



Task Force on Electric Power
For Virginia's High-Technology Industry

Improving Virginia's Attractiveness For High-Technology Industries (Executive Summary Only)

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Virginia's Center for Innovative Technology
Herndon, Virginia 20170-4200

Submitted By:
Dr. Saifur Rahman
Professor and Director

John E. Bigger
Adjunct Professor

Alexandria Research Institute
Virginia Polytechnic Institute and
State University
Alexandria, Virginia 22314

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Executive Summary

1. Introduction

Wherever one looks, things are changing in Virginia. The technology industries in the Commonwealth are becoming a significant factor in its growth; the increasing number of firms locating here and the number of new jobs created show this. According to a market research report developed for Virginia's Center for Innovative Technology (CIT), Virginia's technology industries employed almost 300,000 people in 2000, which is equal to 9 percent of the total Virginia workforce. The technology workers accounted for 17.5 percent of the \$4.8 billion in total wages earned in the Commonwealth. The technology sector employment is also the fastest growing, increasing at a rate twice that of the total Virginia employment.

Individuals in industry, academia, and government at all levels are asking a critical question: ***How can Virginia continue to improve its already competitive position in attracting high-technology industries, by meeting energy infrastructure challenges without negatively impacting its citizens or degrading the quality of our environment?***

Virginia has become a preferred location for high-technology firms such as telecommunications and information companies, e-businesses, and electronic component manufacturing companies. One characteristic of these high-technology firms is that they all require premium-quality electric power around the clock. These facilities generate large tax revenues for state and local governments and, for the most part, do not place high demands upon community services such as schools, police and fire protection, and traffic. Most of their floor space is devoted to racks of computers and servers or production equipment rather than offices and people. The jobs these firms bring are highly paid management, engineering, and technical positions.

Along with the economic benefits these facilities bring to Virginia, however, they also place unprecedented demands on the Commonwealth's infrastructures. The electric load of an e-business data center, for instance, is similar in magnitude to that of a small industrial plant (tens of megawatts), and this power must be of the highest security, reliability, and quality.

To begin to address this critical question, Virginia's CIT funded the Alexandria Research Institute (ARI) to identify issues that may impact Virginia's capability to continue to attract high-technology firms in the future. A 17-member task force, made up of representatives from private firms, Virginia and federal agencies, and faculty from Virginia Tech, supported this effort.

This study had two overall objectives: 1) to identify and characterize infrastructure challenges and associated environmental concerns in providing the high security, reliability, and quality power needed by Virginia's high-tech industry in the future, and 2) to provide information regarding the needs of high-technology firms to economic development organizations throughout Virginia to enhance their ability to identify sites for interested firms.

The approach used for this study was to: a) examine the state of the existing infrastructure, b) understand facility requirements and infrastructure impacts of high-technology firms of interest, c) examine infrastructure impacts from a broad or overall perspective, and d) identify areas where local economic development organizations would benefit from additional information.

2. Virginia's Infrastructures Today

What are the conditions of Virginia's infrastructures today? The existing electricity, natural gas, telephone, wastewater, and water infrastructures have evolved over a period of many decades. The first three were developed by a variety of public, private, and cooperative utilities and the last two by government agencies and a few private companies. The individual organizations, acting in their specific customers' and owners' best interests, have developed systems in which the service is reliable and the costs of the products are reasonable. This is the result of executives, managers and regulators working together with the common goal of providing products and services to Virginia customers where and when they are needed.

However, for the electricity and natural gas sectors, this situation is dramatically changing. The industries are deregulating and as a result, the definition of service is changing, roles and responsibilities of all the involved organizations are changing, and the individual organizations and industries are themselves changing. The problems associated with industry deregulation and its related changes in other states appear in newspaper headlines almost daily.

But less understood is the fact that many infrastructure-related decisions that previously were made by state and local agencies with community input will, under deregulation, either be transferred to federal organizations or will be made in the marketplace. Monitoring these decisions and obtaining information from the private sector in order to determine long-term needs and impacts will become more difficult.

3. Virginia's High-Technology Industries

There are a large number of industries that can be included in the "high technology" business sector definition. Market research, industry assessment, and other studies have used a variety of criteria to define high technology firms and industries. According to a recent CIT staff study, there are over 4,300 high technology firms in Virginia. Over 57 percent of these firms are located in the Northern Virginia area although there are high technology firms in each of the nine economic development areas spread throughout Virginia.

For this study, however, firms that were generally in four industry categories were examined for their impact on Virginia's infrastructures. The firms of interest are mainly (but not exclusively) involved with the manufacture or operation of the following:

- Communications Equipment
- Electronic Components and Accessories
- Telephone Communications
- Computer and Data Processing Services

4. High-Technology Industry Requirements

What are the critical infrastructure needs of high technology firms seeking sites in Virginia today? All firms in the high technology area need reliable power in order to conduct normal business operations. Many of these firms have also installed on-site emergency generating units to provide power during utility outages. But, the firms of interest in this study are characterized by their need for large amounts of premium power with very high security (the supply is adequate to serve all needs), reliability (the supply is always available), and quality (the supply is free of spikes, harmonics, dips, etc.). These requirements are significantly higher than typical firms. For example, a typical office building in Virginia has an electric demand that averages 5-10 Watts/ft² with a service reliability level of 99.9 percent. The facilities of interest in this study have electrical demands that are closer to 100 Watts/ft², have electric service reliability requirements of 99.9999, and need this power 24 hours a day 365 days a year.

To develop a more accurate understanding of the premium requirements of high-technology firms for the Task Force member's review, the detailed requirements for two high-technology facilities were developed: a 240,000 ft² data center and a 150,000 ft² manufacturing facility. These descriptions are representative of facilities being built today in the Northern Virginia area and address the major infrastructure requirements. These example descriptions are shown at the end of this Summary (Tables ES-1 and ES-2) and again in Section 3.2, along with general discussions of the impacts upon both infrastructures and the serving utilities.

Initially, these requirements were studied on an individual facility basis. Later, the impacts of aggregating many of these facilities in a single area on the infrastructures and the serving utilities were examined. One early finding of these examinations was the accelerated permitting and construction schedules requested by the high-technology facilities in order to meet extremely tight time-to-market goals. An illustration of this is that designs and construction techniques being used enable a 100,000-ft² data center project to go from permit approval to initial operation in five to seven months. It was also found that unless the electric utility providing service, for example, has excess capacity in its substation facilities and distribution or transmission lines, the utility may have difficulty providing service on that short schedule.

In addition to the premium electric power, other infrastructure requirements were also examined that relate to fiber optic cable capacity, natural gas service, water supply access and sources, and wastewater capacity and treatment requirements.

An examination of the general siting criteria for new, high technology facilities was also made. Although each firm seeking a site for a new facility has their own specific criteria, there is usually a primary set of criteria for a data center, for instance: a) access to electric service, b) access to and available capacity of fiber cable, and c) economic development incentives. The Task Force examined these and a number of other facility siting criteria.

5. Improving Virginia's Attractiveness

What do Commonwealth and county economic development personnel need to understand about these high-technology facilities to increase the attractiveness of their areas? What are the special/unique requirements that need to be known regarding high technology facilities and need to be addressed to present the most attractive proposal to prospective firms looking for facility sites? One objective of this study is to help economic development personnel throughout the Commonwealth better understanding both the premium power requirements and the impacts of these types of high technology facilities. To that end, the initial work with the two example projects—the 240,000-ft² data center and the 150,000-ft² manufacturing facility—was extended. The result was the development of a Project Siting Matrix that identifies a large number of items relating specifically to high technology facility siting requirements. This matrix is expected to help provide economic development personnel with an increased understanding of high technology facility requirements. This matrix is shown at the end of this Summary, Table ES-3, and again in Section 4.4, along with a brief discussion.

One of the concerns raised by the Task Force members relates to the fact that while the facility project applications are being approved by local and county agencies, approvals for the expansion of critical supporting infrastructures do not seem to be receiving the same level of support. Approving multiple, high-technology facilities in order to obtain their benefits (increased tax base and jobs) yet disapproving the expansion of supporting infrastructures such as power generation, transmission, substation, or gas pipeline projects needed to bring the additional energy to specific areas, indicate a need for increased understanding in these relationships.

Continuing to depend upon the existing infrastructures to support growing demands forces the various systems to be operated much closer to their ultimate capacity, thus reducing the operating safety factors. Allowing this trend to continue for any significant period has shown that it can pose very large problems; this has been dramatically demonstrated over the past two years in California. An increased understanding of the requirements and impacts of high technology facilities, both individually and collectively, as discussed in this report, will enable county and Commonwealth agencies to better maintain the attractiveness of Virginia to high technology industries in the future.

6. Major Infrastructure Impacts

What are the major demands on the Commonwealth's infrastructures being made by high-technology facilities that are here today and those that will locate here in the future? After examining the individual requirements of high-technology firms locating new facilities in Virginia, Task Force members then looked at overall impacts in order to help answer the critical

question stated in Section 1. Using an overall perspective, the members identified a series of critical issues that will impact the Commonwealth's infrastructure capabilities to provide the high quality and reliability service needed by high-technology firms in the future. The issues identified were reviewed a number of times, prioritized, and then placed in one of two categories.

The top category includes issues that could have significant impact on Virginia's continued attractiveness to high technology industries in the future.

- Virginia Electric Power (Generation and Transmission) Capability
- Fiber Optic Cable Access & Capability
- Natural Gas Pipeline (Transmission and Distribution) Capability
- Pending Ozone Nonattainment Area Impacts
- Water and Wastewater Requirements

The second category includes issues that relate directly to siting and operating requirements of high technology facilities.

- Siting Requirements for High-Technology Firms
- Facility Electrical Requirements
- On-Site and Emergency Back-Up Generation

The Task Force members discussed a wide range of aspects regarding each issue. The result, with members from utilities, design and development firms, state and federal organizations, a legal firm, and engineering and consulting firms, was that each issue was examined from many perspectives. ARI staff then developed a "Discussion Document" supplying additional information on each issue and the topic was reviewed again. Critical aspects of each issue and areas where additional information or action may be needed that were beyond the scope of this study were identified. Summarized in this report are the discussions that relate to each issue raised, the impacts today, the outlook for the future, and recommendations to begin addressing the issues.

It should be noted that when this study was started (mid-2000) the national economy was in good condition, and had been for a significant period, and the high-technology industries were growing at a significant rate. As the study is being completed (mid-2001), the national economy has taken a downturn and the high-technology industry growth has slowed considerably. One result of this change in the national economy has been a slowing in the demand for new products and services and a subsequent reduction in the need for new facilities. Although sensitive to national and regional economic conditions, the products and services provided by these industries will continue to grow in the future. Therefore, the demands for expansion of facilities and the increasing impacts on infrastructures that support these industries' needs will also grow; the findings of this study will continue to be relevant.

7. Conclusions and Recommendations

The Task Force members came to a number of conclusions regarding the capabilities of Virginia's infrastructures to continue to support the high technology business sector already located in the Commonwealth and those firms that will locate facilities here in the future. As has been the case in other states in the U.S., not addressing the expansion of a state's infrastructures can lead to significant disruptions in energy, communications, and water service to its citizens and also to significant price increases for the services that are supplied.

The Commonwealth's infrastructures need to support its citizens' needs today and be ready to support population growth and economic development, including the needs of the faster growing high-technology business sector, in the future. Without being planned for and expanded in a timely manner and with the lowest impact on the environment and citizens, the Commonwealth's existing infrastructures could become considerable limitations to the Virginia's attractiveness in the future. And without a longer-term perspective on the capabilities and limitations of the infrastructures, significant problems could arise quickly.

Conclusions

During the course of the work by the Task Force members, a number of general conclusions were drawn regarding Virginia's infrastructures. As this was a scoping study to identify and describe issues that may impact Virginia's ability to continue to attract high technology, these conclusions are meant to identify potentially problematic situations.

- *High Technology Facility Distribution:* With over half of the high technology firms of interest already located in Northern Virginia, the majority of future growth in the high technology area is expected to continue in this area. New, high technology firms, both domestic and international, are moving into this area because it is where the infrastructure support (natural gas, electricity, fiber, etc.) already exists and where the highly skilled workforce is located. Although many high technology firms have located in other areas, e.g., Greater Richmond and Hampton Roads, significant efforts (social, educational, technical, and economic) will be needed to expand the future high-technology growth throughout the Commonwealth.
- *Economic Development Efforts:* Economic development organizations at both the Commonwealth and the county levels are successful in attracting new high technology firms to Northern Virginia. One only needs to review the press releases from both levels to determine this fact. However, understanding the facility requirements and the direct relationship between the demands of these new, high technology facilities and their impact on the infrastructures needs to be increased.
- *Industry Development Schedules vs. Utility Service Schedules:* The pressure to reduce the permitting and construction schedules of new high technology facilities is increasing while the response time by utilities to service requests is changing very little. In general, for the service requests that involve new transmission feeders or utility substations, the response times are getting longer. This difference in customer's development schedules and the utility's ability to respond is becoming a

large factor in facility site selection and may become a negative factor in Virginia's future attractiveness.

- *Infrastructure Interdependence:* The interdependence of Virginia's infrastructures is increasing significantly. For Commonwealth citizens to enjoy the economic, social, education, and technology products and services that high technology firms bring to Virginia, the existing infrastructure capabilities that support Virginia's growing needs, including the new high technology firms, must be expanded in a timely manner.
- *Long Term Evaluation of Infrastructure Expansion Needs:* With the roles, responsibilities, and relationships changing in the electricity and natural gas industry sectors, depending upon the energy markets and/or federal agencies to respond in a timely manner may expose Virginia citizens to more volatile supplies and prices of these critical societal requirements. Monitoring the growing citizen needs and market actions related to resource supplies and energy, communications, and water infrastructures is still needed. This is especially true as Virginia's infrastructures are operated as part of major regional networks and the number of new organizations involved in the infrastructures and markets increase.
- *Virginia Electric Power Supply Status:* There are over 30 new electric power plant projects under development in Virginia. If less than half of these projects are successful, the Commonwealth will change from a major electricity importing state (~30%) to that of a significant exporter in a relatively short period, the natural gas consumption in Virginia could double, the demand for water would increase significantly, and the air quality would be impacted. The overall impacts of these projects on Virginia's resources, infrastructures, and environment need to be assessed and better understood.

Recommendations

The Task Force members make a number of recommendations relating to the specific infrastructure issues they have identified. These recommendations are meant to clarify the issues raised, provide more information about aspects of the issues, or to bring additional outside perspective to the issue; these recommendations are expected to produce more informed decisions relating to Virginia's future economic development and the infrastructure capabilities that support that development. Each of these recommendations is discussed further in Section 6.

- **Streamline Infrastructure Permitting Processes:** It is recommended that electricity, natural gas, and fiber cable infrastructure expansion be made a required part of Virginia's County Comprehensive Plans. It is also recommended that present local/county/Commonwealth infrastructure siting and permitting processes and schedules be reexamined with the objective of developing a more streamlined process. The concept of a Commonwealth-level "one-stop" permit approval process should also be included in this evaluation. The present situation may significantly impede the future expansion of infrastructures, especially where the benefits may be more regional than local (e.g., new or upgraded power transmission and generating facilities).

- **Power Generation Technologies:** It is recommended that options be explored to increase the diversity of technologies and energy sources used by Virginia’s future utility and merchant plants. Of the over 30 power plant projects under development or construction, all but two are designed to use natural gas as the primary fuel and all but one are gas turbine-based peaking and intermediate plants. This is a high-risk approach for Virginia’s future power supply. Virginia’s coal and renewable (wind, biomass, and solar) energy resources need to be part of the energy mix and a broader array of technologies are both needed to support the Commonwealth’s future electricity generation portfolio.
- **Virginia Transmission Capability:** It is recommended that an in-depth examination of Virginia’s high voltage transmission systems (115 kV and above) be conducted to identify areas of congestion, choke points, instability, and the need for new facilities as their operation changes from the traditional local utility supply roles to a regional transmission system during deregulation. This examination needs to be conducted in cooperation with the Virginia utilities and with input from out-of-state utilities, RTOs, ISOs, and other involved organizations. It is being dramatically demonstrated in other states (e.g., California and Texas) that a robust statewide transmission system is a requirement for a competitive electricity market to exist.
- **Virginia Fiber Optic Cable Capability:** It is recommended that an effort be initiated to document the capabilities and characteristics of long-haul fiber optic trunk lines in Virginia and the results integrated into VEDP’s *Prospect Decision Support System*. Economic development personnel at both Commonwealth and county levels indicate this is one of the major “holes” in their knowledge of the Commonwealth’s infrastructures.
- **Virginia Natural Gas Pipeline Capability:** It is recommended that an in-depth examination of Virginia’s natural gas inter-state transmission and intra-state distribution demands—both present and forecasted—be conducted to identify operating limitations, including storage, as the expected increase in demand is realized. The inter-state gas transmission pipeline capacity expansion is not keeping up with Virginia’s gas consumption growth. And the construction of a significant number of new, gas-fueled power plants will have a very large impact on the Commonwealth’s gas infrastructure. Potential new power generation applications, such as distributed generation, may also have an impact on the infrastructure.
- **New Ozone Nonattainment Areas:** It is recommended that a long-range assessment be undertaken to examine the impacts on Virginia’s industries of the pending expansion of the Commonwealth’s Ozone Nonattainment Areas. The assessment needs to include the impacts on and impacts by the proposed power plant projects, the existing fossil-fueled power plants, fuel-switching options for already installed industrial and commercial facilities, and potential new applications, such as distributed generation.
- **Water and Wastewater Sources:** It is recommended that an assessment be undertaken to examine the overall availability of water for projected domestic and industrial requirements within Virginia. Resources, such as reclaimed water from

treatment plants, that can serve industrial and power plant requirements need to be a part of this assessment of the Commonwealth's resources.

- **On-Site Generation Technology:** It is recommended that the Commonwealth initiate efforts to work with industry and accelerate the upgrading of baseline diesel-powered units already installed and those being installed today to produce cleaner operating systems. This will allow continued operation of existing capital equipment and the units to comply with tighter emission requirements while providing the highly reliable power needed. New power generation applications that potentially could develop in the Commonwealth, such as distributed generation, would also benefit from this acceleration effort. Newer technologies such as fuel cells, microturbines, photovoltaics, wind, etc. have not yet demonstrated their long-term capabilities to provide the premium power requirements required by high technology firms considered in this study.
- **Virginia Economic Development Partnership's *Prospect Decision Support System*:** It is recommended that resources continue to be made available to maintain up-to-date databases for the VEDP *Prospect Decision Support System* and additional resources to expand the System's capability to include commercial sites. This is the premier system of its kind in the U.S. and is providing Commonwealth and county-level economic development organizations with valuable data. It is an invaluable tool, not only for industrial firms seeking facility sites in Virginia but also for area planning.

8. Additional Considerations and Alerts

During the evaluations of the critical infrastructure issues, a number of areas were identified where additional investigation or support would clarify existing situations; provide critical information on future activities; or allow early alerts to be raised for both local and Commonwealth-level legislators, regulators, and economic development executives. These are included in the discussions and listed in Section 6.4 Considerations and Alerts of the main report. In some instances, these Considerations and Alerts directly support the Recommendations and in others they describe areas where the Task Force members believe further support would be beneficial.

9. Report Organization

The structure of the report follows the progress of the Task Force efforts. Section 1 provides background information that led to the study, a description of the study, and an introduction to Virginia's energy, communications, and water infrastructures. Section 2 examines the high-technology industry sector and the types of firms that are of interest in this study. Specific requirements for two sample high technology facilities similar to those being built in Virginia are highlighted in Section 3. The factors and impacts that economic development personnel at both the county and the Commonwealth levels need to know about these high technology facilities are discussed in Section 4. When examined in aggregate, specific issues relating to the impacts of these high technology facilities are discussed in Section 5, along with the ability of Virginia's infrastructures to continue to support this rapidly growing

business sector in the future. Section 6 provides an expanded discussion of the Task Force member's conclusions and recommendations.

Table ES-1: Example Project Description: Data Center

Elements	Description
1. Site Location	Area: Virginia County: TBD
2. Customer Type	New data center Ownership: Owner-operator Operation: Round-the-clock operation (7x24xForever)
3. Facility Size¹	Raised Floor Area (ft ²): 100,000 Auxiliary Floor Area (ft ²): 100,000 Office Floor Area (ft ²): 20,000 Total Floor Area (ft ²): 220,000
4. Project Type	New facility on undeveloped site
5. Estimated Investment¹	Total Project Investment: About 7X – 10X Facility Investment Facility Investment: \$90 million
6. Project Schedule	Project Construction Period: 11 Months (Site approval to initial operation – Fast Track) Electronic Equipment Installation: Complete w/in 2 years
7. Electric Utility Supply Service	Energy Requirements: 100 W/ft ² for raised floor area (See Note 1) Peak Demand: 15.0-17.5.0 MVA Average Demand 10.0-12.0 MVA Primary & Alternate Feeders: 34.5 kV/115/230 kV (Origins in separate substations)
8. On-Site Generation	Type: Diesel-Driven Generators No: 12 - 2MW Units Total Capacity: 24 MW (6 MW redundant) On-Site Fuel Storage Capacity: 5 – 25,000 gal. Tanks On-Site Fuel Storage: 104,000 gal. (72 hours)
9. On-Site Reliability	Incoming Electric Service: 99.9 Equipment Requirements: 99.9999 Dual Uninterruptible Power Systems (UPS) Dual Power Distribution Systems Ride-Through Capability: Battery Storage System
10. Fiber Optic Cable Service	Incoming Cable Capacity: Multiple SONET (Synchronous Optical Network) Rings Cable: Multiple Fiber Cables from Multiple Service Suppliers (Range: 2 – 8 suppliers) Cable Type: OC-48 – Standard; can range up to OC-192

¹ Ellerbe Becket - Mission Critical Facilities: Data Center Cost Calculator at <http://www.eb-datacenters.com/dctrcost.html>

11. On-Site Power Quality Requirements and Systems/Hardware	Technology Installed: TBD Utility distribution system history: X sags/year > 20%
12. Air Conditioning/Cooling	Capacity Tons/Hr: 3,000 1. Central chiller unit 2. Distributed AC compressor systems
13. Water Requirements	Requirement: 120 gpm (173,00 gal/day or 63 million gal/yr) Sources: 1. Commercial supply 2. On-site make-up storage 3. On-site water well
14. Employment	Permanent Positions: 30 (Managers, Engineers, Technicians) Time Frame: w/in 6 months of start up
15. Surrounding Environment	Established area of commercial and residential zoning with moderate present development
16. General	This is considered a large facility

- Note 1:
- a. Energy Density for Raised Floor Area: 100 Watts/ft² for 100,000 ft² = 10 MW. Total UPS load requirement for all electronics/computers/communications equipment
 - b. Other Electric Requirements: 7.5 MW. Total for all lighting, internal HVAC, and central cooling plant requirements
 - c. Energy Density for Total Facility: 17.5 MW/220,000 ft² = 80 Watts ft²

Table ES-2: Example Project Description: Electronic Component Manufacturer

Elements	Description
1. Site Location	Area: Virginia County: TBD
2. Customer Type	New electronic component manufacturer Ownership: Owner-operator Operation: Round-the-clock operation (7x24)
3. Facility Size	Facility Size: 150,000 ft ² .
4. Project Type	New facility on undeveloped land
5. Estimated Investment	Total Project Investment: \$ 500 million New Facility Investment: \$ 100 million
6. Project Schedule	Project Construction Period: 12 Months (Site approval to initial operation) Manufacturing Equipment Installation: Complete w/in 12 months of initial operation
7. Electric Utility Supply Service	Peak Demand: 30.0 MVA Average Demand 25.0 MVA Primary & Alternate Feeders: 115 kV/230 kV (Origins in separate substations)
8. On-Site Generation	Type: Diesel-Driven Generators No.: 8 – 2 MW Units: (Units come on line w/in 10 seconds) Total Capacity: 16 MW (See Note 1) On-Site Fuel Storage: 70,000 gal. (72 hours) On-Site Fuel Storage Capacity: 3 – 25,000 gal. Tanks
9. On-Site Reliability	Incoming Electric Service: 99.9 Equipment Requirements: 99.9999 Dual Uninterruptible Power Systems (UPS) Ride-Through Capability: Battery Storage System
10. On-Site Power Quality Requirements and Systems/Hardware	Requirements: Equipment sensitive to voltage sags of 20 % for 4.5 – 5.5 cycles Voltage sags can cause loss of production – valued in \$ millions Utility distribution system history: X sags/year > 20% Dynamic Voltage Regulator Installed

Elements	Description
11. Air Conditioning/ Cooling	Capacity – Tons/Hr: 14,000 Tons
12. Water Requirements	Total Requirements: 400 gpm (575,000 gal/day = 208 million gal/yr) Sources: Primary: Commercial supplier Secondary: TBD Water Disposal Gal/Day: TBD
13. Employment	New positions: 600 (100 executives, managers and engineers and 500 production line operators and technicians) Time frame: 18 – 30 months
14. Surrounding Environment	Established area with commercial and residential zoning and moderate present development
15. General	This is considered a medium size electronic component manufacturing facility

Notes: 1. On-site generation supports: a) clean room integrity, b) facility environmental integrity, and c) personnel safety capabilities. It does not support the manufacturing line(s)

Table ES-3: High Technology Facility Siting Information Matrix

Planning Areas	Supply/Capacity/Generation	Transmission & Distribution	Environment
Infrastructure Capacity			
Power	<ul style="list-style-type: none"> ▪ Utility Supplier Options 	<ul style="list-style-type: none"> ▪ Utility Transmission/ Distribution Co's ▪ T/L and D/L Voltages and Locations (T/L Voltages < 150 kV) ▪ Required Permits 	
Fiber Optic Cable	<ul style="list-style-type: none"> ▪ Standard Cable Required is OC-48 ▪ Requirements Can Range to OC-192 ▪ Multiple Suppliers Needed 	<ul style="list-style-type: none"> ▪ Long-Haul Cable Co's ▪ Cable Type, Capacity, and Dark Fiber Availability ▪ "Last Mile" Suppliers/Distributors 	
Natural Gas	<ul style="list-style-type: none"> ▪ Area Suppliers 	<ul style="list-style-type: none"> ▪ Transmission/ Distribution Co's ▪ Transmission/ Distribution Locations, Capabilities, and Limitations 	
Water	<ul style="list-style-type: none"> ▪ Public/Private Water Suppliers ▪ Ground Water Supplies ▪ Required Permits 	<ul style="list-style-type: none"> ▪ Distribution Facility Locations and Capacities ▪ Required Permits ▪ Fees and Charges 	
Wastewater	<ul style="list-style-type: none"> ▪ Local Treatment Facilities 	<ul style="list-style-type: none"> ▪ Collection Facility Capacity and Location ▪ Fees and Charges 	
Quality			
Power		<ul style="list-style-type: none"> ▪ Transmission Quality and Reliability Levels ▪ Distribution Quality and Reliability Levels ▪ Quality/Fault/Outage Histories 	
Water	<ul style="list-style-type: none"> ▪ Area Water Quality ▪ Chemical Analyses 		<ul style="list-style-type: none"> ▪ Local/Site Processing Needs ▪ Local Storage
Wastewater	<ul style="list-style-type: none"> ▪ Cleanup Requirements and/or Restrictions 		<ul style="list-style-type: none"> ▪ Local/Site Processing Needs ▪ Local Storage

**Table ES-3: High Technology Facility Project Siting Information Matrix
(Continued)**

Planning Areas	Supply/Capacity/Generation	Transmission & Distribution	Environment
Environment			
Site			<ul style="list-style-type: none"> ▪ Zoning and Land Use Restrictions ▪ Sound Restrictions ▪ Visual Limitations ▪ Site Neighbors
Air			<ul style="list-style-type: none"> ▪ Non-Attainment Zones ▪ Pending EPA/DEQ Legislation
Water			<ul style="list-style-type: none"> ▪ Surface Water Availability and Quality ▪ Subsurface Water Availability and Quality
Site Use			
Back-Up Generation	<ul style="list-style-type: none"> ▪ On-Site Fuel Storage Requirements and Restrictions 		<ul style="list-style-type: none"> ▪ DEQ Air Quality Requirements
Other	<ul style="list-style-type: none"> ▪ On-Site Chemical Storage Requirements and Restrictions 		
Permits			
Permit and Permit Schedules	<ul style="list-style-type: none"> ▪ Local Permits and Approvals ▪ State Permits and Approvals 		<ul style="list-style-type: none"> ▪ Special Site Environmental Permits
Application Costs	<ul style="list-style-type: none"> ▪ Local Permit and Approval Costs ▪ State Permit and Approval Costs 		
Development Costs	<ul style="list-style-type: none"> ▪ Special Site Development Costs 	<ul style="list-style-type: none"> ▪ Special Site Connection Costs ▪ Existence of exactions, development impact, and linkage fees 	<ul style="list-style-type: none"> ▪ Special Site Environmental Costs