AGENDA

• MULTIPLE RESEARCH CHANNELS
• THE UTSA COMMITMENT
• BENEFITING FROM THIS PARTNERSHIP
• UTSA RESEARCH PROJECTS
• SOLAR FORECASTING
• HOW IT WORKS
• RESEARCH PHASES
• APPLICATIONS
MULTIPLE RESEARCH CHANNELS

• **TO DATE, OUR R&D HAS BEEN HELPFUL:**
  – These services are meant to be exploratory in nature
  – Applied Research is particularly helpful to us

<table>
<thead>
<tr>
<th>Relationship Term</th>
<th>Decades</th>
<th>Project Specific</th>
<th>9 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. Annual Spend</td>
<td>$1-2 M</td>
<td>Varies</td>
<td>$1-2 M</td>
</tr>
<tr>
<td>Forward Funding Commitment</td>
<td>Determined annually</td>
<td>Determined by project</td>
<td>Up to $41M</td>
</tr>
<tr>
<td>Sample Projects</td>
<td>Energy Storage, Power Quality, Asset Management, Environmental Controls, etc.</td>
<td>Solar+Storage</td>
<td>Smart Grid, Energy Efficiency, Elec Transportation, Solar Forecasting</td>
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</tbody>
</table>

*Relative to recent Board of Trustee inquiries, over the next several months we will provide more information on UTSA*
THE UTSA COMMITMENT

• INITIAL ESTIMATE = $50M over 10 Years
• STATUS TO DATE = Spent Approx. $8.7M over 9 Yrs
  – We have a better run rate than first projected
  – It helps us to have more time to scope and adjust projects that work for us
  – It makes the work more financially manageable
  – @ Levels of $2M or Less a Year it represents > .08% of Gross Revenues
THE UTSA COMMITMENT

Research and development

From Wikipedia, the free encyclopedia

Research and development (R&D, R+D, or R’n’D), also known in Europe as research and technological development (RTD), refers to innovative activities undertaken by corporations or governments in developing new services or products, or improving existing services or products.\(^1\) Research and development constitutes the first stage of development of a potential new service or the production process.

In the United States, a typical ratio of research and development for an industrial company is about 3.5% of revenues; this measure is called "R&D intensity".\(^{citation needed}\) A high technology company, such as a computer manufacturer, might spend 7% or a pharmaceutical companies such as Merck & Co. 14.1% or Novartis 15.1%. Anything over 15% is remarkable, and usually gains a reputation for being a high technology company such as engineering company Ericsson 24.9%, or Allergan a biotech company, tops the spending table with 43.4% investment\(^{citation needed}\). Such companies are often seen as credit risks because their spending ratios are so unusual.
OUR COMPANY IS BENEFITTING FROM THIS PARTNERSHIP

• This month we will do a deep dive on one of our successful UTSA projects
• Over the next couple months, we will bring forward other examples
• Then going forward we will provide timely report outs

- Education for Sustainability Alliance for South Texas
- Carbon Capture, Storage, Sequestration, Reutilization and Management
- Smart Grid Network
- Energy Efficiency and Conservation
- Augmented Reality Science
- Large Scale PV
- Energy Efficiency in Residential Buildings
- Alternative Transportation Initiatives
- Energy Efficiency in Residential Buildings
- Energy Efficiency and SmartLiving
- Electric Transportation
- Intelligent Energy Systems
- Transforming and Modernizing the Electric Sector

Current Projects

- Intelligent Building Energy Management
- Solar Forecasting at JBSA Microgrid
- Energy Harvesting from Roadways
- Smart Grid Security
WHY DO SOLAR FORECASTING?

- The intermittent nature of solar generation
- Impacts on grid stability
- Supports dispatch strategy
- Financial impact
Sky Imager camera detects cloud cover, direction and speed every 15 seconds to estimate intra-hour solar production.
Development of the Sky Imagers has been a multi-stage, iterative design process

**Phase 1**
Day-ahead algorithms developed
Process of forecasting patented

**Phase 2**
Intra-hour algorithms developed
Sky Imager developed
Multiple iterations constructed

**Phase 3**
Low cost Sky Imager developed
Deployed at CPS Energy Microgrid

**Phase 4**
Artificial intelligence to improve forecasting
Deploy cloud-based network of sky imagers
APPLICATIONS

- A grid of Sky Imagers deployed across our service territory allowing for macro and micro forecasting

- Significantly improved forecasting accuracy of Distributed Energy Resource’s versus satellite-derived forecasts

- UTSA licensing commercial rights to patented algorithms to a local startup

- CPS Energy owns a portion of the patent
Questions