SaaS software, copyright protects the way or form in which a program was written but not its actual functionality. Since Directive 2009/24/EC of the European Parliament and of the Council of 23 April 2009 on the legal protection of computer programs was put in place, copyright laws on software have been standardized. The D4E Platform will have to register for copyright protection in order to protect the service against the copy of its source code for the tools are not set to be open source. This is important considering some of the modules contained within the software environment use unique names and designations that do not yet exist within the AEC or software sector. As far as costs go, the European Union can grant a Registered Community Design protection for a validity of 25 years.

**Trademark**

A trademark is useful for the protection of the brand identity. It is crucial to register for a trademark in order to protect D4E’s logo, brand name, and corporate identity and communications typology. Currently, the cost of obtaining a trademark through the European Union Intellectual Property Office is of 850€.

**Patent**

Patent protection is what protects the innovation or the essence of the product against being copied or replicated. Patent protection is extremely useful to benefit from exclusivity of an innovation. Unfortunately, patent protection in the software sector is extremely daunting to obtain. Indeed, the European Patent Office only allows the obtention of a patent on software products when the said products present non-obvious and revolutionary innovations that solve a technical problem. In this way, a software which for instance analyses stock indexes and gives investment tips in terms of defined algorithms cannot obtain a patent whereas a software doing the same thing with a new database format approach capable of processing larger amounts of information can qualify for a patent. Taking this into account, a possible patent application will be filed as despite the fact that the technical base of the software does not present a major innovation, the problem being addressed by D4E in this case is of a technical nature which may enable it to qualify for patent protection.

**Protecting the IPRs**

D4E will retain all ownership of its intellectual property rights. Despite the possibilities for white label licensing down the line, use of intellectual property rights on party of clients should be subject to the terms of the SaaS agreement for the duration of the SaaS agreement. All intellectual property rights will be upheld by external legal services which have been included in the costs section of our financial projections as a monthly fee.
6. STAFFING AND OPERATIONS

6.1 Management Organizational Chart

The business plan for D4E Platform considers a standalone organization in charge of the full deployment and operation of the platform. This assumption could be optimized in case the operations are integrated with an existing organization since the marginal cost would decrease considerably. We have preferred to take this conservative approach for the sake of robustness.

The organization will evolve following the launching, growth and stabilization period, but the philosophy behind will remain.

The R&D relevance from the very beginning aims at a robust and reliable product development able to capture the value proposition and keep an outstanding reputation.

The Sales function is vital for a fast and relevant customer capture since the first day in the market. The Sales function has been divided in:

- Marketing. The Marketing team will be responsible for the material design, advertisements campaign in the media and social networks.
- Sales. The Sales function is the trigger of revenues; therefore, its design has two main thrust lines:
  - Sales Development team with the main role of lead generation in a fast and continuous manner. The leads generated by the Development team should be passed to sales execution with the main target of contract or subscription delivery.
  - Account executives will be devoted to promoting the platform in the appropriate networks and avenues as well as maintaining the established relationships with those channels. In the business model of D4E the growth of the business is of vital importance, mainly in the Enterprise Customer Cluster. In order to accomplish that goal, the churn rate is the main KPI and the account executives should detect any claim from the customer in order to maintain a great customer satisfaction rate. The General Manager is in charge of the monitoring of financial KPIs. This administrative role integrates the accounting/control task with general administrative and Human resources role.

The above diagram will be the result of a progressive hiring process and is only representative of the staffing needs at launch. In the following financial templates that are to be presented,
incremental staffing is represented through established Compound Annual Growth Rate (CAGR) in staffing costs throughout the years.

### 6.2 Staffing

The headcount should evolve in number along the life of the D4E Platform. The following graph is representative of projected salary mass increases relative to the projected sales and market performance of the D4E platform that will be detailed in the next section.

![Monthly salaries by department](image)

*Figure 17 Monthly salaries by department*

### 6.3 Training Plans

D4E Platform has to gain Sales and Marketing efficiency in order to keep the profitable sustainability of the business. To achieve that efficiency boost, training of our personnel is the key.

The S&M team should be trained in the main areas of his function but also in the main features of our product.

The R&D team should keep pace of the last trends in technological advances in order to maintain D4E platform as the spearhead of the business.

The interchange of experiences among mixed team will increase the cross-fertilization of ideas and the early adoptions of customer requirements and claims that will diminish the churn rate and increase the contract value per customer.
7. **FINANCIAL PROJECTIONS**

### 7.1 Key Assumptions, cost drivers and projected market share

#### 7.1.1 Key Assumptions

The table shows the main assumptions used to establish the flow of Customers among the three main Clusters and the growth dynamic of each cluster.

The growth pattern used for Basic and Pro Customers is different than the Enterprise set of customers. In the first case, the main thrust comes from the Marketing effort that is quite substantial from the beginning of the operations. In the later it is assumed that the main effort should come from the dedication of the Sales and Customer Support team.

The selection of the values is very conservative, assuming that the real outcome of the launching campaign could have more stamina.

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Signups</th>
<th>Signups month 1</th>
<th>200</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Signups organic growth rate per month (%)</td>
<td>5-15</td>
</tr>
<tr>
<td></td>
<td>Cost per signup (€)</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marketing spending growth rate per month (%)</td>
<td>1-3</td>
<td></td>
</tr>
<tr>
<td>Pro</td>
<td>Pro Customers month 1</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Customers</td>
<td>Conversion rate Signups to Pro (%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Upgrade rate Pro to Enterprise (%)</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Churn rate per month (%)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ARPA per month</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ARPA increase rate (%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Enterprise</td>
<td>Enterprise Customers month 1</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Customers</td>
<td>Annual Contract Value per Customer (€)</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ACV increase on Renewal (%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Churn rate per year (%)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Payment</td>
<td>Pro Customers</td>
<td>Monthly upfront</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enterprise Customers</td>
<td>Yearly upfront</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Services</td>
<td>Automatic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>Upfront</td>
<td></td>
</tr>
</tbody>
</table>
Signups here are referred to the free trial period for the platform given to new users. This potential marketing strategy was specified earlier on in the document and is generally very effective for SaaS products to gain traction.

Another important assumption that must be mentioned is our launch delays for each product iteration and subscription level. As in any venture involving software development obtaining ready to launch products takes time. In this business plan scenario we have decided to look at financial projections and results over a time span of 3 years starting in 2019. Within that time span it was determined that with the allocated resources, the Pro subscription level would launch after three months of additional development in the first year and the enterprise subscription level would launch in the beginning of the second year.

### 7.1.2 Costs

Regarding the cost structure, the cost has been divided in three main groups:

- **R&D.** This cost aggregates salaries and other direct cost related to personnel.
  - 3 REVIT licences for 3 years at 6600€ per unit
- **Sales & Marketing** cost aggregates salaries of Sales and Marketing staff plus the direct cost of traveling, on boarding, phone, etc. Costs are incremented by 3% on a monthly basis.
- **General & Administrative** cost aggregates salaries and other direct cost attached to the staff and office rent plus external services such as lawyers, accountants, etc.
- **Cost of goods sold (CoGS)** cost includes direct cost attached to goods sold. It includes not only server charges, database storage in external premises, or payment charges, but also salaries of Customer Support staff that are directly linked to the function of lead generation and customer support. These are set at 10% of revenue currently. This percentage provides a very conservative and most likely inflated estimate of infrastructure costs. It is determined that the most likely scenario in the first year would be a combination of medium sized virtual machines by 1&1 or OVH priced at 46.85€ and 52€ monthly respectively [6] and then a move to large virtual machines as the user base grows. To give perspective our infrastructure costs for the first month are estimated at 878€. Obviously, infrastructure costs involve more than just the basic Infrastructure-as-a-Service (IaaS) provider prices. Nevertheless, the conservative cost estimates provide a buffer for all of these.

The cost structure tries to be as variable as possible using a “pay as use” definition instead of an owner strategy. The aim is to provide flexibility and avoid inventory assets and capital use from the start.

As will be seen later, in the stabilization phase, after launch and growth, the main driver of cash inflow will be the Enterprise Customer Cluster. Due to that, the effort in Customer support and Lead generation is substantial and the headcount growth has been sized with the following assumptions:
Assumptions for sale cost

D4E Platform is a recurring business model and therefore it is crucial to maintain a tight control of the main key performance indicators that are able to detect if the Company maintains Growth, Profitability and Sustainability.

The application of a certain KPI depends on the period of life of the Company, some being more relevant in the launching phase. In that phase, it is very important to increase the traffic of visitors and signups and increase the marketing effort so the main assumptions regarding growth and dynamics of the Customer mix are checked and their consistency assessed.

The financial analysis of the operations gives indications about:

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Sales team</th>
<th>Account Executive new ARR p.m. quota (€)</th>
<th>50,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales Director to Account Executives (max)</td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Sales Director to Account Executives (min)</td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Sales Development Representative per Account Executives</td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Sales Development Director per SDR</td>
<td></td>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>

Table 18 Assumptions for sale cost

<table>
<thead>
<tr>
<th>Key performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signups evolution</td>
</tr>
<tr>
<td>Customers per Cluster</td>
</tr>
<tr>
<td>MRR growth</td>
</tr>
<tr>
<td>Cash inflows per Customer Cluster</td>
</tr>
<tr>
<td>Gross Margin</td>
</tr>
<tr>
<td>EBIT</td>
</tr>
<tr>
<td>Customer Acquisition Cost (CAC)</td>
</tr>
<tr>
<td>Monthly Cost per category</td>
</tr>
<tr>
<td>Marketing Efficiency</td>
</tr>
<tr>
<td>Cash Flow of the Operations</td>
</tr>
<tr>
<td>Customer Churn</td>
</tr>
<tr>
<td>Revenue Churn</td>
</tr>
</tbody>
</table>

Table 19 Financial indicators
7.1.3 Target Market Share

According to the churn rates, initial signups, conversion and upgrade rates, cost of signups, pricing policy and other assumptions presented in the preceding section we expect to capture 116 customers in the first year, 567 customers in the second year and 1684 customers in the third year. If we were to use the market sizes established in section 4.1.4 for our launch markets we would obtain the following market shares factoring in growth of BIM users and the architectural sector:

![Figure 18 Projected Market Share](image_url)
These market shares can be seen as conservative since they only take into consideration 4 countries and REVIT users. As the years go by, it is planned that the D4E subscription levels will be offered for different BIM platforms and in different geographic markets. This means that in reality, projected users would represent a very small percentage of the market if taken over the totality of launch markets and future markets together. The progressive increase in growth rate of subscribers due to platform interoperability and geographic expansion is reflected in the progressive monthly subscriber growth rates with the following figure representing this monthly evolution:

![Customers by pricing plan](image)

*Figure 19 Customers by Pricing Plan*

An important feature to notice in this figure is that the customer count for the Pro pricing plan only starts after two months and the customer count for the Enterprise pricing plan only starts in year two factoring in the needed development time to take both products to market.

### 7.2 Profit and Loss Accounts

Here below the P&L proforma of the operations in the next three years:
| Month  | Revenues  | CoGS   | % of revenues | Gross Profit | % of revenues | Operating Costs | % of revenues | Total Operating Costs | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBIT | % of revenues | EBI...
The P&L at EBIT operations level shows the typical shape for the launch of a recurrent revenue business with the initial cash trap in the initial phase of launching. The same information in graphical format is more intuitive.

![Figure 20 Revenues, costs and pro-forma EBIT](image)

Positive EBIT at operations level is achieved at the end of the second year, increasing from there month after month in a very robust path.

It is important to point that the cash flow pattern differs from the revenue since the contracting method requires upfront payment and the consequence is a lower requirement of working capital.

It is important to notice that in both instances of products being launched we can see a dip in EBIT, namely in month and month one of the second year. This is due to the fact that we have factored in marketing expenses for product launches and ancillary needs associated to these launches.

To get a better idea of how churn rates, growth rates, and customer acquisition pan out within our financial engine and projections it is useful to take a look at the following graph documenting monthly recurring revenue movements.
In this case net expansion monthly recurring revenue is the additional revenue obtained through upsells and upgrades established through our conversion rate. Moreover, the churn monthly recurring revenue is what is lost by customers terminating their subscription. Net new monthly recurring revenue is then a difference of the latter two also taking into consideration new customer monthly recurring revenue.

Moreover, in terms of revenue repartition, the following graph gives us an idea of which one of our products brings in the most revenue.
As represented in this graph, revenue generation only starts at the launch points. Moreover, it is planned that Enterprise based revenue will surpass Pro based revenues over time as the product gains acceptance and customers are not as reluctant to invest a larger sum of money for a longer term licence.

### 7.3 Balance Sheets

The balance sheet shows that D4E Platform is a very flexible structure with no fixed assets apart from intangible assets that in the launching phase of the platform are considered immaterial.

Our assets are purely reflective of our cash generated by monthly recurring revenue.
7.4 Cashflows

Cash flow is one of the KPIs relative to the sustainability of D4E Platform operations. It is very relevant to emphasize the importance of the payment pattern established in this platform and extended in the majority of competitors.

The cash flow differs from the revenue recognition since revenue recognition progress along the time with the real performance of the contract whereas cash flow and liquidity comes from the payment performance.

The fact that all the customers pay upfront, monthly in the case of Pro and yearly in the case of Enterprise customers, provides a liquidity cushion that optimize the capital requirements and increases the IRR performance of the operations from the investment standpoint.
Table 22 Foreseen cash flow for the first three years

In order to appreciate the monthly cash flow generation from operations the observation of the next graphs is very helpful.

They show the evolution of the operating inflow and outflow and the balance per month.

The business is able to generate positive cash flow in year two with a strong progression in year three. The main reason for that acceleration comes from the growth in the Enterprise Customer number due to the contract characteristic of upfront payment.
Cash balance is an extremely important indicator, especially for starting ventures as it indicates necessities for additional capital down the line. In our case we can see that according to our projections and an initial investment of 400,000 € there should be no need for additional capital. However, it is important to monitor KPI’s in terms of customers acquired and also upgrades and upsells in order to guarantee that our sales levels are satisfyingly compensating for investments in development. By going through an outsourced cloud based model, more flexibility is achieved in terms of variable cost meaning that fewer customers than projected here will be countered by lesser costs.

7.5 Risk analysis

In this paragraph, there is a review of the main operational risks that can have an impact in the financial position and sustainability of D4E Platform.

The extension of our market and our future growth is largely dependent upon our ability to develop new software products that achieve market acceptance with acceptable operating margins, and increase usage and product adoption of our D4E Platform. Enterprises are requiring their application software vendors to provide greater levels of functionality and broader product offerings. We must enhance our current product line and develop and introduce new products and services that keep pace with increasingly sophisticated customer requirements and the technological developments of our competitors. Our business and operating results could suffer if we cannot successfully execute our strategy.

Our business could suffer if the demand for, or usage of, our D4E Platform declines for any reason, including declines due to adverse changes in the construction industry or in the...
macroeconomic environment, including financial stability. If demand for, or usage of, our software declines for any reason, our operating results, cash flows from operations and financial position would suffer. Our business could be adversely affected by:

- Any decline in demand for or usage of D4E.
- The introduction of products and technologies that replaces or improves our product in terms of value price balance.
- Technological innovations that our product is not able to implement or be compatible.
- Our inability to release enhanced versions on a timely basis with added value for our Customer.
- Adverse changes in the housing sector that reduces the demand of new houses or retrofits.

In addition, worldwide economic downturns and lack of stability in the financial markets could affect the demand of D4E Platform. The housing sector relies on the bank financing of the operations, therefore an increase in the interest rates or lack of appetite for new credit expansion in the banking system would surely impact our operations.

The relationship with our customers is the base of our business but also a potential source of risk that we have to know understand and take preventive measures in early stages. The main risks that we could encounter are:

- Customer claims due to shortage of quality or service response that could affect our reputation.
- Legal claims including product liability that increases our insurance cost and the warranties or service level required.
- Customer payment delays.
- Although our customer base is SME, some Enterprise Customers could develop internally products that could compete in partial or lateral markets.

D4E is designed to operate in an international environment outside of the EU. This factor that is one of the main drivers for success could be a threat in terms of:

- Less effective protection of IPR
- Requirements of foreign laws and other regulations
- Delays in the execution of agreements
- Difficulties in receivable collection in other jurisdictions
- Complex tax regulation and consequences
- Management of litigations in foreign countries.
- Fluctuation of foreign currency exchange rates could impact our operating results.

D4E main asset is the knowhow, therefore human capital is one of the bases of our business. It is very imperative to increase the retention and decrease the rotation of key personnel.

The rotation of personnel not only produces external dissemination of our knowledge, but it also increases our operation cost and restrain our operating efficiency.
8. **FUNDING REQUIREMENTS AND THE PARTNERSHIP ASSOCIATION**

8.1 Funding Requirements

For the sake of this project, we have established financing needs at 400,000€. Since this document serves as operational and market led guidelines to perform business development activities around the outputs of the D4E project, we have considered that all preceding research costs were sunk costs to truly reflect needed capital in order to start a potentially successful venture. In the financial projections showed before, the initial capital was not accounted as a loan with principal and interest repayments but rather an equity injection on part of potential external parties.

Since external cloud based servers and infrastructure would be used, the initial capital is especially important in order to cover the salaries of required staff. Indeed, as a young and novel application system, important development efforts will be needed requiring important human capital with no incoming cash inflow during the first months. Moreover, development work to rapidly scale the application to other geographical areas than the initial ones will be needed as described earlier. These are all highly qualified jobs generally requiring performance incentives and high salaries. Therefore, in determining the necessary amount for starting this venture we must ensure that launch costs are covered without over extending capital. In this sense, through estimates, it was observed that our initial capital injection is able to cover the totality of operating costs for the first 16 months. Moreover, considering the growing cash inflows over time, this should lead to an absence of liquidity problems. The next graphs highlight perfectly the evolution of costs over the 3 test years and the clear preponderance of salaries within the cost structure of the potential business venture.

![Monthly costs by P&L category](image)

*Figure 25 Monthly costs by profit and lost category*
As we can see sales and marketing expenses mainly start in the 3rd month due to the fact that time is needed for our initial product version, Pro Service level, to develop. This means our main initial expenses are related to R&D and general administrative costs. Moreover, as can be seen in the previous graph, Costs of goods sold are high in the beginning and then go down. This is because we accounted for the cost of running simulations on the virtual machines as well as the REVIT licences needed for our developers.

The following graph presents a different segmentation of the same costs. As mentioned before D4E is a software oriented venture, for this reason the company possesses little fixed assets which in part explains the preponderance of salaries in costs.

![Monthly costs by category](image)

**Figure 26 Monthly costs by category**

### 8.2 Partnership Association

As a testament to the engagement of project partners towards the project in carrying out tasks leading to such exploitation scenarios and financing possibilities, a partnership alliance has been signed by the following list of partners:

<table>
<thead>
<tr>
<th>Beneficiary Num.</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SOLINTEL M&amp;P SL</td>
</tr>
<tr>
<td>2</td>
<td>TECHNISCHE UNIVERSITAET DRESDEN</td>
</tr>
<tr>
<td>3</td>
<td>Teknologian tutkimuskeskus VTT Oy</td>
</tr>
<tr>
<td>4</td>
<td>LENZE-LUIG 3-L-PLAN GBR</td>
</tr>
<tr>
<td>5</td>
<td>Loughborough University</td>
</tr>
<tr>
<td>6</td>
<td>FRAUNHOFER-IAO</td>
</tr>
<tr>
<td>7</td>
<td>UNINOVA-INSTITUTO DE DESENVOLVIMENTO DE NOVAS TECNOLOGIAS-ASSOCIACAO</td>
</tr>
<tr>
<td>9</td>
<td>University of Salford</td>
</tr>
<tr>
<td>10</td>
<td>SISTEMAS Y MONTAJES ELECTRICOS SL</td>
</tr>
<tr>
<td>Beneficiary Num.</td>
<td>Name</td>
</tr>
<tr>
<td>-----------------</td>
<td>------</td>
</tr>
<tr>
<td>11</td>
<td>IZNAB SPOLKA Z OGRANICZONA ODPOWIEDZIALNOSCIA</td>
</tr>
<tr>
<td>12</td>
<td>GASPAR SANCHEZ MORO ARQUITECTOS SL</td>
</tr>
<tr>
<td>15</td>
<td>CADCAMATION KMR SA</td>
</tr>
<tr>
<td>16</td>
<td>TPF SPOLKA Z OGRANICZONA ODPOWIEDZIALNOSCIA</td>
</tr>
</tbody>
</table>

A Design4Energy association was setup, this alliance binds partners to furthering the exploitation of D4E outcomes beyond the end of the project framework, to establish a long-term collaborative relationship, and to promote the Design4Energy outcomes and professional service to potential stakeholders together. The established association will serve as a channel for further communication and foundation for further collaboration, members will have priority in involving the future joint venture or establishment of business activities.
9. CONCLUSIONS

9.1 Summary of Achievements

The main achievement of report 9.3 has been to establish and identify market guidelines as well as operational guidelines to take into consideration in order to develop a business based on the results of the D4E project. The approach used to perform this task has been of a practical nature rather than a prescriptive nature. What is meant by this is that studying the case of a potential product launch and business plan is more revealing in this regard than simply listing out the said guidelines.

Through this process, we have been able to observe market requirements and guidelines in terms of pricing, positioning, service definition needed initial capital inflow, size of our segments among others. Moreover, guidelines of a more operational nature were also provided notably on the strategy behind cloud computing and positioning the potential business as a SaaS operation.

9.2 Relation to continued developments

Establishing market viability for D4E derived products and services is important to validate the previous research that has been performed and the future research and studies that will be performed.
## ACRONYMS AND TERMS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACV</td>
<td>Annual Contract Value</td>
</tr>
<tr>
<td>AEC</td>
<td>Architecture, Engineering and Construction</td>
</tr>
<tr>
<td>ARPA</td>
<td>Average revenue per Account</td>
</tr>
<tr>
<td>CAC</td>
<td>Customer Acquisition Cost</td>
</tr>
<tr>
<td>CAGR</td>
<td>Compound Annual Growth Rate</td>
</tr>
<tr>
<td>CLV</td>
<td>Customer Lifetime Value</td>
</tr>
<tr>
<td>CoGS</td>
<td>Cost of goods sold</td>
</tr>
<tr>
<td>CoP</td>
<td>Community of Practices</td>
</tr>
<tr>
<td>CRM</td>
<td>Customer Relationship Management</td>
</tr>
<tr>
<td>D4E</td>
<td>Design4Energy</td>
</tr>
<tr>
<td>DSM</td>
<td>Digital Single Market</td>
</tr>
<tr>
<td>EBIT</td>
<td>earnings before interest and tax</td>
</tr>
<tr>
<td>EMEA</td>
<td>Europe, Middle East, Asia</td>
</tr>
<tr>
<td>ERP</td>
<td>Enterprise Resource Planning</td>
</tr>
<tr>
<td>EUPPD</td>
<td>European Union Public Procurement Directive</td>
</tr>
<tr>
<td>G&amp;A</td>
<td>General &amp; Administrative</td>
</tr>
<tr>
<td>HVAC</td>
<td>Heating, Ventilation and Air Conditioning</td>
</tr>
<tr>
<td>IaaS</td>
<td>Infrastructure-as-a-Service</td>
</tr>
<tr>
<td>IPR</td>
<td>Intellectual Property Rights</td>
</tr>
<tr>
<td>IRR</td>
<td>Internal Rate of Return</td>
</tr>
<tr>
<td>KER</td>
<td>Key Exploitable Results</td>
</tr>
<tr>
<td>KPI</td>
<td>Key Performance Indicator</td>
</tr>
<tr>
<td>MRR</td>
<td>monthly recurring revenue</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>Operations &amp; Maintenance</td>
</tr>
<tr>
<td>Odoo</td>
<td>An all-in-one management software</td>
</tr>
<tr>
<td>OVH</td>
<td>An internet hosting company</td>
</tr>
<tr>
<td>P&amp;L</td>
<td>PROFIT &amp; LOSS STATEMENT</td>
</tr>
<tr>
<td>PEST</td>
<td>Political, Economic, Social and Technological</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>RFQ</td>
<td>Request For Quotation</td>
</tr>
<tr>
<td>ROI</td>
<td>Return Of Investment</td>
</tr>
<tr>
<td>S&amp;M</td>
<td>Sales &amp; Marketing</td>
</tr>
<tr>
<td>SaaS</td>
<td>Software-as-a-Service</td>
</tr>
</tbody>
</table>
SMEs.......................... Small and Medium-sized Enterprises
SWOT ......................... Strengths, Weaknesses, Opportunities, and Threats
VM ............................... Virtual Machine
XML .............................. Extensible Markup Language. It is a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable.
12. REFERENCES


[17] Design Builder, Available at: https://designbuilder.co.uk/energy-assessors/


[19] Buildertrend. Available at: https://buildertrend.com/

[20] Box for Construction. Available at: https://www.box.com/industries/construction

13. **APPENDICES**

13.1 **Appendix 1: Cloud services available on the market**

Reports 3.1, 3.2 and 3.3 all explore major considerations around these databases from a data format standpoint as well as an API standpoint. Considering the fact that this section focuses on market guidelines for business development we are more concerned with the actual costs and license prices for the cloud infrastructure which will support our databases and collaborative virtual workspace for a potential initial product.

As mentioned before, the D4E platform will function as a SaaS provider cloud based application establishing the following relationships between provider and end user [4].

![Figure 27 SaaS structure](image)

The reason why cloud computing was chosen in this instance are multiple [5].

- Lesser needs for initial capital outflow on physical equipment and servers which could prolong the “valley of death curve”
- Less capital outflows over the years in server maintenance
- When using a public cloud, computing resources are elastic and can be scaled up or down in order to adapt to demand and use of the software and limiting the exposure and risk of buying physical equipment which might not be necessary.
- When more capacity is needed, it is easy to scale up without any long-term investments needed
- Hypervisor is capable of sending the capacity of operating systems where needed
- Server failures are less of a problem as more servers are available for backup

Considering the uncertainties related to launching new software products, especially in the early years when little traction exists, cloud computing is an extremely efficient way to not overexpose the venture in terms of costs.

The main providers of cloud infrastructure and public cloud services in Europe are detailed in the following table [6].

<table>
<thead>
<tr>
<th>Provider</th>
<th>Data Center Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&amp;1</td>
<td>Germany</td>
</tr>
<tr>
<td>Amazon</td>
<td>Ireland</td>
</tr>
<tr>
<td>Azure</td>
<td>North Europe</td>
</tr>
</tbody>
</table>
Table 23 Main providers of cloud infrastructure and public cloud services in Europe

<table>
<thead>
<tr>
<th>Provider</th>
<th>Data Center Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>CenturyLink</td>
<td>GB1</td>
</tr>
<tr>
<td>DigitalOcean</td>
<td>Amsterdam</td>
</tr>
<tr>
<td>Dimension Data</td>
<td>London</td>
</tr>
<tr>
<td>Google</td>
<td>Europe West</td>
</tr>
<tr>
<td>OVH</td>
<td>SBG3</td>
</tr>
<tr>
<td>Rackspace</td>
<td>London</td>
</tr>
<tr>
<td>SoftLayer</td>
<td>AMS01</td>
</tr>
</tbody>
</table>

As stated in report 7.4, the virtual workspace works as a general manager having the control over other application by REST-based application layers. Hence, the backend is a conceptually distributed architecture having its modules on the main server, in the component database and in the simulation execution system.

It is commonly thought that cloud computing providers only differ in price according to the capacities of the virtualization vehicles being sold. Nevertheless, according to the Cloud Spectator Europe Report Price Performance Analysis of the Top 10 Public IaaS Vendors, due to differences in architecture, hardware quality and performance tuning, equivalent specs for Virtual Machines on which web applications can be run and physical servers exploited exhibit differences in performance of up to 2.4x [6]. Therefore, it is crucial for the success of D4E to understand the performance and price differences within the European cloud market and take the best decisions.

To assess performance of each major European provider as listed above, Cloud Spectator have set up 24 hour testing sessions where single and multiple cycles were run on a defined set of virtual machines as defined in the following figure (Performance and Variability of CSP’s) [6]. Performance was then defined in terms of the amount of cycles each virtual machine was able to complete in the allotted 24-hour time frame.

Table 24 Virtual Machine sizing

<table>
<thead>
<tr>
<th>SIZE</th>
<th>vCPU COUNT</th>
<th>RAM COUNT (GB)</th>
<th>DISK SIZE (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>2</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>Medium</td>
<td>4</td>
<td>8</td>
<td>150</td>
</tr>
<tr>
<td>Large</td>
<td>8</td>
<td>16</td>
<td>200</td>
</tr>
<tr>
<td>Extra Large</td>
<td>16</td>
<td>32</td>
<td>500</td>
</tr>
</tbody>
</table>

During these testing sequences, 1.194,690 data points were obtained yielding the following performance results [6].
From this a 0-100 performance index is created leading to the following ranking of the main European providers [6].

As demonstrated by this figure, the providers who obtain the best performance scores in virtualization are DimensionData, 1and1 and Azure [6].

Taking into consideration these performance figures is not enough to establish which provider D4E should be looking at in order to develop its cloud infrastructure. Indeed, price considerations are also extremely important and vary considerably across providers for products with seemingly similar specifications. Indeed, price differences of up to 4.5x were observed between the 10 providers in similar segments [6]. The following set of figures from Cloud Spectator’s 2017 European Report provides an overview of monthly pricing in Euros for each provider at different virtual machine sizes. As seen in the following set of figures and tables, OVH, 1&1 and DigitalOcean are the most cost competitive offerings throughout the
whole spectrum of machine sizes [6].

![Figure 29 Monthly Cost of VMs Across CSPs](image1)

![Figure 30 Monthly Cost of Medium VMs](image2)

![Figure 31 Monthly Cost of Large VMs](image3)

In order to properly inform potential cloud users of the tradeoffs in cloud service providers, Cloud Spectator employ a simple methodology in order to establish a Price Performance Index which ranks the different providers taking into consideration cost and performance.
issues. The methodology is defined by the following set of calculations [6]:

\[
\text{price performance value} = \frac{\text{Virtual Machine Performance Score}}{\text{Virtual Machine Cost}}
\]

\[
\text{Best Virtual Machine Value} = \max(\text{price performance value})
\]

\[
\text{CloudSpecs Score} = 100 \cdot \frac{\text{price performance value}}{\text{Best Virtual Machine Value}}
\]

Applying this approach to the performance data and costs previously stated and depicted throughout the figures and tables, the Report obtains the indexed Price Performance results in the table below for all ten cloud service providers [6]. As a conclusion, OVH and 1&1 seem to provide the best value for money within D4E’s most probable starting market and will most likely be the initial providers of choice.

![Figure 32 Overall CloudSpecs Ranking](image)

From a Virtual Machine size point of view, considering the current architecture of D4E databases, the most likely scenario is that a set of medium virtual machines will be needed in the first year scaling up to larger ones in the second. This estimation will have to be determined more precisely as the project matures since capacity definition in cloud computing is not a straight forward process with multiple solutions and possibilities for single situations.