1.0 Overview
With nearly 70% of renewable energy in its electricity mix, Austria is among the global leaders in this respect. Without any doubt, it is the natural conditions in Austria—hydropower, biomass, and a high wind energy potential—that allowed such a development. For the second year in a row, wind energy in Austria increased by around 300 MW (Table 1).

By the end of 2013, nearly 1,700 MW of wind power were operating in Austria. An additional 380 MW of wind power will be constructed in Austria in 2014. Burgenland, the easternmost of Austria’s nine federal states, reached its goal and now generates enough electricity from wind power to cover more than the overall annual energy usage of the state.

2.0 National Objectives and Progress
The Ökostromgesetz (GEA) 2012 launched a significant expansion in wind power installations in 2012 and 2013. This law sticks to the existing feed-in tariff (FIT) system and established a target of adding 2,000 MW of wind power to the capacity of 2010 (1,011 MW) by 2020. The FIT is still set by an ordinance of the Minister for Economic Affairs and is not fixed in the GEA itself. For the first time, tariffs for two years were fixed by the ministries, bringing some certainty for investors. The FIT for 2014 is fixed at 0.0935 EUR/kWh (0.1288 USD/kWh), for 2015 it is fixed at 0.0927 EUR/kWh (0.1277 USD/kWh).

2.1 National targets
The GEA 2012 adheres to the existing target of 15% of renewable energy supply without large hydro and a specific target of an additional 700 MW of wind power capacity by 2015 (a rise to 1,700 MW). This target was already reached in the first quarter of 2014. But GEA 2012 establishes a new long-term target of adding 2,000 MW of wind power to the existing capacity (1,011 MW) by 2020, which means a target of 3,000 MW by 2020. This target is even higher than Austria’s target for wind energy in its National Renewable Energy Action Plan (NREAP). In this NREAP (according to European Union directive 2009/28/EC), Austria set a target of 1,951 MW by 2015 and 2,578 MW by 2020. In a 2007 study, the Austrian Wind Energy Association estimated that by 2020 an annual wind power potential of 3,450 MW (production of 7.3 TWh) can be achieved (Figure 1).

2.2 Progress
The large expansion of wind power installations started in 2012 (Figure 1). At the end of 2013, 1,684 MW of wind capacity were installed in Austria, for an annual production of around 3.6 TWh of electricity production. This is equivalent to more than 5.8% of the Austrian electricity demand (end energy consumption of households). Wind electricity avoids more than 2.2 million tons of CO₂ emissions every year. With an estimated 2,064 MW in 2014, the annual production of all Austrian wind turbines counts for an equivalent of more than 7% of the Austrian electricity demand and avoids approximately 3 million tons of CO₂.

Most wind turbines (796.7 MW) are still installed in Lower Austria, followed closely by Burgenland (770.4 MW), Styria (82.6 MW), Upper Austria (26.4 MW), Vienna (7.4 MW), and Carinthia (0.5 MW), as shown in Figure 2.

2.3 National incentive programs
GEA 2012
The GEA adopted in 2002, triggered investments in wind energy in 2003–2006 (Figure 1). Then, an amendment in 2006 brought uncertainty to green electricity producers and new restrictions for projects. This led to
The Austrian federal state of Burgenland now generates enough electricity from wind power to cover more than the state's annual usage.

nearly four years of stagnation of the wind power market in Austria. A small amendment to the GEA in 2009 and a new FIT set in 2010 (0.097 EUR/kWh; 0.134 USD/kWh) improved the situation.

In July 2011 the Austrian parliament adopted new legislation for electricity from renewable energy sources, GEA 2012. This law sticks to the existing FIT system but for the first time establishes a stable legal framework through 2020, with a target of adding 2,000 MW wind power to the existing capacity (1,011 MW) by 2020. However, there are still restrictions for new projects: those projects only get a purchase obligation and a FIT if they get a contract with the Ökostromabwicklungstelle (OeMAG), the institution in charge of buying green electricity at the FIT and selling it to the electricity traders. The OeMAG has to give contracts to green electricity producers as long as there are enough funds for new projects. The budget started with 50 million EUR/yr (69 million USD/yr) for new projects. This is enough for approximately 120 MW to 350 MW of new wind capacity per year depending on the market price for electricity and the applications from Photovoltaics (PV) and small hydro power plants. For the first ten years the law is in action, this budget decreases by 1 million EUR (1.378 million USD) per year. Applicants have to submit all legal permissions to get money from these funds. After a positive state-aid decision of the European Commission dating from February 2012, the GEA 2012 entered into force on 1 July 2012.

Green Electricity Regulation: Ökostromverordnung 2012
The FIT is still set by an ordinance and is not fixed in the GEA 2012 itself. The FITs are fixed in the Ökostromverordnung/Green Electricity Regulation by the Minister of Economy in accordance with the Minister of Environment and the Minister of Social Affairs. The tariffs are guaranteed for 13 years. The purchase obligation is limited to a specific amount of capacity (depending on the available funds for new projects). Currently there are 1,555.4 MW supported by a FIT under the Green Electricity Regulation, producing more than 3.3 TWh/yr. The FIT for 2014 is fixed at 0.0936 EUR/kWh (0.1289 USD/kWh), for 2015 it is fixed at 0.0927 EUR/kWh (0.1277 USD/kWh).

2.4 Issues affecting growth
Crucial for the growth of wind power capacity are the amount of the FIT, the stability of the incentive program, and the annual amount of money for new projects (annual funds). Due to the adoption of the GEA

Table 1. Key National Statistics 2013: Austria

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total installed wind capacity</td>
<td>1,684 MW</td>
</tr>
<tr>
<td>New wind capacity installed</td>
<td>309 MW</td>
</tr>
<tr>
<td>Total electrical output from wind</td>
<td>3.6 TWh</td>
</tr>
<tr>
<td>Wind generation as % of national electric demand</td>
<td>5.8%</td>
</tr>
<tr>
<td>Average national capacity factor*</td>
<td>24%</td>
</tr>
<tr>
<td>Target: 3,000 MW wind power by 2020</td>
<td></td>
</tr>
</tbody>
</table>

Bold italic indicates an estimate.
2012, the determining factor for wind power growth will be the amount of the FIT. Because the tariffs are fixed for two years, some stability is guaranteed. But with the growing demands from the grid providers, the installation costs are expanding rapidly and constrain growth.

### 3.0 Implementation

#### 3.1 Economic impact

The Austrian wind power market is made up of wind turbine operators and planning offices on the one hand and component suppliers for international wind turbine manufacturers on the other hand. In 2010, the annual turnover of operators of existing wind parks was over 150 million EUR (206.7 million USD).

Austria’s wind energy industry includes more than 120 supplier and service companies. These are leading companies in the fields of conducting, wind power generators, wind turbine generator design, and high tech materials. Moreover, Austrian service providers such as crane companies, planning offices, and software designers work intensively abroad. Local companies are committed successfully both in the onshore and the offshore sector. At the same time, many wind energy operators have taken the step abroad to be able to realize their know-how on a global level. More than 120 companies of the Austrian wind energy supplier industry obtain an export volume of more than 500 million EUR (689 million USD). This is backed by strong growth rates between 20–25% of the wind industry sector during the last years.

#### 3.2 Industry status

Cooperatives own 20% of all existing wind turbines, and another 40% are owned by utilities. The rest are owned by private companies. The first wind turbines in Austria were built in 1994 when cooperatives or single wind turbines built by farmers were most common. With a more stable framework in the support system since 2000, but especially since 2003, utilities and other companies entered the market. The Austrian operators are very active in the neighbouring countries of central and Eastern Europe, and some independent companies have also started businesses outside Europe. The one domestic manufacturer of large turbines, Leitwind, began the manufacture of wind turbines in Telf in Tyrolia in 2008. Apart from Leitwind, there are no major manufacturers of wind turbines in Austria, however there are manufacturers of small (micro) wind turbines.

Austrian component suppliers also serve the international wind turbine market. Bachmann Electronic GmbH is a leading manufacturer of turbine control systems. Hexcel Composites GmbH develops and produces materials for blades. Elin EBG Motoren GmbH is an important supplier for the global market for generators.

Fostered by the growth of the domestic market, the number of small and medium enterprises entering the market increased during the last years. Due to the economic structure of the Austrian industry there is a significant potential for high quality products on the software, service and component sector, which is partially transferred from the automotive and aerospace industry.

#### 3.3 Operational details

Enercon and Vestas are the most important suppliers of turbines (Figure 3). Most of the turbines in Austria are 1.8 MW to 2.3 MW in capacity, but since 2013 more than 80% of new installations are 3-MW turbines or larger. Enercon and Energie Burgenland Windkraft GmbH built two of the largest..
wind turbines in the world—E-126 models rated at 7.5 MW each. In 2013, Windkraft Simonsfeld built the tallest turbine in Austria. The 3.2-MW turbine reaches a total height of 200 m (tower plus blade).

### 3.4 Wind energy costs

Table 2 shows estimated costs for wind energy project elements (price basis for 2013).

<table>
<thead>
<tr>
<th>Cost Element</th>
<th>EUR/kW</th>
<th>USD/kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total investment costs</td>
<td>1,715</td>
<td>2,363</td>
</tr>
<tr>
<td>Turbine costs</td>
<td>1,390</td>
<td>1,915</td>
</tr>
<tr>
<td>Incidental costs (planning, connection to grid and grid reinforcement, etc.)</td>
<td>325</td>
<td>448</td>
</tr>
<tr>
<td>O&amp;M costs average</td>
<td>0.023</td>
<td>0.032</td>
</tr>
<tr>
<td>O&amp;M costs years 16–20</td>
<td>0.028</td>
<td>0.0369</td>
</tr>
</tbody>
</table>

### 4.0 R, D&D Activities

#### 4.1 National R, D&D efforts

Since 2007, 13 wind energy related R&D projects were supported by the Austrian Climate an Energy Fund (4 million EUR; 5.5 million USD). One 2.5-year project is improving understanding of the risk of ice fall from wind turbines. The project (ending in 2014) will develop a model to estimate risk zones near wind turbines, taking into site-specific parameters into account. In another effort, funds from 2013 have been allocated to compile a Wind Energy Technology Roadmap (end 2014).

National Research funds have also been applied to investigate the usability and economics of small wind turbines to accommodate growing demand in this field. This project is funded by the Austrian Research and Development Program “Neue Energien 2020” of the Austrian Climate and Energy Fund.

#### 4.2 Collaborative research

In 2009, Austria joined IEA Wind Task 19 Wind Energy in Cold Climates. The Ministry for Transport, Innovation and Technology has assigned Energiewerkstatt as the Austrian representative in this Task due to long-time experience with wind energy projects in the Austrian Alps. The research activities will continue until end of 2015 and focus on the following three research aspects:

1. Evaluation and comparison of the licensing process and the legislative requirements in each partner country in terms of the assessment concerning the risk of down-falling ice fragments from wind turbines.
2. Evaluation of the operational performance of a stand-alone power supply unit for an intelligent, demand-oriented energy supply of heated wind measurement sensors.
3. Evaluation of operational data of a wind farm in Sweden in terms of performance and vulnerability of a Siemens rotor blade heating system.

In 2013, Austria joined IEA Wind Task 27, Small Wind Turbines in High Turbulence Sites. The cooperation will continue until end of February 2016.

The Austrian company ‘Energiewerkstatt’ (energiewerkstatt.org) is the coordinator of the South Eastern European Wind Energy Project (SEEWIND), one of the largest Research and Demonstration Projects carried out under the Sixth Framework Programme (FP6) of the European Commission. SEEWIND is a research and demonstration project with ten partners from six European countries. SEEWIND has a total budget of 9.6 million EUR (13.2 million USD) to install one pilot wind turbine each in Bosnia, Croatia, Herzegovina, and Serbia. The project began in May 2007 and will last seven years (www.seewind.org). The experiences of SEEWIND are also important for the Austrian market, because the three SEEWIND project sites have challenges similar to many locations in Austria.

### 5.0 The Next Term

The GEA 2012 and the FIT for 2014 and 2015 provide a solid basis for the further development of wind power in Austria. It will be crucial for the growth of wind power capacity for measures to be taken for grid reinforcement and enlargement in the eastern part of Austria. Furthermore, Lower Austria decided on new zoning restrictions. The installation of new wind farms is therefore restricted to just 2% of the federal state. It is questionable whether Lower Austria can achieve the renewable energy goals set out in its 2030 energy road map.

Opening Photo: Windfarm in Lower Austria. Credit: IG Windkraft/Jürgen Pletterbauer

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