Roadmap to R1

MISSOURI S&T

Our Visions

MISSOURI S&T VISION:

- Missouri S&T will be the leading public technological research university for discovery, creativity and innovation. We will cultivate curiosity, creativity and confidence in our graduates. We will be the institution of choice for partners around the world seeking a highly qualified, talented and entrepreneurial workforce; innovative research; relevant educational program.

MISSOURI S&T RESEARCH VISION

- We aspire to be among the list of *R1: Highest Research Activity* universities. Doubling our annual research expenditures by 2025 is an audacious but achievable goal that will contribute to this higher classification.

MISSOURI S&T

Research Roadmap

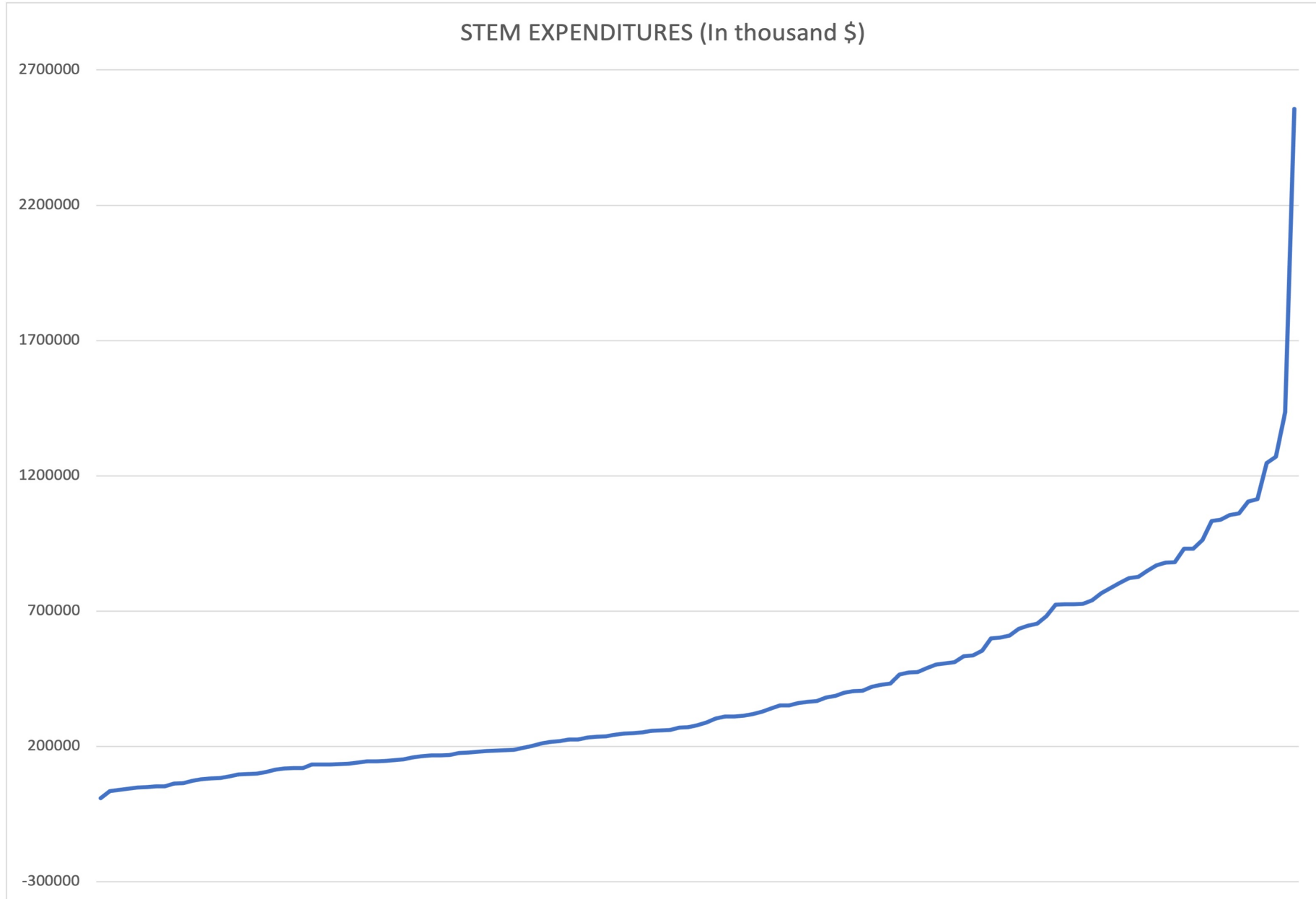
- Multistep bottom-up process
- Include as many faculty as possible
  - Diversity of disciplines, faculty levels, points of view
- Steps:
  - Survey to all faculty about perceived bottlenecks in research (interdisciplinary, industry, large grant efforts, access to agencies, barriers to scholarship, etc.) – 2/13/2020 – 53 responses
  - Planned retreat for 3/19/2020 – Pandemic
  - Virtual Zoom Research Retreat – 5/15/2020 – 35 participants – Focused on SWOT analysis
  - Using SWOT results we held another virtual meeting – 7/23/2020 – more than 100 faculty invited
    - > Outcome was 8 "research constellation" areas
      - **Manufacturing**
      - **Infrastructure**
      - **Materials**
      - **Intelligent Systems**
      - **Bio-X**
      - **Data Science**
      - **Resources: Natural, Energy, Water, for Society (ReNEWS)**
      - **Training, STEM Education, and Workforce Development**
  - Groups scheduled multiple meetings over the next few months – 100s of faculty participated
    - > 285 S&T faculty were identified in one or more research constellations
  - Seven (7) final reports delivered between 12/2020 and 2/2021

MISSOURI S&T

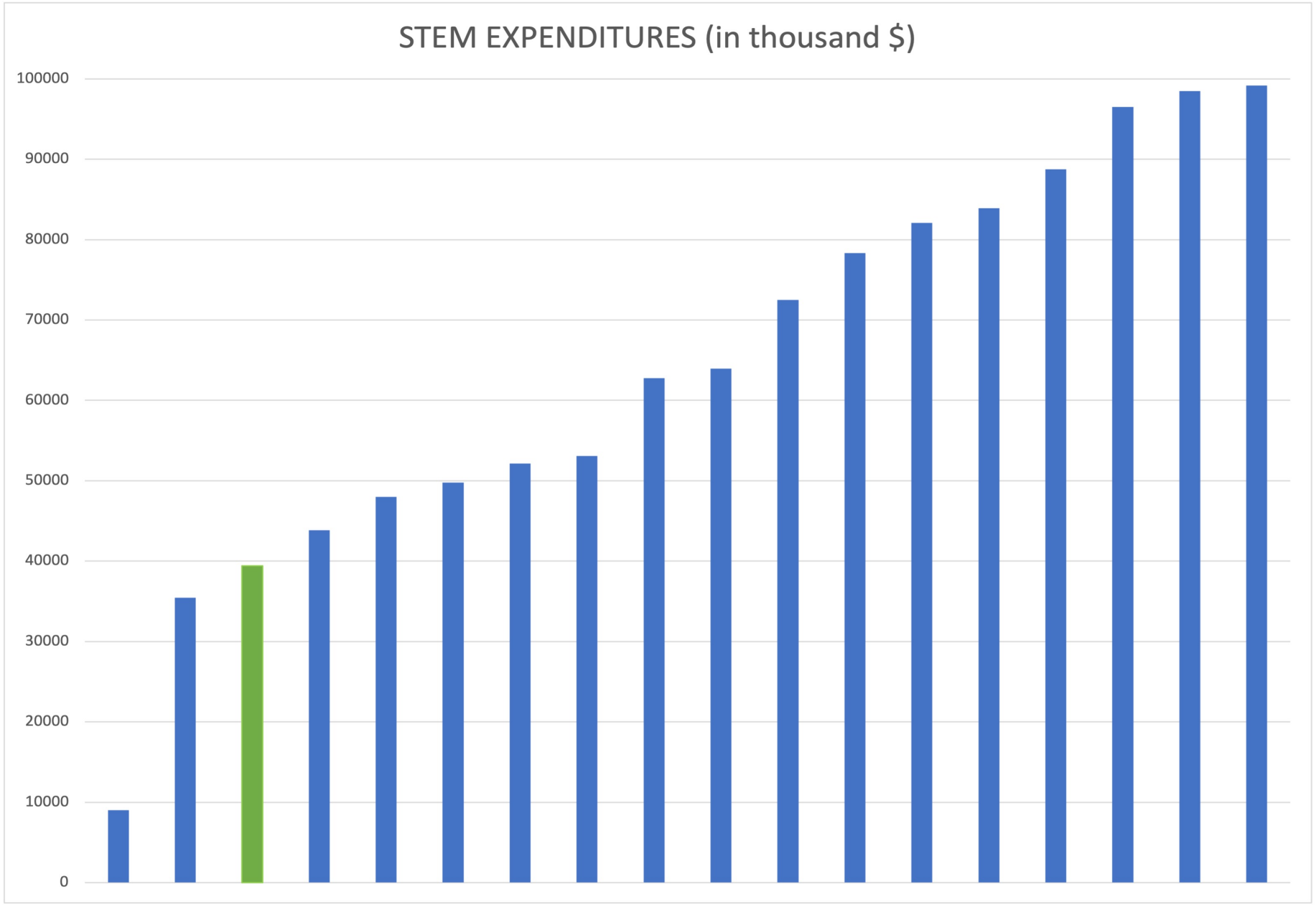
Steps toward R1

- R1 metrics
- Seven parameters:
  - Research expenditures total and per capita (HERD)
    - > STEM research
    - > Non-STEM research
  - Doctoral graduates
    - > STEM and non-STEM
  - Non-TT research staff (research professors, post-docs)
- Where does S&T stand?
  - 131 R1 Universities
  - Graphs include S&T's position

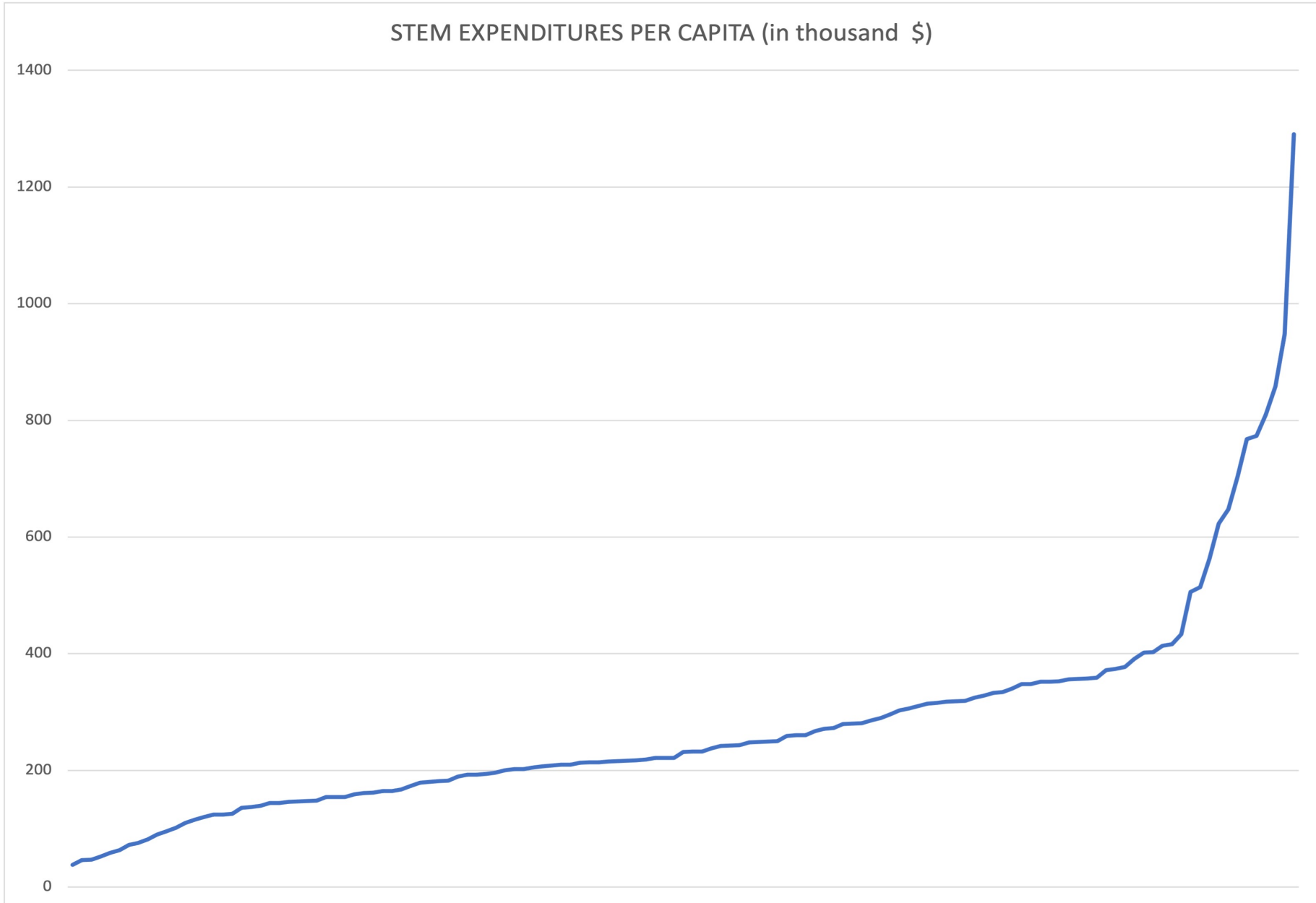
MISSOURI S&T



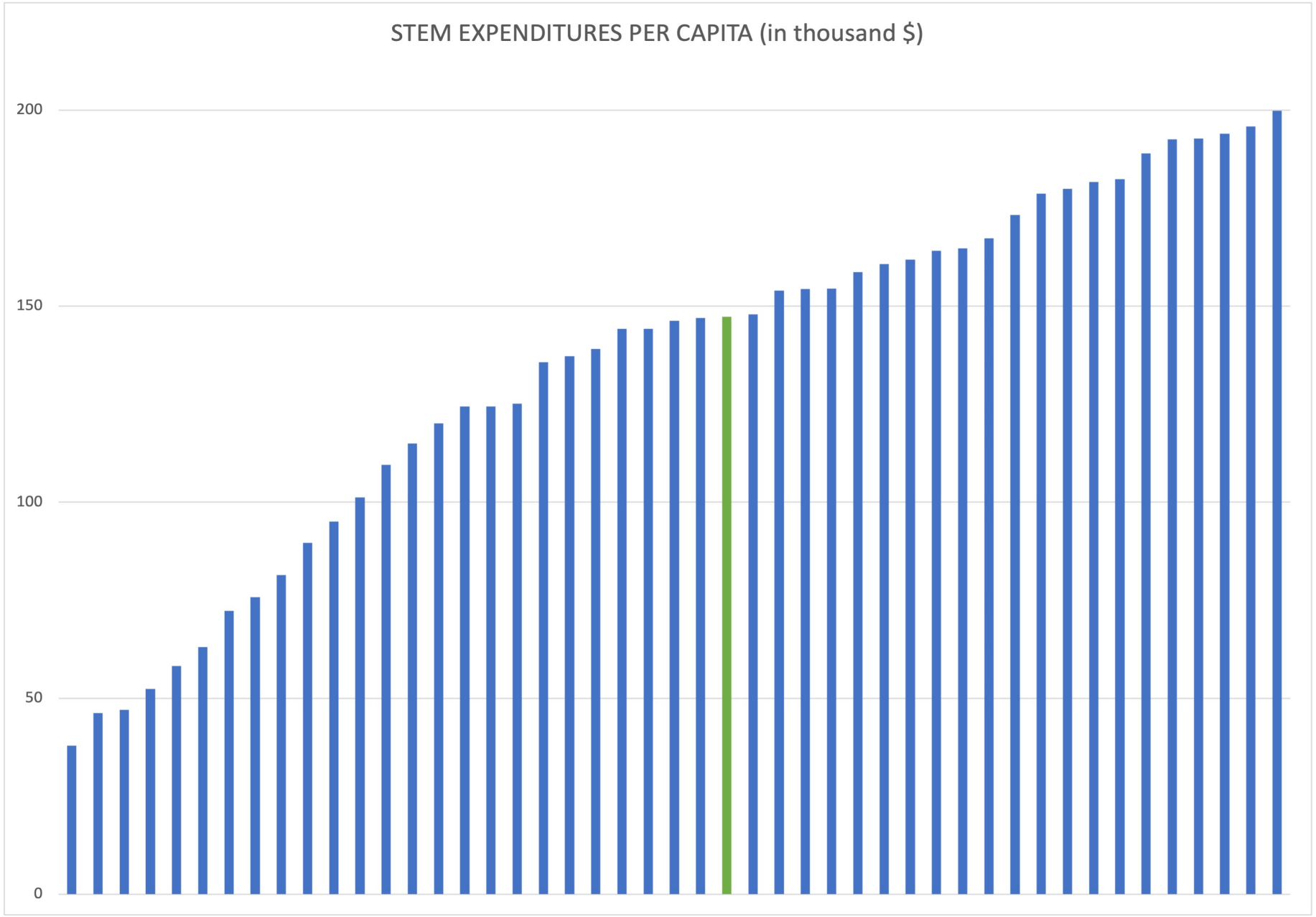
STEM expenditures for R1 Universities



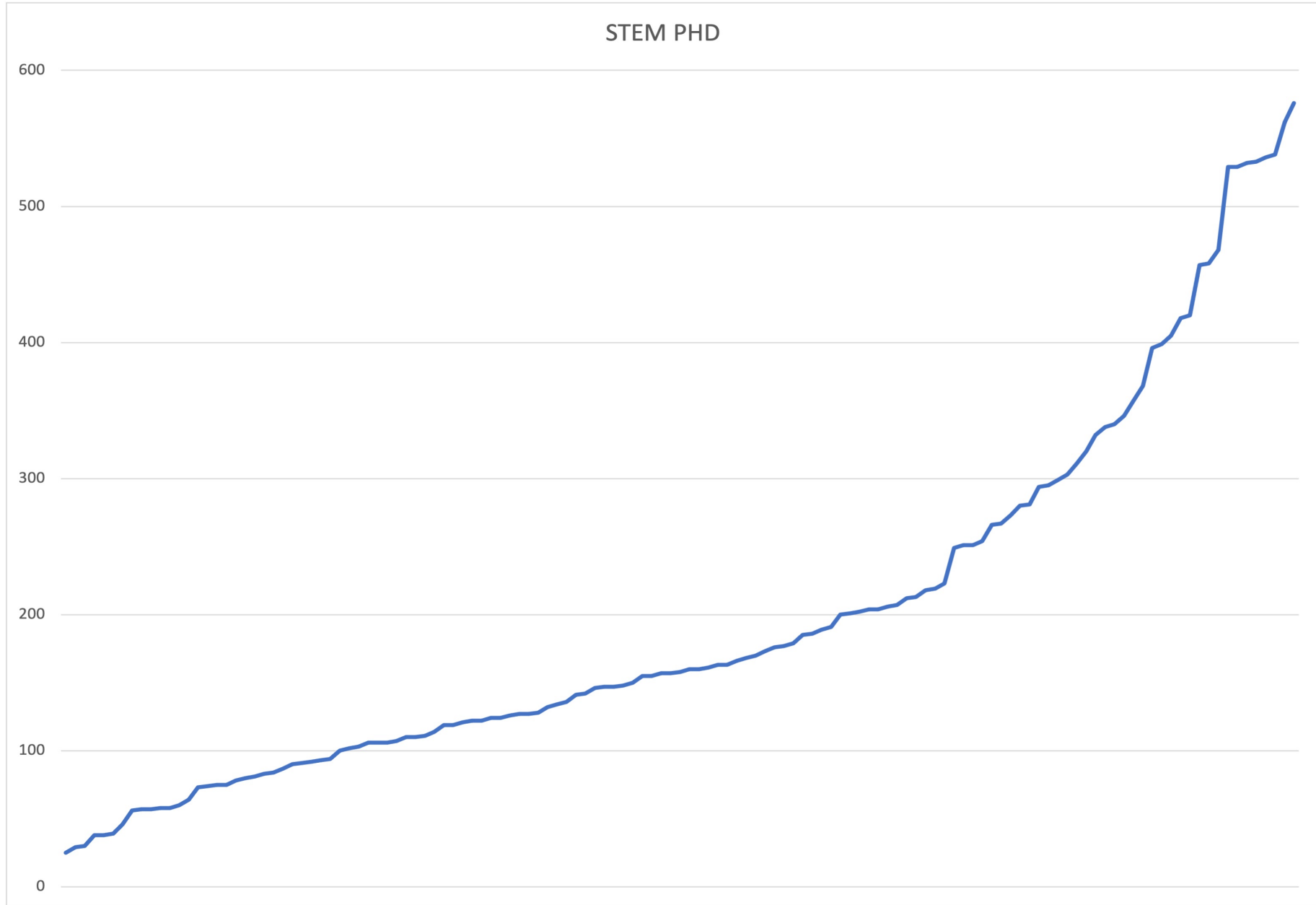
STEM Expenditures for R1 Universities. S&T's position shown in green.



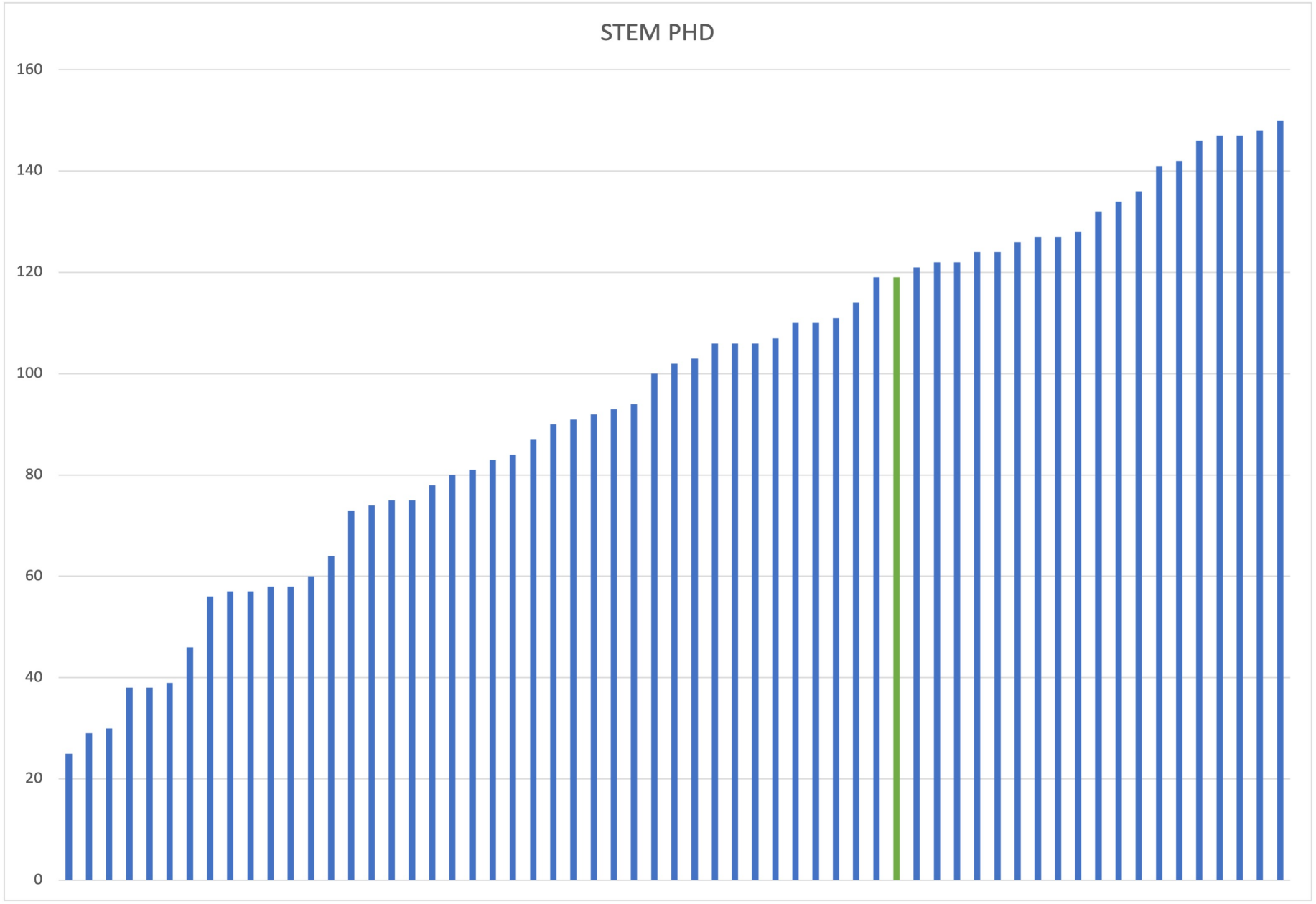
STEM expenditures for R1 Universities. S&T's position shown in green.



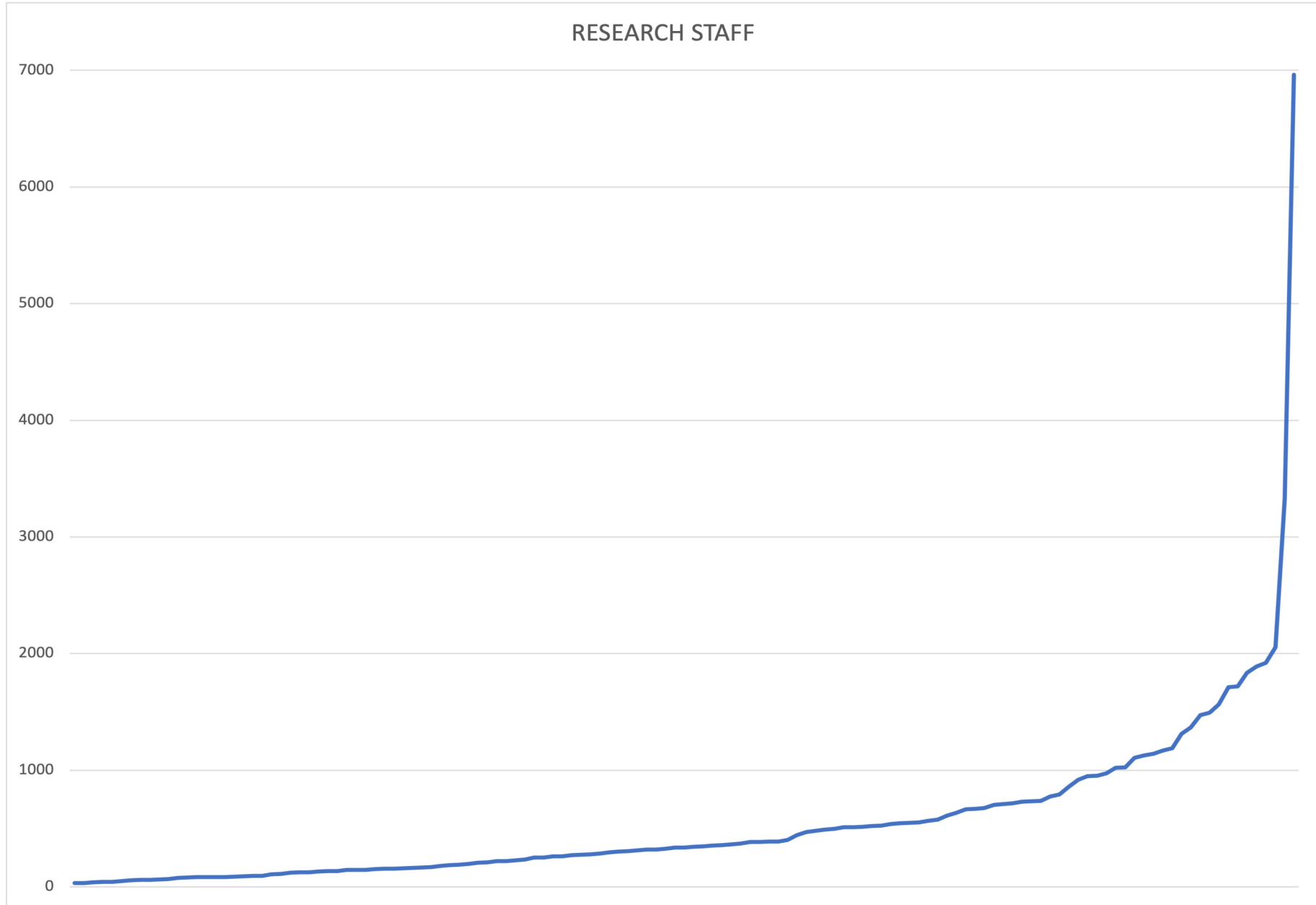
Per capita STEM expenditures for R1 Universities. S&T's position shown in green.



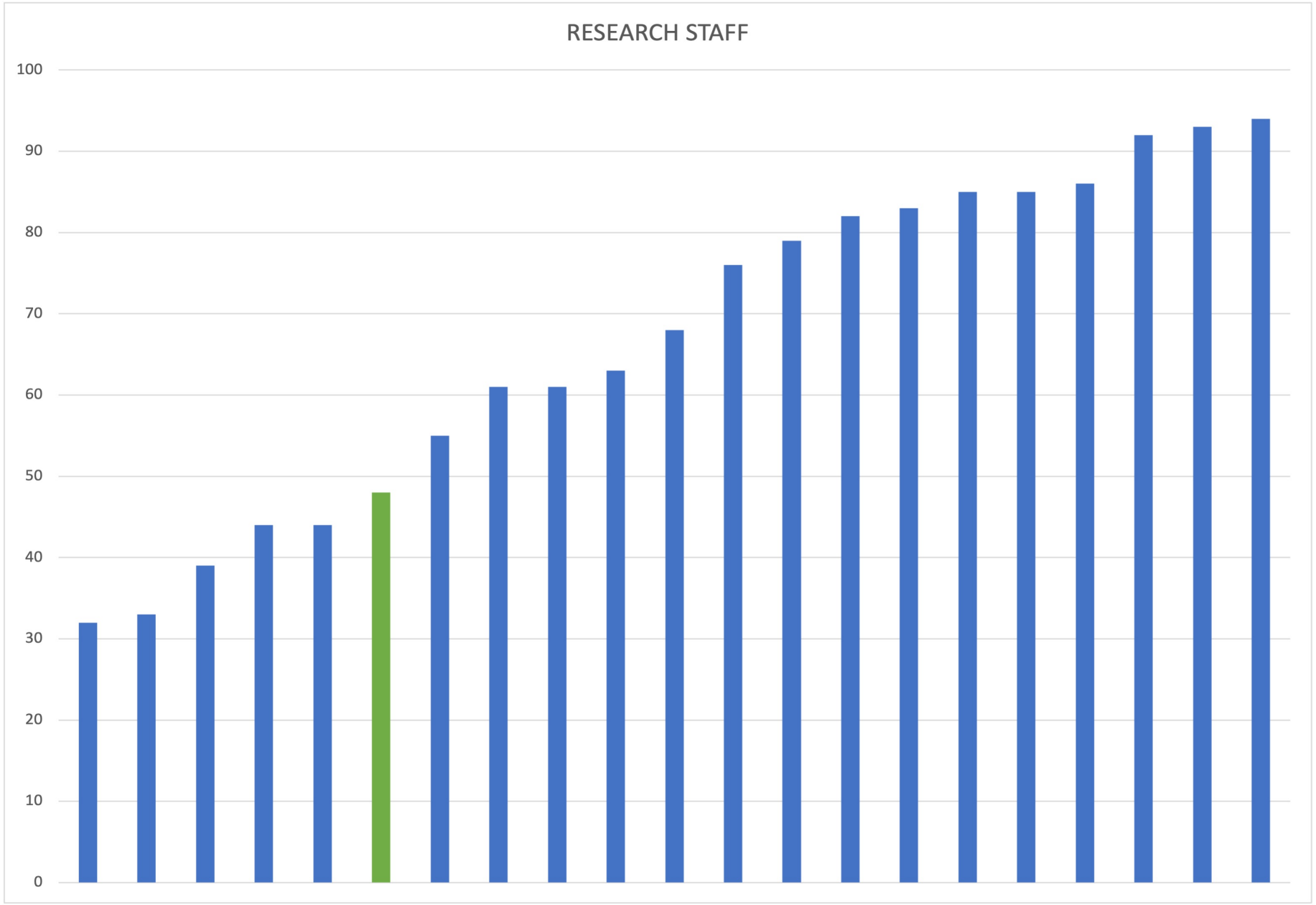
STEM PhDs for R1 Universities



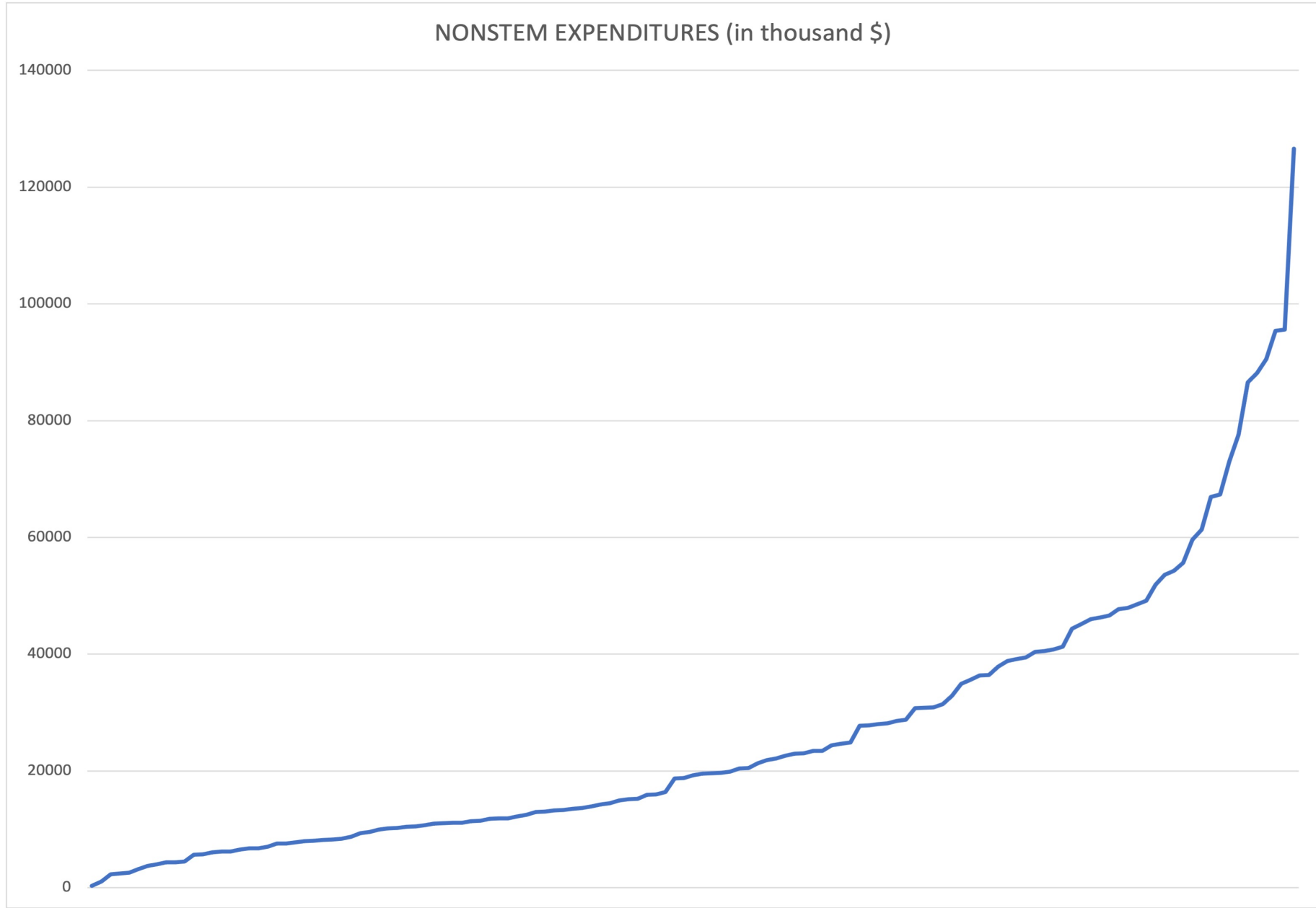
STEM PhDs for R1 Universities. S&T's position shown in green.



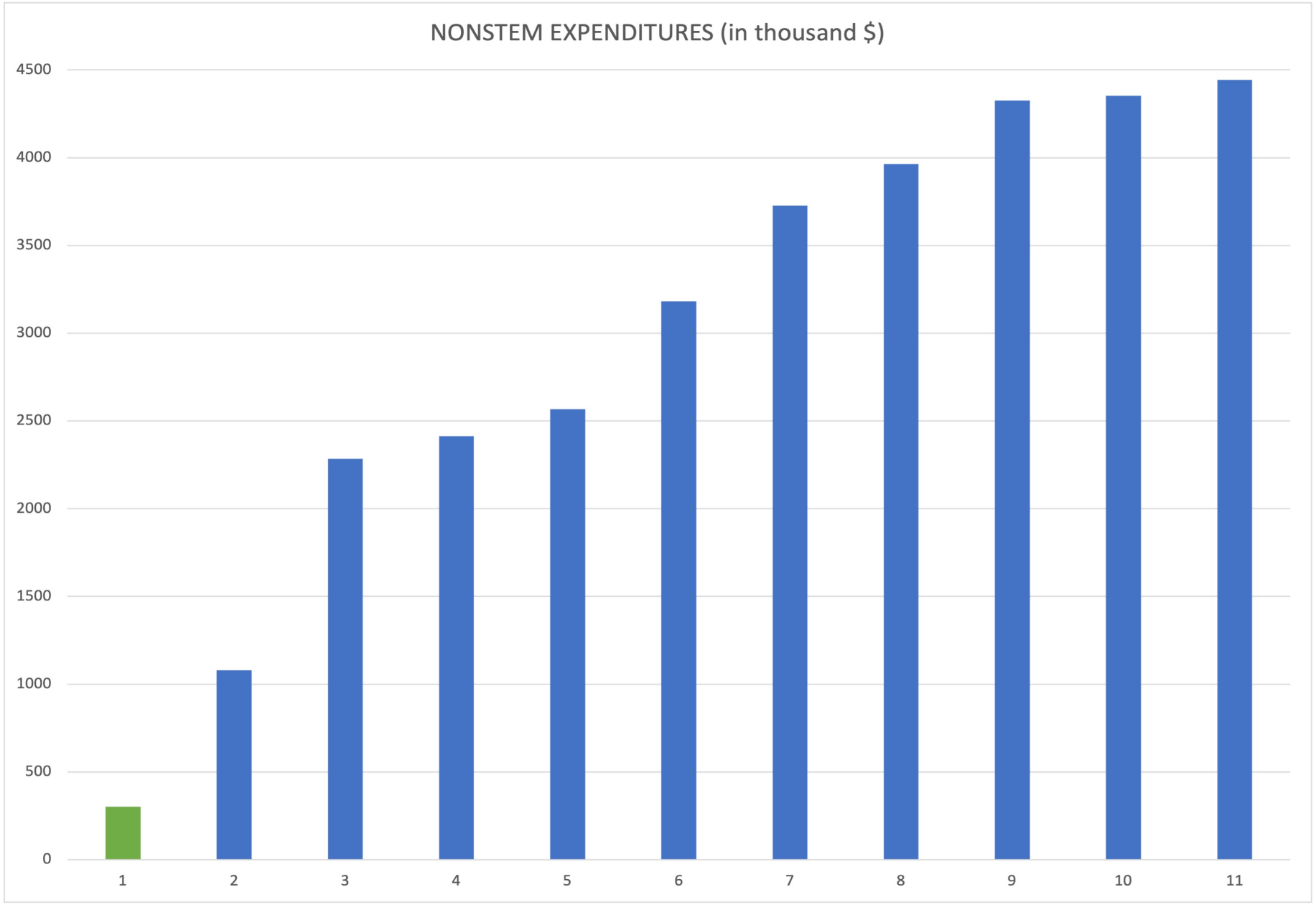
Research staff for R1 Universities



Research staff for R1 Universities. S&T's position shown in green.

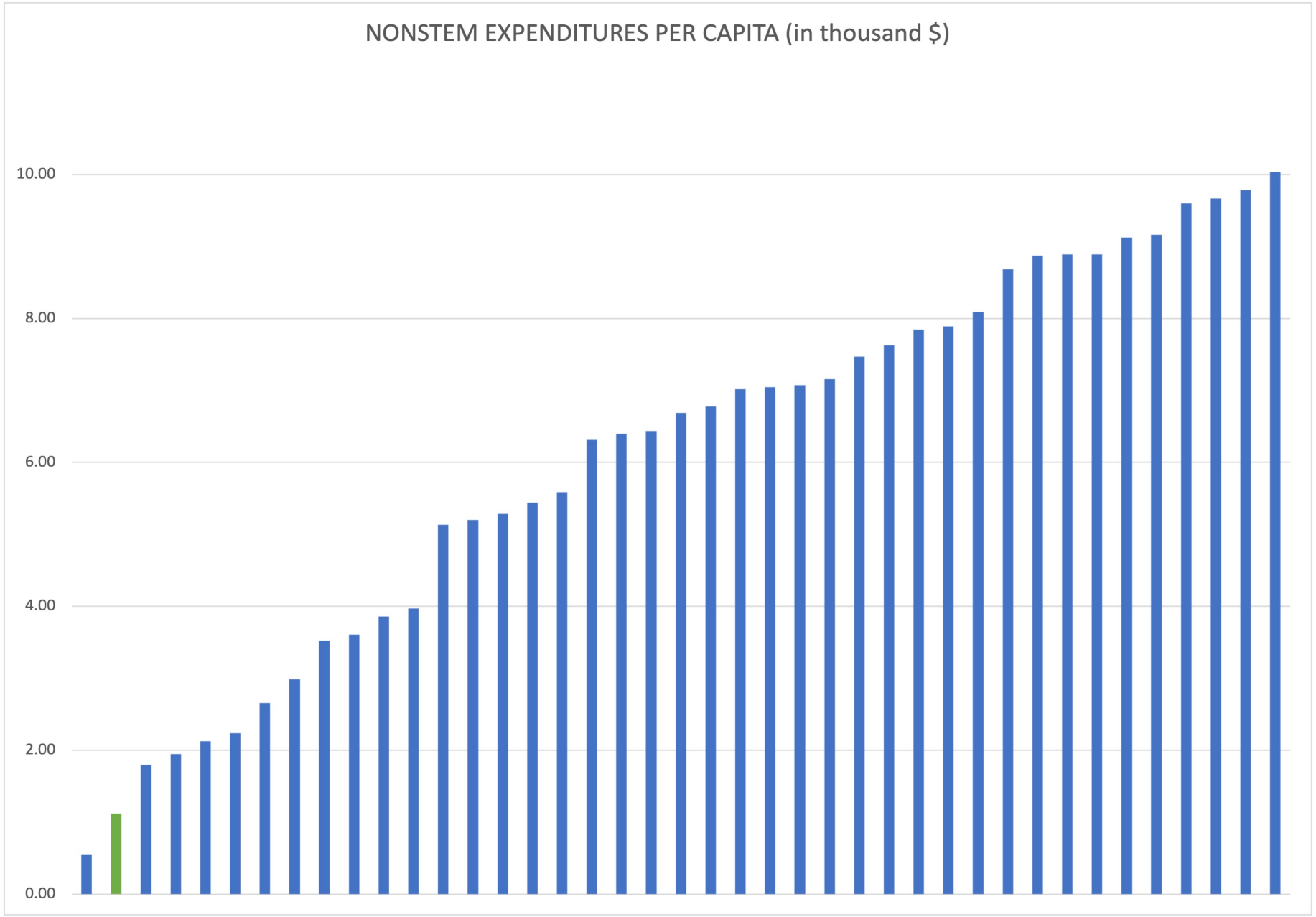


Non-STEM expenditures for R1 Universities

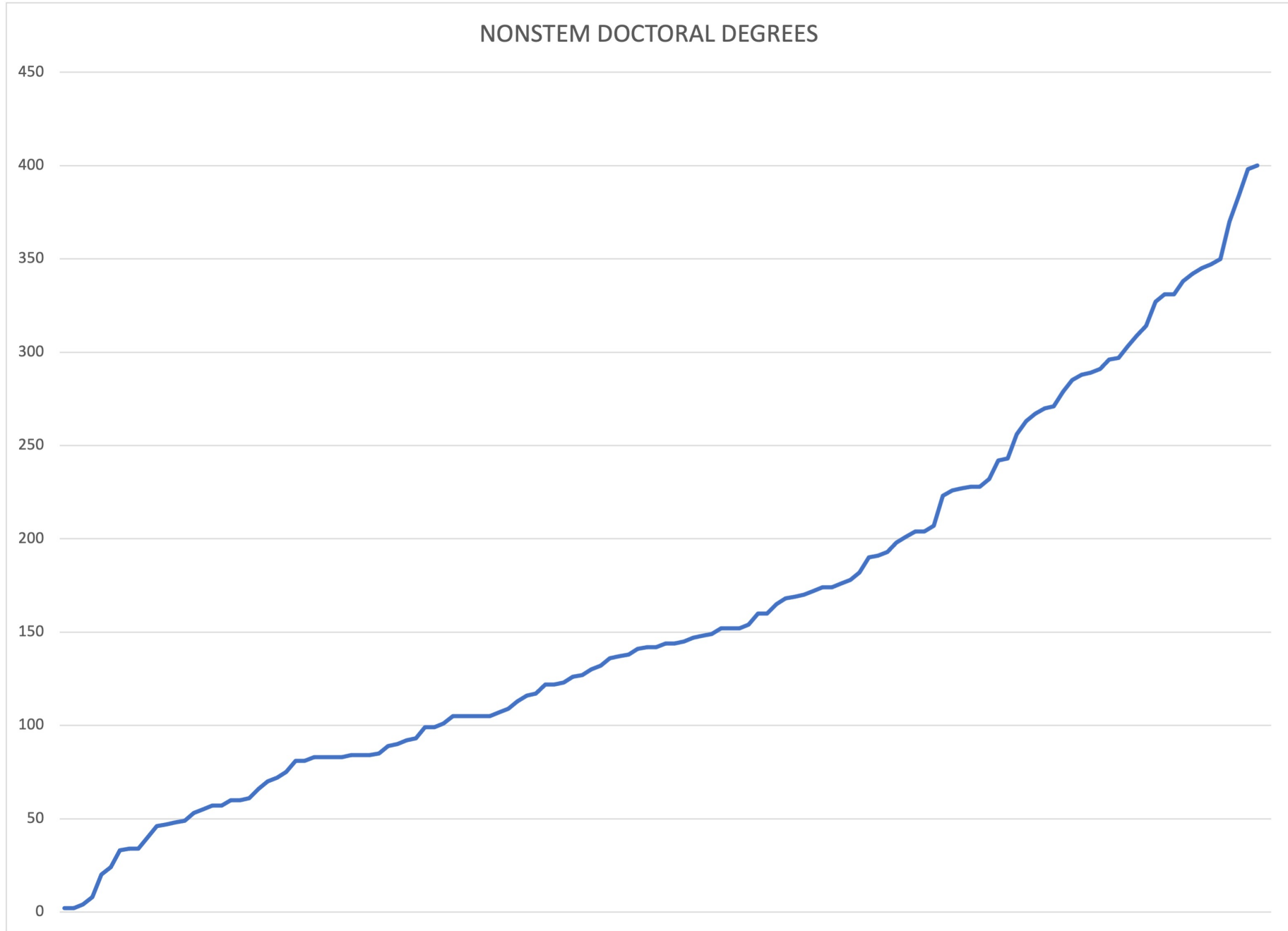


Non-STEM research expenditures for R1 Universities. S&T's position shown in green.

Per capita non-STEM research expenditures for R1 Universities



Per capita non-STEM research expenditures for R1 Universities. S&T's position shown in green.


NONSTEM DOCTORAL DEGREES
450
400
350
300
250
200
150
100
50
0

So, really, where do we stand towards R1?

- Out of 131 R1+S&T:
  - STEM Expenditures: 130
  - STEM Expenditures per capita: 105
  - STEM Doctoral degrees: 88
  - NTT Research staff: 126
  - Non-STEM Expenditures: 132
  - Non-STEM Expenditures per capita: 131
  - Non-STEM Doctoral degrees: 132
- We are not that far from R1

MISSOURI S&T

Steps toward R1

- We need to increase all our numbers. How?
  - Research Roadmap process
    - > Identify our current and future strength areas
    - > Identify where the disciplines are going and get ready to react
    - > Use Roadmap to go after large, multidisciplinary, multi-year grants
    - > Establish Federal Centers of Excellence
  - Continue focusing on PhD recruiting
    - > GRAs, GTAs, 100 KI fellows
  - Grow non-STEM areas
    - > Research, PhD programs
  - Use soft funds to hire non-TT research staff

MISSOURI S&T

How is the Research Roadmap impacting journey towards R1

- Bio-X
  - Formed a NIH mentor team for faculty
    - > Held NIH funding workshop
    - > NIH awards increased from 1.6% of our awards to 6% so far
  - Our Ozark Biomedical Initiative is expanding to include WUSTL
  - We are working with WUSTL's Radiation Oncology on joint research
    - > New CEC Department of Nuclear Engineering and Radiation Science will play a big role
- ReNEWS
  - Ties well with KI Research Center
  - Research is growing:
    - > NIOSH/CDC $1M grant
    - > Strong potential for $3+M earmark for flood and water research
- Data Science
  - Fledgling area with great potential
  - Working on major NIH grant
- STEM education
  - Fledgling area playing significant role as partner in major efforts

MISSOURI S&T

How is the Research Roadmap impacting journey towards R1

- Manufacturing and Materials
  - Traditional areas of strength
    - > DoD and DOE grants of more than $31.5M in steel
    - > Hypersonics materials grant of $10M with Clemson – Working on $15M plus up
    - > Hypersonics major initiative with TAMU
    - > MURI sub-award
    - > Working towards a DoD IDIQ Center of Excellence
    - > Much much more
- Artificial Intelligence and Infrastructure
  - Traditional areas of strength
    - > $20M NSF proposal for AI for Infrastructure
    - > $6M DoD plus-up for using AI and indigenous materials for 3D printing of structure
    - > $2.5M AFOSR plus-up for defense against drones
    - > Preparation of pre-proposals for ARPA-E for determining the future of infrastructure and energy
    - > Many other successes
- Major Interdisciplinary Effort (AI, EE, Data Science, Systems, Education, Materials, Infrastructure) on Critical Infrastructure
  - $25+M effort for a Federal Research Center underway

MISSOURI S&T

STEM Research is not Enough

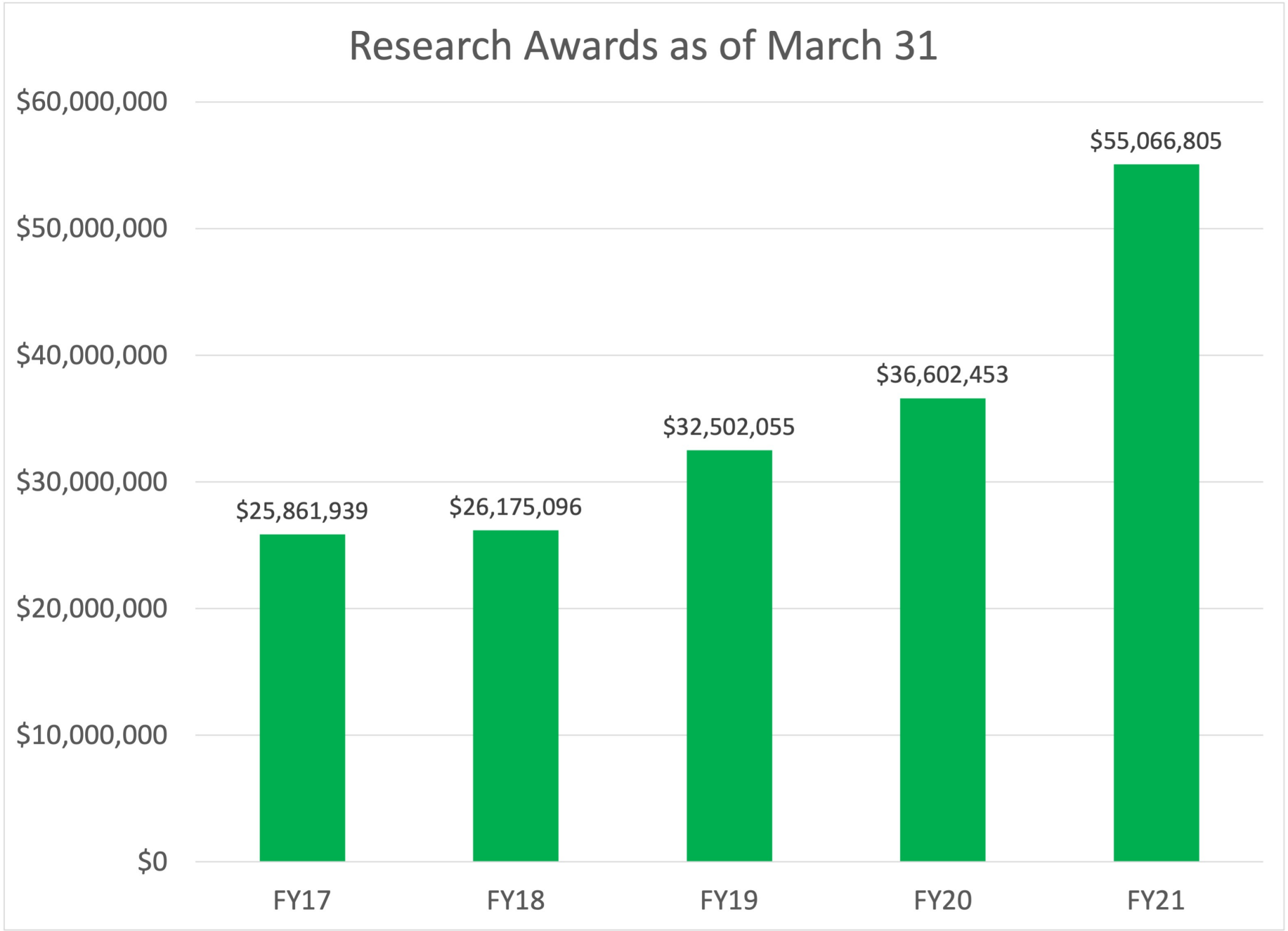
- We need to increase:
  - Non-STEM research expenditures and PhD graduates
  - Non-TT research staff
- Purchased access to *CANDID* a database of more than 150,000 foundations
- Working with departments to consider introducing PhDs in non-STEM areas
  - The Center for Science and Technology in Society is working on a non-STEM interdisciplinary PhD
  - Studying how the Kummer College can offer a PhD in "Innovation and Entrepreneurship"
  - Working with WUSTL's Radiation Oncology department on a joint PhD – if it is considered in Medicine it will be non-STEM
  - Together with HR examining obstacles in hiring Research Professors
  - Because of the pandemic and very large grants PIs are increasing hires of research staff

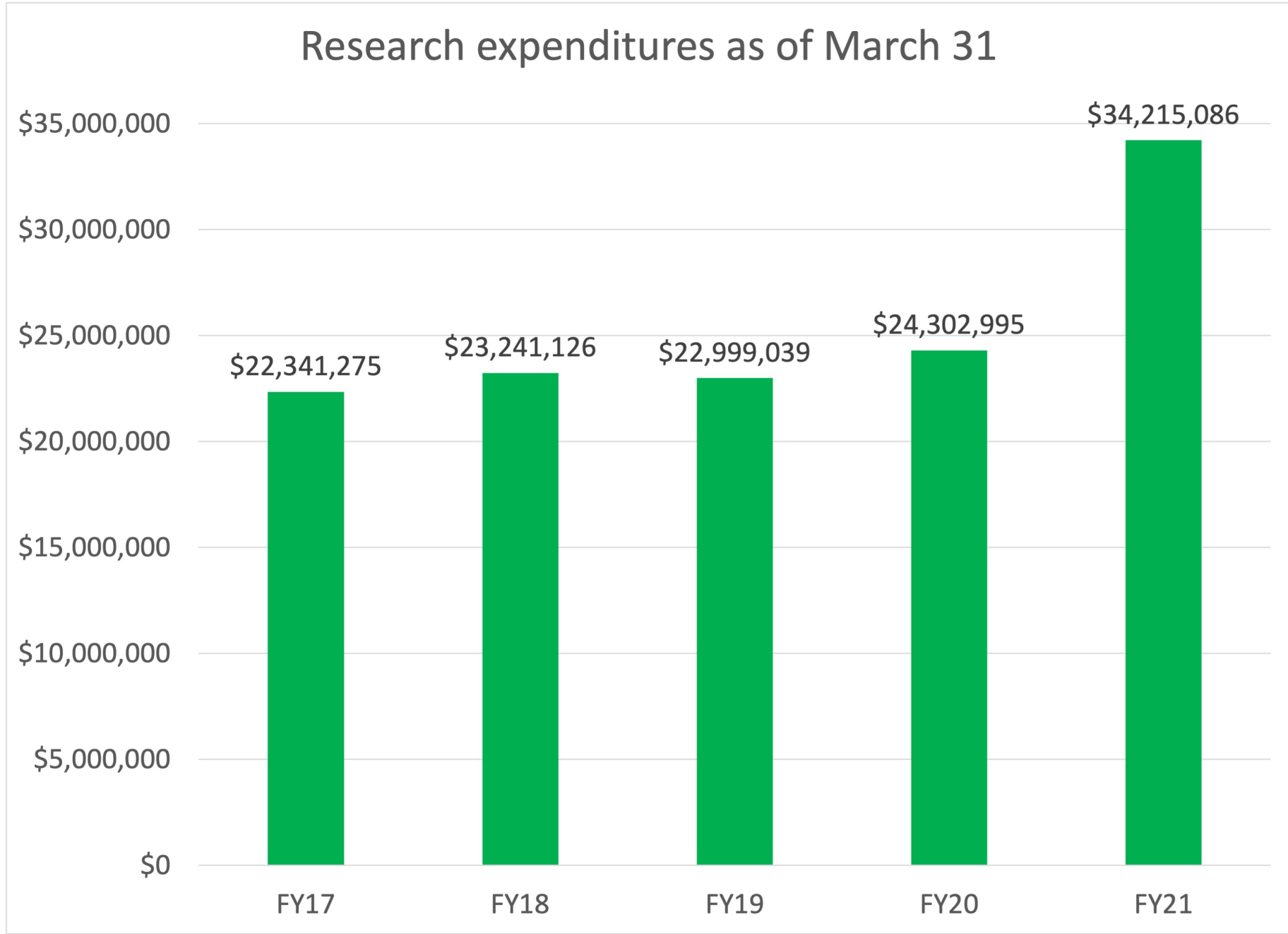
MISSOURI S&T

How is the Research Roadmap impacting journey towards R1

- Other major efforts:
  - Four GAANN proposals from EE, MAE, Mining, Materials
  - Three MRI awards in two years
    - > Infrastructure, Chemistry, High-Performance Computing supporting multiple areas (materials, physics, chemistry, MAE, etc.)
  - Continuing industry outreach
    - > Workshops on ”working with industry”
    - > Research Enabled portal
  - Support from VCR
    - > Proposal workshops (NIH, DoD, industry, “Beyond NSF”)
    - > Support for junior faculty
      - Two (maybe three) CAREER awards this year
      - Targeting NASA and DOD YIP
    - > Support for major proposal efforts
    - > Introduced monthly, electronic expenditure and effort reports for PIs

MISSOURI S&T


Research Awards as of March 31
$60,000,000
$50,000,000
$40,000,000
$30,000,000
$20,000,000
$10,000,000
$0
$25,861,939
$26,175,096
$32,502,055
$36,602,453
$55,066,805
FY17
FY18
FY19
FY20
FY21


Research expenditures as of March 31
$35,000,000
$30,000,000
$25,000,000
$20,000,000
$15,000,000
$10,000,000
$5,000,000
$0
$22,341,275
$23,241,126
$22,999,039
$24,302,995
$34,215,086
FY17
FY18
FY19
FY20
FY21